Town of North Kingstown
Natural Hazard Mitigation Plan

North Kingstown, Rhode Island

Prepared by:
GZA GeoEnvironmental, Inc.

Prepared For:
The Town of North Kingstown, Rhode Island

May 20, 2025

Local Natural Hazard Mitigation Plan

Prepared in accordance with the requirements presented in the FEMA Local Mitigation Plan Review Guide and the Local Mitigation Handbook

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Town of North Kingstown

Rhode Island

No. 7

TOWN COUNCIL

Gregory A. Mancini
Council President

Linnea M. Drew
Council Member

Elizabeth Hill Ross
Council Member

Matthew B. McCoy
Council Member

Dr. Kimberly Ann Page
Council Member

August 18, 2025

At the Regular Meeting of the Town Council of the Town of North Kingstown held on

August 18, 2025, a resolution was passed as follows:

WHEREAS, the North Kingstown Town Council recognizes the threat that natural hazards pose to the people within our community; and

WHEREAS, proactive mitigation of natural hazards before disaster can reduce or eliminate long term risk to people and property; and

WHEREAS, the Town of North Kingstown has prepared a natural hazard mitigation plan in accordance with the Disaster Mitigation Act of 2000; and

WHEREAS, the 2024 HM identifies mitigation goals and actions to reduce or eliminate long term risk to people and property in North Kingstown from impacts of future hazards and disasters; and

WHEREAS, adoption by the North Kingstown Town Council demonstrates their commitment to achieving the hazard mitigation and flood management goals outlined in the 2024 plan.

NOW, THEREFORE, BE IT RESOLVED: That the North Kingstown Town Council adopts in its entirety the Town of North Kingstown Natural Hazard Mitigation Plan, 2024 Update.

Jeannette Alyward
Town Clerk

EXECUTIVE SUMMARY

The Town of North Kingstown Natural Hazard Mitigation Plan (HMP) focuses on both hazard mitigation planning and climate adaptation and satisfies the regulatory requirements for hazard mitigation planning through the Federal Emergency Management Agency (FEMA) and guidance through the State of Rhode Island, Emergency Management Agency State Hazard Mitigation Plan and Local Hazard Mitigation Plan Template. A major update to this Plan from the 2019 plan is that it includes a detailed HAZUS report, updated assets, and data from the FEMA National Risk Index (NRI).

Planning Process

This HMP was developed through the following steps.

1. Create Local Planning Team/ Core Project Team made up of municipal department members and community stakeholders.
2. Perform public outreach and incorporate feedback into the planning process.
3. Define hazard mitigation and climate adaptation goals.
4. Develop inventory of town assets and critical facilities.
5. Identify main natural hazards that pose risk to the town and incorporate feedback from the town.
6. Conduct a vulnerability and risk assessment of top natural hazards.
7. Identify town strengths and vulnerabilities.
8. Review and update existing mitigation strategies.
9. Define and prioritize mitigation actions.
10. Develop an action and implementation strategy.

Vulnerability and Risk

The Town of North Kingstown HMP Plan assesses the potential impacts to the town from a variety of natural hazards, including:

FLOODING	**WINTER WEATHER**
EXTREME HEAT	**SEVERE WIND**

The HMP Plan documents the exposure of town assets and critical facilities to these natural hazards, the frequency of events, and the risk associated with each hazard. Hazard information was developed from the latest available science, from local knowledge of the Local Planning Team (LPT) and town, and through public outreach.

Hazard Mitigation and Climate Adaptation Strategy

Reducing the potential vulnerability of the town to the identified risks from natural hazards requires a long-term hazard mitigation and climate adaptation strategy. In accordance with FEMA HMP criteria, the mitigation strategy has three required components: (a) mitigation goals; (b) mitigation actions; and (c) an action plan to carry them out.

The Town of North Kingstown endorsed the following set of common hazard mitigation and climate adaptation goals to protect community assets and critical facilities:

1. Preserve, restore, and enhance the natural resources and environment in North Kingstown to promote resilient ecosystems against natural hazard impacts.
2. Reduce the vulnerabilities of our built environment - our communities, infrastructure, buildings, and historic and cultural resources.
3. Develop and implement plans and policies that encourage resilient natural systems, built environments and communities.

4. Create a coordinated approach to mitigation planning and action through education, communication, and outreach.

This plan identifies how the town will accomplish the goals it set forth during the planning process by identifying a series of mitigation actions described in Section 5. These actions were grouped by goal, then further sorted according to related topics called “strategies”. The actions are measures, projects, plans or other activities that are anticipated to reduce the current and future risk to the town from the evaluated natural hazards. Actions were identified by the LPT, subject matter experts, and in consideration of feedback from public outreach.

Each of the actions was then assigned a priority (high, medium, low) and a responsible party and potential funding source(s) were identified to form an initial action plan to carry them out.

Acknowledgements

This project was made possible through funding from the FEMA Hazard Mitigation Grant Program (HMGP). The town wants to thank the North Kingstown Town Council, Town Manager Ralph Mollis, the North Kingstown Planning Commission, the Local Hazard Mitigation Committee, and the Rhode Island Emergency Management Agency, for their support of this effort.

Thank you to the Town of North Kingstown community members and leaders for their commitment and dedication to this process, the Core Team Members, and Local Planning Team included.

QUICK PLAN REFERENCE GUIDE

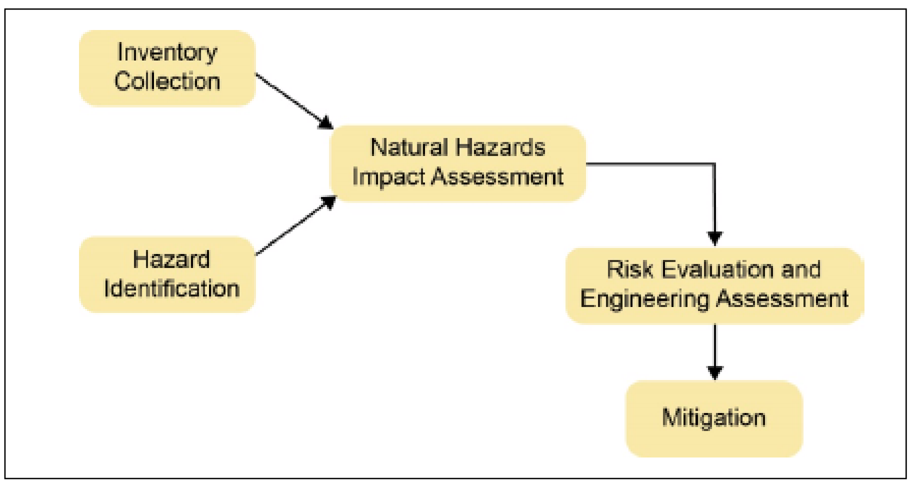
The following provides a Quick Reference Guide to the Town of North Kingstown Natural Hazard Mitigation Plan Update:

STEP 1: UNDERSTAND THE PLANNING PROCESS

Section 2 - Planning Process describes the planning process and identifies the members of the Local Planning Team (LPT) that participated in the Plan development. **Attachment 6** presents public outreach documentation.

STEP 2: INVENTORY TOWN ASSETS (COMMUNITY PROFILE)

Section 3 - Community Profile presents a brief overview of the town assets. **Attachment 1** provides a detailed description of these assets, including the Town population, and an inventory of Essential and Lifeline Systems, High Potential Loss Facilities, Transportation Infrastructure, and Town Facilities and Zoning Districts and General Building Stock.



Conceptual Steps in Assessing and Mitigating Losses due to Natural Hazards (FEMA)

STEP 3: IDENTIFY NATURAL HAZARDS

Section 4 - Natural Hazard Risk identifies and summarizes the natural hazards applicable to the town. **Attachment 2** provides the detailed description of relevant natural hazards. The hazards are characterized including past hazard events and expected probability of occurrence. Future climate-related changes to severe weather and climate-related hazards are also presented based on the current available science.

STEP 4: ASSESS NATURAL HAZARD IMPACTS AND RISK

Section 4 - Natural Hazard Risk also presents the results of an assessment of the vulnerability of the town to the natural hazards. **Attachment 3** provides a detailed hazard vulnerability assessment. FEMA HAZUS-MH simulations were performed for Hurricane (probabilistic), Flood (1% and 0.2% Annual Exceedance Probability [AEP] floods), and Earthquake (2% in 50 years). The simulation results are presented in **Attachment 4**.

STEP 5: MITIGATION PLAN AND IMPLEMENTATION

Sections 5, 6, and 7 present mitigation strategies and actions, regional and intercommunity considerations, and plan implementation details. **Attachment 3** provides the basis for ranking natural hazard priorities. **Attachment 5** presents state and federal hazard mitigation and response grant funding sources. References and resources, and key contacts are presented in **Attachments 7** and **8.**

UNDERSTANDING NATURAL HAZARD RISK

This Natural Hazard Mitigation Plan Update is intended to provide the Town of North Kingstown with a risk-based approach to making planning decisions. In simple terms...

Risk = the probability of an event occurring ***x*** the consequences of that event

Risk can be assessed qualitatively or quantitatively. The evaluation of the risks associated with the North Kingstown natural hazards required: 1) identifying the type of natural hazard(s) applicable to North Kingstown vicinity; 2) evaluating their probability of occurrence; and 3) evaluating their consequences. For example, a coastal flood could impact North Kingstown resulting in damage to property, injury, or death and/or other economic or natural resource impacts. Different coastal flood conditions (water level, limit of flooding, wave height, etc.) are associated with different probabilities of occurrence and different degrees of consequences. By characterizing the hazard, evaluating its probability, and evaluating the consequences, the likelihood that these consequences will be experienced is determined. Once the consequences are understood in this way, value and risk-based planning decisions can be made.

Quantitative Risk Assessment

Quantitative assessment of natural hazard risk typically defines hazard probability in terms of Annual Exceedance Probabilities (AEP). The AEP refers to the probability that an event (e.g., a specific flood water level) will be experienced or exceeded in any given year. For example, the 1% AEP event has a 1 in 100 chance of being met or exceeded in any given year. This probability is often described in terms of a recurrence interval. The recurrence interval is also a statistical indication of the probability of an event and can be considered as the “expected” frequency of an event, on average and over a long period of time. The 100-year recurrence interval is consistent with a 1% AEP. Estimates of AEP are typically presented as “mean” values and have uncertainty represented by lower and upper bounds.

Quantitative estimates of natural hazard probabilities, to be statistically meaningful, require long periods of record of actual historical hazard data or use of other statistical methods. Certain natural hazards such as earthquakes have been defined quantitatively by the federal government (FEMA, USGS, and/or the US Army Corps of Engineers), and these values have been used for this Plan. For other natural hazards (e.g., Hail), this Plan has used limited historical data to extrapolate probabilities. While not statistically valid, the extrapolated estimates are useful in categorizing likelihood of occurrence (e.g., high to very low). Even though these “quantitative” values are presented in the Plan, the reader should be aware that they are not statistically meaningful due to the limited period of record of historical data.

Evaluating Consequences

This Plan Update evaluates the consequences associated with natural hazards in several different ways. The FEMA HAZUS-MH software is used to calculate losses (e.g. building damage) associated with Hurricanes (high winds), Coastal Flooding and Earthquakes. For the other natural hazards, the consequences were extrapolated from available historical data. Similar to the estimated probabilities for these hazards, this approach is not statistically valid; however, it is useful for categorizing the consequences (minor to catastrophic).

Risk Over Time

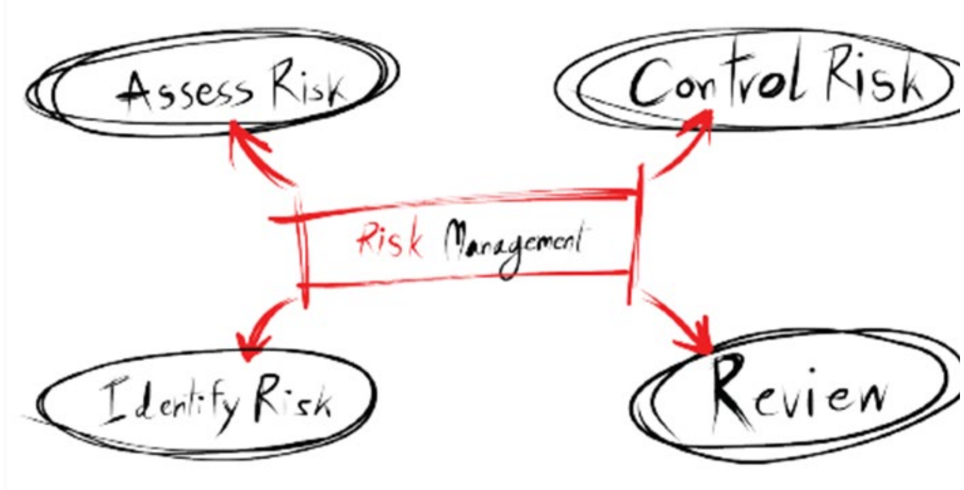
While AEPs and recurrence intervals define the annual risk (i.e., risk in any given year), the risk of experiencing that same hazard event at least once will increase when longer periods of time are considered. For example, the 1% AEP flood has a 1 in 4 chance (25%) of occurring at least once over a 30-year period.

Climate Change

Climate change can affect the risk of severe weather and climate-related hazards. For example, a flood level that has a 1% AEP today may have a much higher probability of occurrence in the future due to increased precipitation.

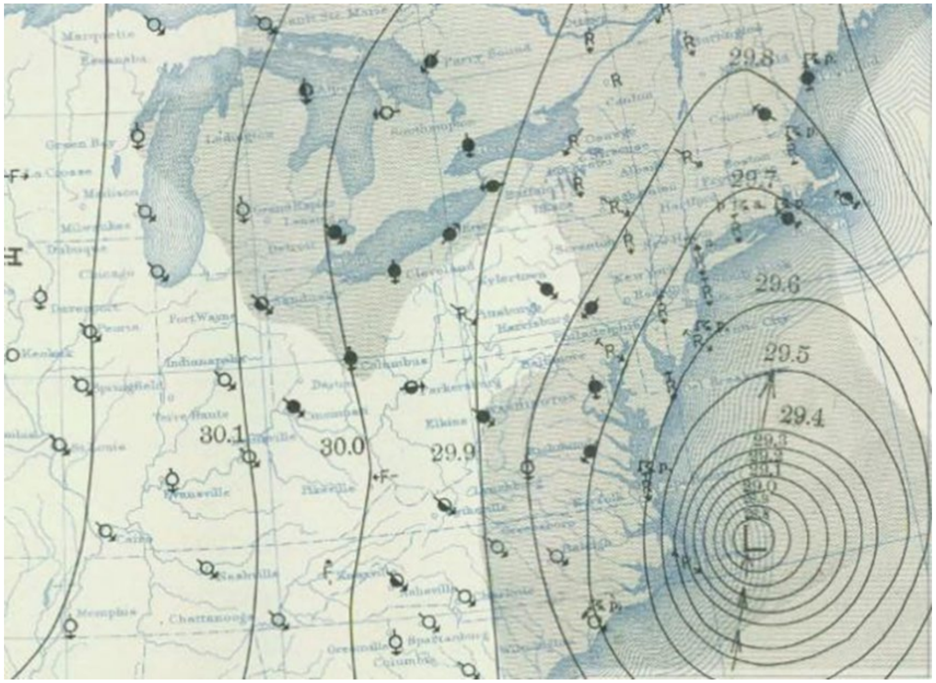
Low Probability is not the Same as Impossible

Even though a hazard is predicted to have a low probability of occurrence, that does not mean it cannot happen. For example, a major hurricane, such as the Hurricane of 1938, has a low likelihood of occurring at North Kingstown based on the available historical data, but it could happen - it is just predicted to be a low probability for planning purposes.



Risk Management Planning Process

SECTION 1: PLAN INTRODUCTION



Historical Surface Weather Map of the Hurricane of 1938 in September 1938

PURPOSE OF PLAN

The following presents the Natural Hazard Mitigation Plan for the Town of North Kingstown, Rhode Island. The Town of North Kingstown is a suburban waterfront community of about 28,000 residents, located 15 miles South of Providence, Rhode Island. The town is situated on the East of the Rhode Island mainland along the West Passage embayment within the larger Narragansett Bay. The town is bordered by East Greenwich and Warwick to the North, Exeter to the West, and South Kingstown and Narragansett to the South.

As a coastal New England town, North Kingstown is vulnerable to coastal storms, intense rainfall, and extreme wind. The town is also vulnerable to other severe weather hazards, climate-related hazards (e.g., extreme heat and cold) and geologic hazards (e.g., earthquakes). The town has developed this Plan to identify the risks and vulnerabilities associated with natural disasters and to develop long-term strategies for protecting people and property from future hazard events.

Ultimately, the goal of the Plan is to enable action to reduce loss of life and property by lessening the impact of natural disasters. The development of the Plan enables the town to:

- Increase education and awareness about the town's vulnerability to natural hazards;
- Build partnerships for risk reduction involving government, organizations, businesses, and the public;
- Identify long-term, broadly supported strategies for risk reduction;
- Align risk reduction with other state, tribal, or community objectives;
- Identify implementation approaches that focus resources on the greatest risks and vulnerabilities; and
- Communicate priorities to potential sources of funding.

PLAN REQUIREMENT

In addition, FEMA requires state, tribal, and local governments to develop and adopt hazard mitigation plans as a condition for receiving certain types of non-emergency disaster assistance, including funding for mitigation projects. Jurisdictions must update their hazard mitigation plans and re-submit them for FEMA approval every five years to maintain eligibility.

The State of Rhode Island Emergency Management Agency (RIEMA) encourages local municipalities to take ownership of the multi-hazard mitigation planning process by pursuing and developing local multi-hazard mitigation plans (MHMP).

Natural Hazard Mitigation Goals

The Town of North Kingstown endorsed the following set of common hazard mitigation and climate adaptation goals to protect community assets and critical facilities for this HMP Update:

1. Preserve, restore, and enhance the natural resources and environment in North Kingstown to promote resilient ecosystems against natural hazard impacts.
2. Reduce the vulnerabilities of our built environment - our communities, infrastructure, buildings, and historic and cultural resources.
3. Develop and implement plans and policies that encourage resilient natural systems, built environments and communities.
4. Create a coordinated approach to mitigation planning and action through education, communication, and outreach.

Natural Hazard Mitigation Strategies

1. Promote land management strategies.
2. Promote drought resilience.
3. Develop resilient design and construction standards.
4. Incorporate flood resilience in transportation planning, engineering, and programming.
5. Identify and protect vulnerable structures and critical infrastructure.
6. Protect cultural and historic resources.
7. Improve dam resilience.
8. Support floodplain management.
9. Align town and state programs to support hazard mitigation goals.
10. Develop solutions to fund hazard mitigation.
11. Support local hazard mitigation planning.
12. Increase local capacity to improve resilience.
13. Coordinate hazard mitigation mapping, data, and research.
14. Increase public knowledge and literacy of hazards and mitigation.
15. Strengthen networks that support resilience.

SECTION 2: PLANNING PROCESS

The FEMA process for hazard mitigation planning includes the following steps:

1. Organize the Planning Process and Resources

At the start, focus on assembling the resources needed for a successful mitigation planning process. This includes securing technical expertise, defining the planning area, and identifying key individuals, agencies, neighboring jurisdictions, businesses, and/or other stakeholders to participate in the process. The planning process for local and tribal governments must include opportunities for the public to comment on the plan.

2. Assess Natural Hazard Risks

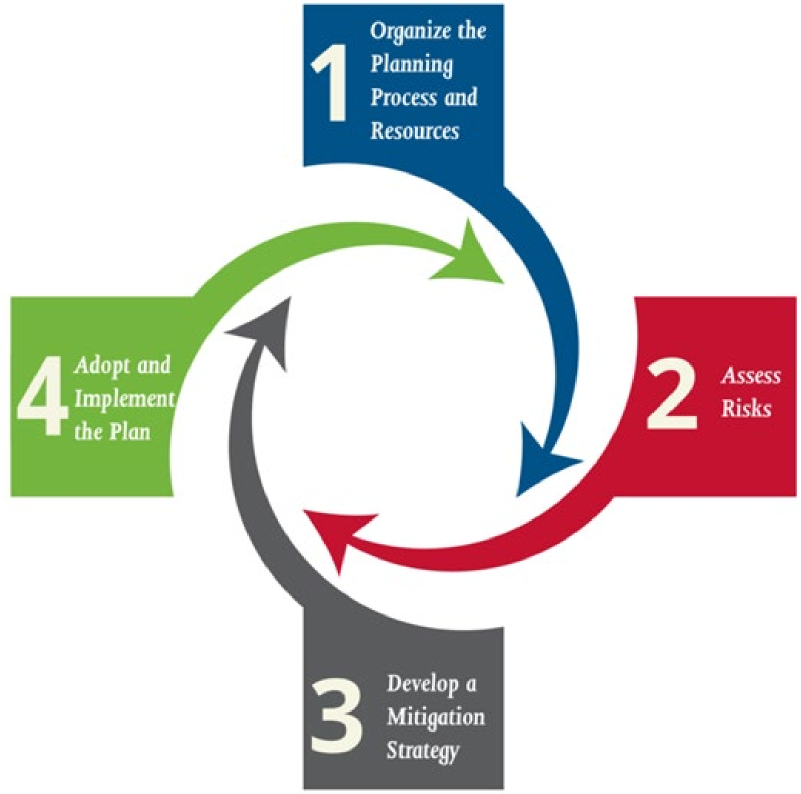
Identify the characteristics and potential consequences of hazards. It is important to understand what geographic areas each hazard might impact and what people, property, or other assets might be vulnerable.

3. Develop Mitigation Strategies

Develop long-term strategies for avoiding or minimizing the undesired effects of disasters. The mitigation strategy addresses how the mitigation actions will be implemented and administered.

4. Adopt and Implement the Plan

Once FEMA has received the adoption from the governing body and approved the plan, the state, tribe, or local government can bring the mitigation plan to life in a variety of ways, ranging from implementing specific mitigation projects to changing aspects of day-to-day organizational operations. To ensure success, the plan must remain a relevant, living document through routine maintenance. The state, tribe, or local government needs to conduct periodic evaluations to assess changing risks and priorities and make revisions as needed.



The Town of North Kingstown followed this process, including:

Figure credit FEMA/Jenny Burmester – Aug 21, 2017

- Organizing a diverse local planning team.
- Retaining GZA to provide technical and planning expertise.
- Providing opportunities for the public to comment on the plan prior to final plan approval.
- Reviewing and incorporating applicable existing plans, studies, reports, and technical information into the plan.

The town assembled a Local Planning Team (LPT) with critical town leadership responsibilities. The LPT was tasked with providing oversight and guidance in developing the Plan.

LOCAL PLANNING TEAM MEMBERS AND MEETINGS

Town of North Kingstown

- Ralph Mollis – Town Manager
- Nicole LaFontaine – Director of Planning and Development
- Becky Lamond – Supervising Planner
- Elle Moore – Planning Technician
- Donald Peck – Asst. Building Official
- Scott Kettelle – Chief (formerly), Fire Department
- John Urban – Chief, Police Department
- Marie Marcotte – Director of Senior and Human Services
- Mark Zamperini – Lakeside Nursing and Rehabilitation Center
- Adam White – Public Works Director
- Aly Sparks – Deputy Public Works Director and Town Engineer
- Meg Kerr – Planning Commission Member
- Eli Mulligan – Administrative Captain, Police Department
- Scott Lessard – Fire Department
- Rita Lavoie – Planning & GIS Manager, Quonset Development Corporation
- John Linacre – Chief, Fire Department
- Matthew Souza – Building Official
- Joel Rocha – Storm Water Specialist, Public Works
- Jim Broccoli – Harbormaster

The LPT conducted two working group meetings to provide input and guidance in developing the plan throughout the planning process. The meetings were held on 5/14/2024 and 6/23/2024. The purpose of each working group meeting is summarized below:

- Working Group Meeting No. 1: Reviewed the existing inventory of town assets and updated inventory with new assets since the previous plan as presented in Section 3 and **Attachment 1**. Prepared for the upcoming public meeting and finalized the inventory of town assets.
- Working Group Meeting No. 2: Reviewed and discussed natural and climate change related hazard characterizations with respect to North Kingstown as presented in Section 4 and **Attachment 2**. Discussed and prepared the hazard mitigation strategy for North Kingstown including goals and specific mitigation actions by hazard. Reviewed mitigation actions from the prior plan as presented in Sections 4 and 5.

The town conducted two public meetings that included residents, community stakeholders, business, and town officials, including the LPT members. The purpose of these meetings was to solicit input during the planning process for consideration and integration into the development of the Plan. The meetings were held at the North Kingstown Town Hall and publicized on the town's website, newspaper, and in local businesses. At the first public meeting, hosted by the Planning Commission on May 21, 2024, a presentation was given to provide background on Hazard Mitigation Planning and to describe the town's assets inventory, hazards characterization, and risk assessment. The second public meeting was hosted by the Town Council on June 24, 2024, and covered the existing hazard mitigation capabilities of the town, and mitigation goals for the updated plan were presented. The slides presented in the public meetings are included in **Attachment 6**.

EXISTING PLAN REVIEW

- Strategy for Reducing Risks from Natural Hazards in North Kingstown, Rhode Island - A Multi-Hazard Mitigation Strategy 2019 5-Year Update
- Shoreline Change Special Area Management Plan (SAMP)
- Rhode Island Coastal Resources Management Council (CRMC) Climate Change and Sea Level Rise Policy
- State of Rhode Island Hazard Mitigation Plan (February 2024)

- 2023 Hazard Mitigation Plan – University of Rhode Island
- Rhode Island Sea Grant Strategic Plan, 2018-2023
- North Kingstown Municipal Resilience Program Community Resilience Building Process & Workshop Summary of Findings (August 2021)
- NOAA 2022 Sea Level Rise Technical Report
- Town of North Kingstown Harbor Management Plan, 2017
- Adapting to Coastal Storms and Flooding Report (2014, Nature Conservancy)
- Coastal Zone Management Act
- Federal and state flood regulations
- Local floodplain ordinances
- Federal Coastal Barriers Act
- National Flood Insurance Program
- State and federal permits related to natural hazard mitigation, resilience, and adaptation measures
- Water Supply System Management Plan
- North Kingstown Tree Inventory Management Plan
- The North Kingstown Emergency Operations Plan (EOP)

PUBLIC OUTREACH SUMMARY

Public Outreach and Review was conducted to supplement this hazard mitigation plan update including risks, vulnerable areas, and mitigation strategies. The town conducted public survey is detailed in **Attachment 6** and summarized in the following paragraph.

The public survey was posted in public areas around town – at the library, grocery store, municipal office building, and department of public works. It was posted and re-posted online on the town's website and social media pages and emailed to the members of nine boards and commissions, who were asked to further share the survey with their personal contacts. That resulted in the survey being shared in four different local email blasts or newsletters. It was also advertised in the local newspaper, The Independent. The online survey inquired about natural hazards from extreme events which have been experienced recently and those which may occur in the future impacting the town's infrastructure, social resources, and environmental resources. There were 11 survey questions posed within the survey. One hundred and twenty-three (123) people responded to the survey, providing answers to the questions as well as open-ended written responses that have been considered in this plan update.

The town distributed the plan update via email to and requested the review and comment from the towns of East Greenwich, Jamestown, Warwick, South Kingstown, Narragansett, and Exeter on September 26, 2024.

SECTION 3: COMMUNITY PROFILE

Location: North Kingstown is a coastal community in the northeastern portion of the United States situated along the western shore of Narragansett Bay in the State of Rhode Island. North Kingstown is one of nine (9) towns located within Washington County in south-central Rhode Island. The town is landlocked on three sides with the Bay forming its eastern boundary. North Kingstown is bounded by East Greenwich and Warwick to the North, Exeter to the West, and South Kingstown and Narragansett to the South.

Characteristics: North Kingstown has the typical physical characteristics of a Southern New England coastal town, with uplands bordered by low-lying areas, tidal wetlands, salt marshes, tidal flats, and beaches. North Kingstown has approximately 30 miles of shoreline abutting Narragansett Bay. The total area of North Kingstown is about 58.3 square miles, 14.8 square miles of which is water. The Hunt River forms the northern border of the town while the Annaquatucket and Pettaquamscutt (Narrow) Rivers both run through the southern portions of the town. Significant coastal features along the town's 30-mile coast include Allen Harbor, Quonset Point, Wickford Harbor, and Bissel Cove. There are approximately 6,343 acres of wetlands (22.6%) and 14,085 acres of forest (49.8%) in the town. North Kingstown's coastal location and low-lying areas, makes the town susceptible to coastal flooding, river flooding and flash flooding and more recently storm surges as witnessed during the December 23rd, 2022, and January 13th, 2024 Nor'easters and Hurricane Sandy in 2012.

Beaches: North Kingstown's eastern shoreline contains several beaches. Moving from North to South, they include Calf Pasture Point Beach, Spink Neck Beach, Compass Rose Beach, Blue Beach, North Kingstown Town Beach, Rome Point Beach, Plum Point Beach, and Plum Beach.

Harbors: There are several harbors and marinas, including Wickford Harbor, a dredged channel and harbor with breakwaters; Allen Harbor; and marinas located within each of the harbors. Mooring fields are also located in the harbors, with several smaller mooring fields situated along the coastline.

The town is governed by a Town Manager and a five-member Town Council.

Attachment 1 provides a detailed description of the town's community profile including population, land use, essential facilities, lifeline systems, support, high occupancy and vulnerable populations, historic properties, and natural resources. The following pages provide a brief overview.

COMMUNITY PROFILE SNAPSHOT

Per the United States Census Bureau 2020 Census (2020):

Population: 27,732

Population change since 2000:
1,246 (+4.7%)

Age and Sex:

Percent female / male:
51.6% / 48.4%

Persons <5 years:
4.2%

Persons <18 years:
18.4%

Persons ≥ 65 years:
20.8%

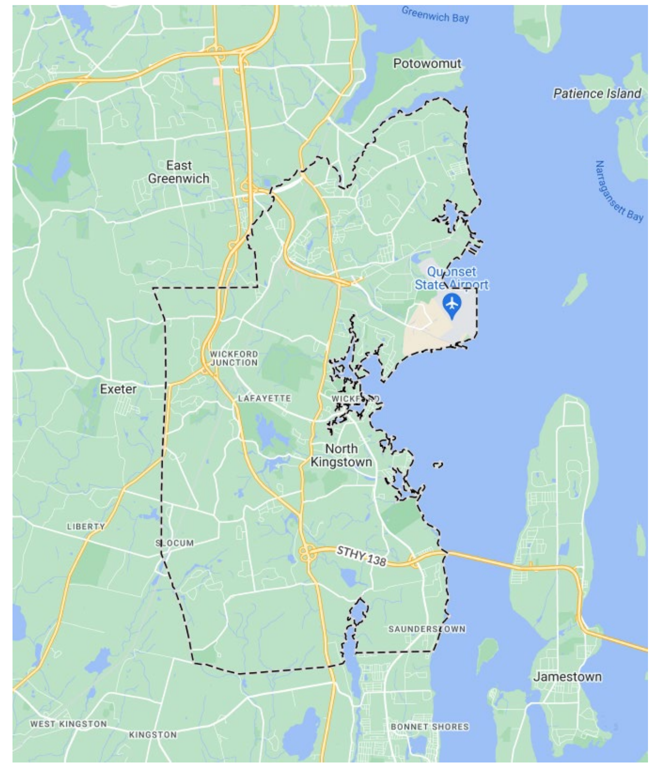


Figure 1: Site Locus

Race:

White alone:	89.5%
Black or African Amer. alone:	0.7%
Amer. Indian or Alaska Native alone:	0.1%
Asian alone:	3.2%
Two or more races:	5.8%
Hispanic or Latino:	3.3%
White alone, not Hispanic or Latino:	88.2%

Health:

With disability, under 65 years (2018-2022): 5.5%
Person's w/o health insurance, under 65 years: 2.2%

Education:

High school graduate or higher (age 25+): 96.6%
Bachelor's degree or higher (age 25+): 49.2%

Economy:

In civilian labor force, total, age 16+ (2018-2022): 66.3%
In civilian labor force, female, age 16+(2018-2022): 60.1%

Income and Poverty:

Median household income: $116,053
Per capita income: $55,950
Persons in poverty: 6.4%

Family and Living Arrangements:

Households: 11,341
Persons per Household: 2.42
Language spoken at home other than English, age 5 years+: 6.4%
Median house cost: $444,200
Percent owner-occupied: 76.4%
Population Density: 642.4/sq. mile

Building Stock: 11,243 Buildings

- 60.8% Residential (building exposure: $3.89B)
- 33.0% Commercial/Industrial (building exposure: $1.63B)
- 6.1% Agricultural/Religion/Government/Education (building exposure: $398M)
- Total building exposure: $6.4B (see **Attachment 4** for more details)

Support, High Occupancy and Vulnerable Population Facilities:

- 37 Facilities including but not limited to Townhall, Public Schools, Marinas, Libraries, Emergency Medical Service Stations, Churches, and Childcare Facilities.

Land Use, % by area:

- 27.3% Conservation/ Limited
- 10.6% Major Parks/ Open Space
- 6.2% Non-urban Developed
- 3.6% Prime Farmland
- 5.6% Reserve[1]
- 5.2% Sewered Urban Developed
- 37.2% Urban Development
- 4.3% Water Bodies

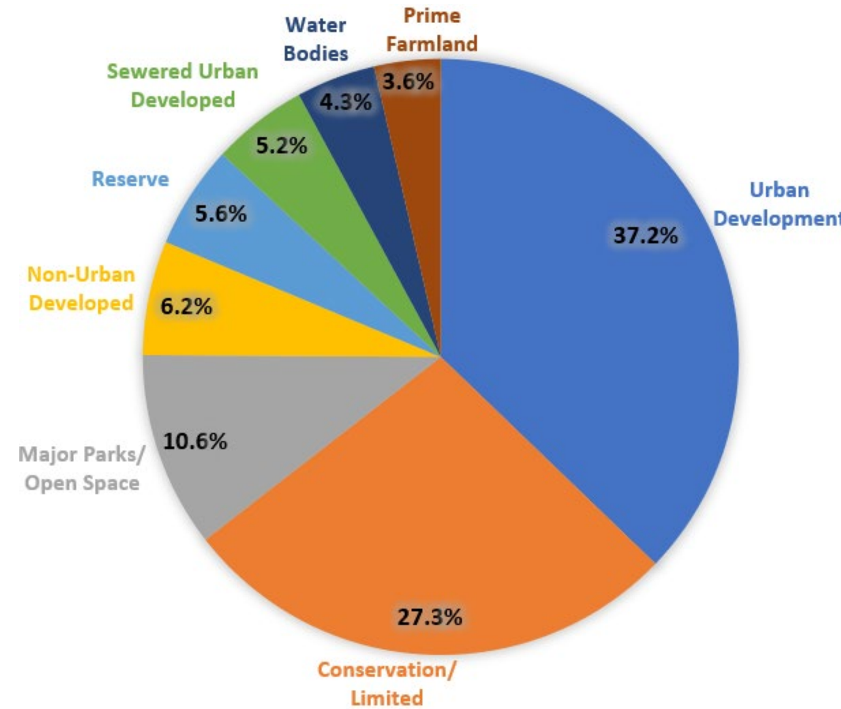


Figure 2: North Kingstown Land Use by Area

[1] Areas determined by RIGIS that were undeveloped in the 1995 land use land cover RIGIS dataset and will not be needed for State's development needs through 2025

Zoning:

·Corporate Compound
·Compact Village Development
·General Business
·General Industrial
·Heavy Business
·Institutional/Office
·Low Density Residential
·Light Industrial
·Multi-Family Residential
·Neighborhood Business
·Neighborhood Residential
·Open Space
·Public Lands
·Planned Business Development
·Pojac Point Residential
·Post Road
·Planned Village District
·Quonset Business Park District
·Rural Residential
·Very Low Density Residential
·Village Residential
·Waterfront Business
·Wickford Junction District
·Wickford Village Center
·Overlay Districts: Groundwater Recharge, Wellhead Protection, Scenic, and Flood Hazard

Future Development:

·Quonset Business Park Area
·NK Solar
·Wickford Elementary School Redevelopment
·Old Theater Redevelopment
·Hollow Ridge
·Post Road Apartments
·Quonset Apartments
·Reynolds Farm North
·Gilbert Stuart Estates
·McDonalds

Historic Districts:

· 18 historic district areas and 12 historic sites

Transportation Infrastructure:

· 8 miles of US Roads
· 22 miles of State Roads
· 224 miles of Town Roads
· 58 RISPP Bridges
· Regional and Amtrak Rail

Essential Facilities:

· 1 Townhall
· 1 Municipal Office Building
· 2 Police Stations
· 4 State Facilities
· 5 Fire Stations
· 4 Emergency Facilities, including 2 Red Cross Surveyed Shelters
· 6 Electricity Substations
· 11 Groundwater Wells and Storage Tanks

Lifeline Systems:

· Town Water Supply System (three different aquifers, the Hunt, Annaquatucket, and Pettaquamscutt)
· Sanitary Wastewater Treatment (four Wastewater Management Districts and On-Site Septic)
· Electricity (RI Energy)
· Natural Gas (RI Energy)
· Telecommunications (multiple)
· Separate Stormwater and Sanitary Infrastructure

Response Facilities (Quonset):

· Miozzi (asphalt manufacturing plant for disaster response)
· Electric Boat Fire Facilities
· National Guard Base
· Army Reserve Base

Hazardous Materials:

· Hazardous waste management facilities are defined as facilities which receive hazardous wastes for treatment, storage, or disposal. North Kingstown contains many facilities that could be considered on this list, but it has been reduced to the larger facilities for this plan. The highest concentration of these facilities is located in the Quonset Business Park, which contains Tier 2 facilities, which have a reporting requirement under the Emergency Planning and Community Right-to-Know Act (EPCRA) where facilities must submit an annual report of hazardous chemicals on-site in quantities exceeding specific thresholds.

· 1 Active Solid Waste Facility

High Potential Loss Facilities:

· 20 Dams (11 Low, 3 Significant, and 6 High Hazard Type)

Natural Resources:

· 13 Natural Heritage Areas

The town consists of (7) seven census tracts, referred to with a census number, but will also be referred to by the flowing community area names in this Plan (also reference **Attachment 2 Figure 1**):

- Census tract 44009050102 - Davisville
- Census tract 44009050103 - Quonset
- Census tract 44009050104 - Quidnessett
- Census tract 44009050301 - Lafayette
- Census tract 44009050302 - Wickford
- Census tract 44009050401 - Slocum
- Census tract 44009050402 - Saunderstown

Social Vulnerability Index:

North Kingstown's Overall Social Vulnerability: 6 out of the 7 census tracts within North Kingstown are categorized as Low, however tract 44009050103, which includes Quonset Point is categorized as High. For the Quonset census tract, North Kingstown ranks in the upper 82nd percentile of all U.S. census tracts.

COMPREHENSIVE PLAN

As required by Rhode Island General Laws in Chapter 45-22.2 entitled "Rhode Island Comprehensive Planning and Land Use Regulation Act", comprehensive plans must incorporate natural hazards into the plan. The plan must include an identification of areas that could be vulnerable to the effects of sea-level rise, flooding, storm damage, drought, or other natural hazards. To address this requirement, the comprehensive plan has a separate element entitled "Natural Hazards and Climate Adaptation". The 2019 hazard mitigation plan provided a foundation for improved mitigation opportunities as evidenced in this element. The hazard mitigation plan is also listed as a relevant planning document in the comprehensive plan and in so doing, effects all the plan elements.

The comprehensive plan was re-written and adopted in 2019. The hazards element has several goals, policies and actions that align with the hazard mitigation plan. While the actions have been revised with this update, when the required 10-year update to the comprehensive plan is completed in 2029, the new actions included in this LHMP will provide the basis for the natural hazards element and be incorporated into the comprehensive plan at that time.

The goals, policies and actions outlined in the comprehensive plan will help to implement the mitigation strategies found in this plan. Many of the new actions in this hazard mitigation plan update incorporate the 2019 actions.

The comprehensive plan identifies high winds, coastal flooding, snow, ice and extreme cold, riverine flooding and drought as the hazards with the most impact to the town. These same hazards are addressed throughout this plan update.

The first goal of the natural hazards element is to "Promote resilience and adaptation to natural hazards and a changing climate to protect lives, infrastructure, resources, and property". The first policy is to "Ensure existing property and business owners are aware of their exposure and risk to coastal hazards and support efforts to improve resiliency". The actions related to this policy include:

PRIORITY	ACTION #	ACTIONS	RESPONSIBLE PARTY	TIMEFRAME	PARTNER AGENCIES
★	7.1.a	Notify property owners within the Special Flood Hazard Area (SFHA) of their exposure to projected sea level rise scenarios.	Building Official, Planning Dept	1 to 3 years	Staff time
★	7.1.b	Create more resilient housing stock through "code-plus " techniques that go above and beyond local building codes to reduce damage and debris from structures during a storm or flooding event.	Building Official	1 to 3 years	Staff time

Another policy in the comprehensive plan is to "Avoid or minimize the exposure of future development to natural hazards and climate change". The following actions are intended to meet this policy:

PRIORITY	ACTION #	ACTIONS	RESPONSIBLE PARTY	TIMEFRAME	PARTNER AGENCIES
★	7.2.a	Evaluate vacant properties within the SFHA and identify opportunities to acquire, purchase, or establish perpetual conservation easements on these parcels.	Town Council	1 to 3 years	Staff time, RIEMA, RIDEM
	7.2.b	Assess feasibility of structuring Purchase Development Rights (PDR) program specific to the SFHA to reduce density in the potential impacted areas of town.	Planning Department	7 to 10 years	RIDEM, RIEMA, Town Budget, Staff time
	7.2.c	Define areas impacted by sea level rise and other flood events for protection, accommodation, preservation, and managed retreat.	Planning Department	7 to 10 years	RIDEM, CRMC, RIEMA, Staff time

Additionally, the comprehensive plan seeks to "Consider natural hazards and potential climate change impacts in all long-range planning and critical public facilities and infrastructure projects". This will be accomplished by implementing the following activities:

PRIORITY	ACTION #	ACTIONS	RESPONSIBLE PARTY	TIMEFRAME	PARTNER AGENCIES
★	7.3.a	Create a database of municipal properties and structures within the SFHA or projected sea level rise areas and record of flood impacts.	Building Official	1 to 3 years	Staff time
★	7.3.b	Request RIDOT conduct a feasibility study to identify strategies to protect evacuation routes and state roadways from storm damage and projected sea level rise inundation. Evaluate the necessity and feasibility of elevating low points along evacuation routes.	RIDOT, DPW	1 to 3 years	RIDOT, Staff time
★	7.3.c	Prioritize public facility improvements that are necessary for increased resiliency on the town Capital Improvement Program and roads currently and potentially impacted by a sea level rise or coastal flooding for inclusion on the state Transportation Improvement Program (TIP) and town Capital Improvement Program.	RIDOT, DPW	1 to 3 years	Staff time
	7.3.d	Restrict development of new roads in areas exposed to coastal flooding and sea level rise scenarios.	DPW, RIDOT, Planning Commission	7 to 10 years	Staff time
	7.3.e	Update and continue to implement the town's Hazard Mitigation Plan with regard to town-owned transportation infrastructure.	Planning Dept, DPW	7 to 10 years	Staff time, RIEMA

As it relates to our natural resources, the comprehensive plan has included a policy to "Protect and preserve natural resources to promote resilience and adaptation to natural hazards and climate change". These actions will help to accomplish this.

PRIORITY	ACTION #	ACTIONS	RESPONSIBLE PARTY	TIMEFRAME	PARTNER AGENCIES
★	7.4.a	Preserve open space in existing salt marsh complexes, floodplain, and in areas exposed to coastal hazards, sea level rise projections and salt marsh migration.	Town Council	1 to 3 years	RIDEM, CRMC, Staff time
	7.4.b	Establish a process and financial incentives for property owners to define conservation easements on their properties to protect areas projected to be inundated by sea level rise or salt marsh migration.	Planning Department	7 to 10 years	RIDEM, CRMC, NK Land Conservancy, Narrow River Land Trust

Historic and cultural resources are also addressed in the plan as demonstrated in the policy to "Protect and preserve important historic and cultural resources from natural hazards and climate change". The following actions are related to this policy:

PRIORITY	ACTION #	ACTIONS	RESPONSIBLE PARTY	TIMEFRAME	PARTNER AGENCIES
★	7.5.a	Create a database of parcels within the historic districts, the Special Flood Hazard Areas (SFHA), and within the projected sea level rise areas to monitor impacts to these areas and coordinate with property owners on potential strategies to protect historic assets.	Building Official	1 to 3 years	RIEMA, Staff time, RIHPHC, property owners
★	7.5.b	Coordinate with the State Historic Preservation Officer and the local Historic District Commission to provide resources and design guidelines for historic home owners within historic districts who may desire to flood-proof their property or structure.	Historic District Commission (HDC), RI Historic Preservation and Heritage Commission (RIHPHC), Building Official	3 to 5 years	Staff time, RIHPHC
	7.5.c	Establish financial incentives for owners of historic properties who voluntarily invest in adaptation strategies to flood-proof or otherwise protect vulnerable assets, such as low-interest loans or historic preservation grants.	Historic District Commission (HDC), RI Historic Preservation and Heritage Commission (RIHPHC), Building Official	7 to 10 years	Staff time, Town budget, RIHPHC, CRMC

There are several other planning documents that link to and integrate hazard mitigation-related measure. From a state perspective, the State Transportation Improvement Program (STIP) is a list of transportation projects the State of Rhode Island intends to implement using U.S. Department of Transportation funds. There are several projects within North Kingstown listed in the STIP. Each project in the STIP are identified as having a sea level rise (SLR) component. For North Kingstown, the Wickford Village Sidewalk and Resiliency Enhancements project are identified as having an SLR component. This project is described in the STIP as including rehabilitation of historic bridge structures, resurfacing of the roadway, and sidewalk improvements to improve pedestrian accessibility. The Post Road and West Main Street sidewalk improvement project in the STIP may also include stormwater measures to address drainage issues along these corridors. A portion of this project is also identified as having an SLR component. There are several STIP projects in North Kingstown to preserve or rehabilitate bridge infrastructure. The Gilbert Stuart Bridge was rehabilitated in 2022. This project was identified as having an SLR component. The Devils Foot Road Railroad bridge is also scheduled for reconstruction. There may be stormwater improvements associated with that reconstruction. Portions of Route 2 and Route 1A will be repaved and may include drainage improvements. Since the 2019 plan was adopted, there have been drainage improvements completed as part of the STIP on Post Road/Route 1. The improvements included a drainage structure at the intersection of Post Road and Essex Road.

In terms of drinking water protection, the groundwater recharge and wellhead protection overlay districts regulates the uses and densities that can locate in the aquifer area in an effort to protect the town's drinking water from contamination. The Water Supply System Management Plan has extensive actions that should take place in the event of natural or man-made disasters to protect the water supply from contamination. As an additional protection measure, the town is committed to acquiring land and conservation easements in the groundwater protection areas. All of these actions limit the potential for groundwater contamination and ensure sufficient recharge of the aquifer, ultimately mitigating the effects of drought.

Another pertinent document is the North Kingstown Tree Inventory Management Plan. This plan recommends regular tree trimming to reduce the potential for damage to utility lines from fallen limbs. The Conservation Commission is in the process of updating the street tree inventory that was first conducted in 2001.

The North Kingstown Emergency Operations Plan (EOP) was updated in 2021. The EOP addresses the town's planned response to natural disasters among several other events requiring emergency response. The EOP recognizes the four phases of emergency management: Preparedness, Response, Recovery and Mitigation. As relevant to the LHMP, the mitigation section addresses the following: anticipating, planning for, and readying the necessary notification systems; identifying opportunities to mitigate hazard impacts on transportation systems and infrastructure; reviewing the LHMP and Rhode Island State Hazard Mitigation Plan as they relate to assets, infrastructure, and risk reduction; providing in-kind professional, technical, and administrative resources to mitigation efforts; and coordinating and supporting the establishment of review and study teams to include contracting local government for mitigation needs.

The Harbor Management Plan (HMP) was updated and approved in 2021. The HMP includes a Storm Preparedness Plan which aligns with the actions of this plan. The goals of the Storm Preparedness Plan are as follows:

To prevent the loss of life and property by:

- Properly preparing harbor and shoreline areas for storm events;
- Having a completed and enforceable response and recovery plan;
- Working in cooperation with harbor and shoreline users to ensure that a coordinated approach is applied to hazard mitigation;
- Integrating harbor hazard mitigation activities with other, ongoing, local hazard mitigation programs; and
- Identifying and completing long-term actions to redirect, interact with, or avoid the hazard.

The town participated in the Rhode Island Infrastructure Bank's Municipal Resilience Program (MRP) in 2021. The MRP provides direct support to cities and towns to complete a community-driven process that will bring together climate change information and local knowledge to identify top hazards, current challenges, and community strengths. This process will identify priority actions and strategies to improve the municipality's resilience to all natural and climate-related hazards using a flexible, tested approach called Community Resilience Building (CRB). Through the MRP and CRB process, the town was able to assess its vulnerability to and prepare for climate change impacts, build community resilience, and receive designation as a Resilient Rhody Municipal Resilience Program (MRP) municipality. A report was created which summarizes the findings of this process including an assessment of hazards and climate change impacts to and identifies projects, plans and policies for improved resilience in North Kingstown. The report outlined hazards of concern, determined the town's strengths and weaknesses, identified actions and established opportunities for collaboration. The hazard mitigation plan was a primary resource for much of the information to establish the dialogue and generate these findings. The top hazards identified as part of the MRP process were coastal flooding, storm surge, high winds, extreme temperatures and riverine flooding. These hazards are directly in keeping with the hazards identified in the HMP.

Other resources and plans incorporated into this hazard mitigation plan update include the Shoreline Change Special Area Management Plan (SAMP), Rhode Island Coastal Resources Management Council (CRMC) Climate Change and Sea Level Rise Policy, the NOAA 2022 Sea Level Rise Technical Report, Federal and state flood regulations, Adapting to Coastal Storms and Flooding Report (2014, Nature Conservancy), 2023 Hazard Mitigation Plan – University of Rhode Island, Coastal Zone Management Act, Federal Coastal Barriers Act, Local floodplain ordinances, and State and federal permits related to natural hazard mitigation, resilience, and adaptation measures.

These sources collectively inform this hazard mitigation plan by providing scientific data, policies, and guidelines for managing natural hazards, sea-level rise, and flood risks. The Shoreline Change SAMP offers detailed maps for managing erosion, while the CRMC Climate Change and Sea Level Rise Policy guides local adaptation efforts. NOAA's 2022 report on sea-level rise and the Coastal Zone Management Act provide key sea level projections and frameworks for coastal planning. The Federal Coastal Barriers Act helps prevent development in vulnerable areas, and federal and state flood regulations, along with local floodplain ordinances, set standards for flood management. Reports like the 2014 Adapting to Coastal Storms and Flooding Report and the 2023 URI Hazard Mitigation Plan offer recommendations for resilience, while state and federal permits ensure that mitigation measures comply with regulatory requirements. Utilizing these resources helps to shape comprehensive, science-based, and legally compliant hazard mitigation strategies.

COMMUNITY RATING SYSTEM (CRS)

The Community Rating System (CRS) is a voluntary program that recognizes and encourages a community's efforts that exceed the NFIP minimum requirements for floodplain management. North Kingstown's entry date to the CRS was on October 1, 1993. The CRS program emphasizes three (3) goals: 1) Reduce and avoid flood damage to insurable property 2) Strengthen and support the insurance aspects of the National Flood Insurance Program (NFIP); and 3) Foster comprehensive floodplain management.

By participating in the CRS program, communities can earn a 5 % -45% discount for flood insurance premiums based on the activities that reduce the risk of flooding within the community. Some of these activities include maintaining records for floodplain development, publicizing the flood hazard, improving flood data, and floodplain management planning. North Kingstown is one (1) of eleven (11) communities in Rhode Island that currently participates in the CRS and receive flood insurance premium discounts. North Kingstown has a CRS rating of 9, which entitles property owners to a 5% discount on their flood insurance premium. The total annual savings to all those policy holders in North Kingstown is $24,531, averaging $49 per policy holder. It is a priority and stated goal for North Kingstown to improve their CRS rating over the life of this plan. The town intends to achieve a class 7 rating by the next Plan update.

The Town of North Kingstown participates in the NFIP, as described in the Town's Municipal Zoning Code, Sec. 21-188. - Special flood hazard overlay district. The most recent Flood Insurance Rate Map (FIRM) In North Kingstown, the effective FIRM was revised in 2023, with panels dated 2010, 2013, and 2020 and within the town, the Building Official enforces the local NFIP.

The hazard mitigation plan is directly linked to the CRS program. Most importantly, having an adopted hazard mitigation plan, which meets the criteria as a floodplain management plan, the town gains points towards a higher rating and additional savings to policy holders. The town council is provided with a yearly update on the actions outlined in the HMP to demonstrate plan implementation.

As part of our participation in the Community Rating System (CRS) program, the town provides a public outreach component. As part of this requirement, the town maintains Elevation Certificates (EC) for all new construction and substantially improved buildings in the Special Flood Hazard Area. We also provide basic flood information, additional FIRM information, flood depth data, historical flood information, and natural floodplain functions to inquirers on a regular basis. We also provide information on the flood insurance requirements to the public who come to the office or ask by phone. This information can be accessed by visiting the town hall in person, telephoning the offices or emailing staff. The town also provides access to the FIRM and flooding information on the municipal web site at https://northkingstownri.gov/212/Flooding-Flood-Insurance-and-Community-R . We also send yearly outreach to lenders, insurance agents and real estate offices about the FIRM, flood insurance and elevation certificate information that is available. The town also publishes a public notice advertisement in the local newspaper announcing where residents can access information related to flood zones and flood protection information. The North Kingstown Free Library continues to be a repository of information for flood protection data as well. A flyer informing property owners of the availability of flood hazard information is available at the local library as well as the Planning Department as part of our repository. A similar publication is included in the local newspaper The Independent.

SECTION 4: NATURAL HAZARD RISK

NATURAL HAZARD RISK OVERVIEW

GZA conducted an updated Natural Hazard Risk Assessment to evaluate the potential consequences of natural hazards to the people, economy, and built and natural environments of the town of North Kingstown. The FEMA National Risk Hazard Index (NRI) was used to evaluate economic losses due to several hazards, listed in **Table 1.** The FEMA NRI results are presented in **Attachment 4**. The FEMA National Risk Index was used to score the natural hazards based on the expected annual loss for each hazard, as well as the community resilience and social vulnerability for each community (see **Table 1**).

The details of the risk assessment and how the hazards were ranked are presented in **Attachments 2 and 3.**

The top 3 ranked hazards include:

- **Coastal Flooding** 1

The extent of coastal storm surge impacts a large area of shoreline and low-lying areas of the town and it is a top-ranked hazard due to: 1) flood inundation impacts to the Town's Essential Facilities; 2) impacts to transportation infrastructure; 3) impacts to the lifeline systems; 4) impacts to Beach Communities; and 5) natural resources including marshes and beaches. Extensive damage to the Transportation Infrastructure and Essential Facilities would result in significant impacts to residents due to loss of access to key roadways and loss of emergency response services (at least temporarily).

North Kingstown has land area in the A, AE, VE, and X Flood Hazard zones as designated by FEMA. The "A" and "AE" zones are classified as zones where properties have a 1 % chance of flooding in any year and a 26 % chance of flooding over the life of a 30-year mortgage. "VE" zones indicate that properties have a 1 % chance of flooding in any year and also face hazards associated with coastal storm waves. "X" zones are subject to a 500-year flood. These properties are outside the high-risk zones; therefore, the risk is reduced, but not removed. These properties are in an area of overall lower risk.

Sea level rise is expected to raise this hazard due to increasing extent and depth of flooding, as well as the worsening effects of waves resulting principally from rising sea levels. This will in turn result in greater impacts to even larger extents of shoreline and increasing the vulnerability of major transportation, essential facilities, lifeline systems, residential and commercial properties as well as increasing the size of regularly flooded areas, including marshes and further eroding shorelines.

- **Hurricanes/ Tropical Storms/ Nor'easters** 2

Severe wind, and related damages during hurricanes is ranked second due to its relatively high probability of occurrence, its coincidence with coastal flooding and its potential for wide-spread damage. In particular, a hurricane strike at or near North Kingstown with a 1% probability of occurrence (100-year recurrence interval) would be catastrophic (similar to the 1938 and 1954 hurricanes). In addition to high winds, hurricanes will also create large storm surges, waves, and heavy rainfall.

Hurricanes are tropical based storms that travel north up the Atlantic coast and feature heavy rain and high velocity winds. Hurricanes occur from late summer to early fall, as opposed to nor'easters, which are similar to hurricanes in effect but occur in the winter months. Nor'easters have a typical storm surge of 3', which can increase flooding especially at high tide or spring tides. Both types of storms can cause large amounts of damage across a wide area.

- **Riverine Flooding** 3

The extent of riverine flooding impacts is ranked as the third highest hazard for the town. Riverine flooding is a function of precipitation levels (both rain and snow) and water runoff volumes within the stream or river. Riverine flooding is defined as the periodic occurrence of over bank flows of rivers or streams resulting in partial or complete inundation of the adjacent floodplain. The recurrence interval of a flood is defined as the average time interval, in years, expected to take place between the occurrence of a flood of a particular magnitude to an equal or larger flood. Flood magnitude increases with increasing recurrence interval. When land next to or within the floodplain is developed, these cyclical floods can become costly and dangerous events.

The Hunt and Annaquatucket are major rivers with a history of flooding.

The Hunt River flows northeast into Potowomut Pond and eventually empties into Narragansett Bay and is located along the northern border of North Kingstown and the southern border of Warwick. As recently as the 2023-2024 winter storms, the north end of Post Road on the East Greenwich border was closed because the Hunt flooded, necessitating a detour.

The Annaquatucket River The river flows north to RI Route 4, then turns southeast and flows into Belleville Pond, then to Narragansett Bay through Bissel Cove. In March of 2010, five to ten inches of rain fell across the area, causing the river to rise and Featherbed Lane to close. Hurricane Sandy also knocked out the bridge on Featherbed Lane a few years later.

The Pawcatuck River and tributaries run west to east through the southern reaches of the State including portions North Kingstown. While there is limited development in these areas, during significant flood events flooding damages do occur (RIHMP 2024).

Table 1: North Kingstown Natural Hazard Ranking based on the hazard frequency of occurrence, severity, and extent of impact area.

Severe Weather Hazards:	Hazard Index	Hazard Rating
Strong Wind	24.5	Very Low
Tornadoes	27.3	Relatively Low
Hurricanes/Tropical Storms	74.7	Relatively Moderate
Lightning	44.6	Relatively Low
Hail	24.8	Very Low
Coastal Flooding	87.4	Relatively Moderate
Riverine Flooding	71.4	Relatively Moderate
Severe Winter Weather	32.9	Very Low
Ice Storms	64.6	Relatively Moderate
Severe Weather Hazards:	**Hazard Index**	**Hazard Rating**
Climate-Related Hazards:		
Heat Wave/ Extreme Heat	18.3	Relatively Low
Cold Wave/ Extreme Cold	44.6	Relatively Low
Drought	35.1	Relatively Low
Wildfire	59.6	Very Low
Geologic Hazards:		
Earthquake	29.5	Very Low
Landslides	37.7	Relatively Moderate

Table 2 presents a summary of the predicted hazard likelihood of occurrence/frequency, severity/magnitude and impact area for each natural hazard that is relevant to North Kingstown. The hazard probability of occurrence (frequency) is characterized as:

Frequency:

Very Low: Events that occur less frequently than once in 1,000 years (less than 0.1% per year).

Low: Events that occur from once in 100 years to once in 1,000 years (0.1% to 1% per year)

Medium: Events that occur from once in 10 years to once in 100 years (1% to 10% per year).

High: Events that occur more frequently than once in 10 years (greater than 10% per year).

The hazard impact in part is characterized as follows:

Severity:

Minor: Limited and scattered property damage; no damage to public infrastructure (roads, bridges, trains, airports, public parks, etc.); contained geographic area (i.e., 1 or 2 communities); essential services (utilities, hospitals, schools, etc.) not interrupted; no injuries or fatalities.

Serious: Scattered major property damage (more than 50% destroyed); some minor infrastructure damage; wider geographic area (several communities); essential services are briefly interrupted; some injuries and/or fatalities.

Extensive: Consistent major property damage; major damage to public infrastructure (up to several days for repairs); essential services are interrupted from several hours to several days; many injuries and fatalities.

Catastrophic: Property and public infrastructure destroyed; essential services stopped, thousands of injuries and fatalities.

Climate change will influence Severe Weather Hazards and Climate-Related Hazards. **Table 3** compares key components of North Kingstown's climate today to changes predicted by the year 2050. The impact of certain climate change effects on the town such as increased precipitation and flooding are predictable. The impact of other effects such as the increase in the frequency and duration of Heat Waves are less predictable. However, these Climate-Related hazards are predicted to become a high priority for North Kingstown over the next decade.

Table 2: Town of North Kingstown Natural Hazard Overview

Natural Hazard	Likelihood/Frequency	Severity/Magnitude	Impact Area
SEVERE WEATHER HAZARDS			
Severe Wind:			
Strong Wind	· Strong Wind within Washington County: 1.2 events per year (26 events over 34 years); **Very Low**	Minor to Extensive	Town-wide
Hurricane	· Hurricanes within Washington County: 0.2 events per year (32 events over 73 years); **Relatively Moderate**	Serious to Catastrophic	Town-wide
Tornado	· Tornadoes within Washington County: 0.1 events per year (3 events over 72 years); **Relatively Low**	Serious to Catastrophic	Town-wide

Natural Hazard	Likelihood/Frequency	Severity/Magnitude	Impact Area
Lightning	·Lightning within Washington County: 11.6 events per year (158 events over 22 years); **Relatively Moderate**	Minor (fatality risk is very low)	Town-wide or portions of Town
Hail (≥ 3/4 inch)	· Hail within Washington County: 1.7 events per year (36 events over 34 years); **Very Low**	Minor to serious	Town-wide or portions of town
Flooding:			See FEMA's National Flood Hazard Layer (NFHL) Viewer for detail.
Coastal Flooding	· Stillwater elevation (SWEL) = 5.4 to 6.1 ft NAVD88: 10% AEP (10-year recurrence interval); **Medium**	Minor to Serious	Portions of town along Wickford Cove including W Main St. and Newton Ave.
	· Stillwater elevation (SWEL) = 8.4 to 9.5 ft NAVD88: 2% AEP (50-year recurrence interval); **Medium to Low**	Serious	Portions of town east of U.S. Route 1; Earle Dr. and Lone Tree Point; Brown St.; W Main St.; Main St.; Wright Lane; Lexington Ave.; Fowler St.; Low-Lying Areas in Quonset
	· Stillwater elevation (SWEL) = 10.6 to 12.1 ft NAVD88: 1% AEP (100-year recurrence interval); **Low**	Serious to Catastrophic (10% of buildings and 6% of roadways)	Portions of town east of U.S. Route 1; Most of Wickford; Waldron Ave.; Quonset State Airport
	· Stillwater elevation (SWEL) = 20.1 to 22.9 ft NAVD88: 0.2% AEP	Catastrophic (18% of buildings including 2 Fire	Portions of town east of U.S. Route 1; Most of QDC and

Natural Hazard	Likelihood/Frequency	Severity/Magnitude	Impact Area
	(500-year recurrence interval); **Very Low**	Stations, 13% of roadways)	Wickford; Quidnessett Country Club and coastal neighborhoods to the south
Riverine Flooding	· Riverine Flooding within Washington County: 0.8 events per year (20 events over 24 years); **Very Low**	Minor to Serious	Portions of town

Town impact due to coastal flooding:

· Essential facilities: North Kingstown Town Hall at 80 Boston Neck Road, North Kingstown Fire Department Station 3, and Quonset Fire Department are expected to be impacted during the 1% AEP flood.

· 4 Historic Sites, Wickford Historic District, 3 Churches, 5 Marinas, 1 Library, 1 Emergency Medicinal Service Station, and 8 bus stops are expected to be impacted by 1% AEP Flood.

· 1,130 buildings are predicted to be impacted during the 1% AEP flood. The number represents 10.1% of the total number of buildings in North Kingstown.

· 2,020 buildings are predicted to be impacted during the 0.2% AEP flood. The number represents 18% of the total number of buildings in North Kingstown.

· 15.6 miles of town/ State Roads impacted. Section of U.S. Route 1 and State Route 1A during floods of <1% AEP (>100-year recurrence interval).

· 34.9 miles of town/ State Roads impacted. Section of U.S. Route 1 and State Route 1A during floods of <0.2% AEP (>500-year recurrence interval).

· Widespread impacts to on-site septic systems during to the 1% AEP and 0.2% AEP flood.

Table 2 Continued: Town of North Kingstown Natural Hazard Overview

Severe Winter Weather:			
Winter Weather	· Winter Weather within Washington County: 4 events per year (40 events over 16 years); **Very Low**	Serious	Town-wide or portions of town
Ice Storm	· Ice Storms within Washington County: 1.4 events per year (59 events over 67 years); **Very Low**	Serious	Town-wide or portions of town

Snowfall estimates (snowfall estimates from Rhode Island area):

· NCEI indicates that Rhode Island can expect at least two winter storm events per year

· Average annual snowfall of 25-50 inches

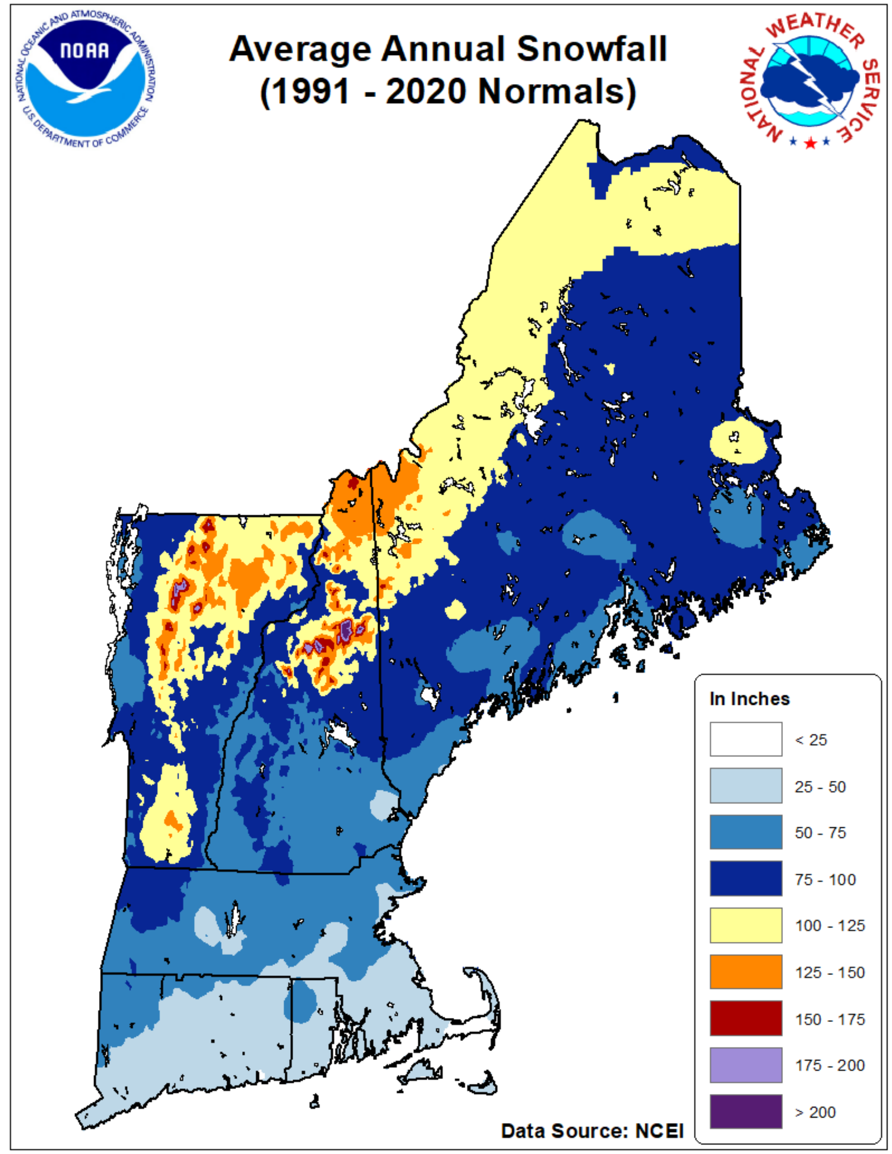


Figure 3: Average Annual Snowfall - NCEI

Table 2 Continued: Town of North Kingstown Natural Hazard Overview

CLIMATE-RELATED HAZARDS			
Extreme Temperatures:			
Heat	· Heat Wave within Washington County: 0.6 events per year (6 events over 16 years); **Very Low**	Minor to Serious (in particular for more vulnerable populations)	Town-wide
Cold	· Cold Wave within Washington County: 0.1 events per year (1 events over 16 years); **Very Low**	Minor	Town-wide
Drought	· Some level of drought can be expected 1.4 times per year in Washington County; **Relatively Low** · A weekly estimate of the percentage of each Washington County to Drought Monitor Categories (D0 – Abnormally Dry; D1 – Moderate Drought; D2 – Severe Drought; D3 – Extreme Drought; D4 – Exceptional Drought) is 26.6%.	Minor - could be Serious if affects town water supply	Town-wide
Wildfire	· The historical data indicates that the probability of wildfire within North Kingstown is very low. Quantitative probabilities of occurrence are 0.001% chance per year. **Very Low**	Minor	Town-wide

Town climate considerations:

Periods of colder temperatures occur at North Kingstown and can cause wind chill conditions. Wind chill conditions example:

- 0° F and 25 mph sustained wind speeds, 30-minute exposure
- 5° F and 55 mph sustained wind speeds, 30-minute exposure

The severity and magnitude of extreme heat events at North Kingstown is, in part, dependent upon: 1) demographics; and 2) the capability of residents to get cool (e.g. air conditioners in homes). North Kingstown's demographic data indicates that about 31% of the population may be at a greater than average vulnerability.

- 21% of North Kingstown's population is older than 65 years
- 4% of North Kingstown's population is less than 5 years
- 6% of North Kingstown's population is at the poverty level

Table 2 Continued: Town of North Kingstown Natural Hazard Overview

GEOLOGIC HAZARDS			
Earthquake	· 4-10 damaging earthquakes predicted in 10,000 years (~1,000-2,500-year recurrence interval) Peak Ground Acceleration (PGA) in the vicinity of North Kingstown is 0.14-0.15g; **Very Low**	Serious	Town-wide
Landslide	· Landslide conditions do not exist within the town. Local areas of shoreline bluff may experience sloughing or slope stability failure due to coastal erosion. **Very Low (only local shoreline bluff failures)**	Minor	Town-wide
Tsunami	· The probability of a significant tsunami affecting North Kingstown is **Very Low**.*	Minor to Catastrophic	Town-wide
SECONDARY HAZARDS			
Dam Failure	· High Hazard Dams in the town are: Carr Pond, Rodman Mill, Shady Lea Mill, Silver Spring Lake, Slocum Road Upper, and Slocum Woods. The Silver Spring dam has residential usage downstream and is listed as in unsafe condition, needing to be addressed. · Dams outside of town that may also pose a risk include Slocum Reservoir Dam (RI01108).	Minor to serious	Portions of Town See Locations of Dams in Rhode Island by RI DEM GIS for location details.

*2024 State of Rhode Island Hazard Mitigation Plan excluded Tsunami from the State's list of natural hazards

About earthquakes and tsunamis at North Kingstown:

1. The direct earthquake risk to North Kingstown is due to the ground motion that results during the earthquake. "While earthquake events do occur in Rhode Island, they tend to occur at a much lower intensity than elsewhere in the region. Additionally, earthquake events felt in Rhode Island are likely the result of an earthquake that occurs in the surrounding region." (2024 RI Hazard Mitigation Plan). The Seismic Design Category for the majority of North Kingstown is A or B indicating a low seismic hazard. The 10% in 50 years (500-year recurrence interval) ground motion would be experienced as light to moderate perceived

shaking and none to very light damage. The 2% in 50 years (2,500-year recurrence interval) ground motion would be experienced as very strong perceived shaking and moderate damage. Based on HAZUS-MH simulations of North Kingstown, 587 buildings are predicted to experience damage, ranging from slight to complete, from the 2,500-year (2% in 50 years) recurrence interval earthquake. The estimated economic losses are about $43 million for the 2,500-year event.

2. Given its coastal setting, there is some risk of a tsunami reaching North Kingstown. However, the risk of a significant tsunami is generally believed to be very low. There are two primary tsunami sources that could affect the Southern New England coast: 1) a tsunami generated by an earthquake along the Puerto Rican trench (located in the Caribbean); and 2) a slope failure of the continental shelf off of New England (likely due to an earthquake). A landslide of the Cumbre Viejo in the Azores is also a potential New England tsunami source. If these occurred, and a tsunami reached the Narragansett Bay area, it would have to propagate as a tidal bore within the Bay to reach North Kingstown, further reducing the town's risk.

Table 3: Climate Change and North Kingstown

North Kingstown Climate Today	North Kingstown Climate 2050
Temperature: The average max temperature is approximately 59°F. · The average low temperature in Winter (December, January and February) ranges from 20°F to 25°F, with the coldest temperature occurring during January. · The average high temperature in Summer (July and August) ranges from 80°F to 81°F, with the warmest temperature occurring during July. · Days above 90°F (based on state-wide data): 8 days · Heat Index above 105°F: 0 days · For Rhode Island from 1950 to 2020, days with a max temperature above 90°F has been above average since the 1990s, with the highest number hot days occurring from 2015–2020 (an average of 14 hot days per year).	***Temperature***: The average annual temperature could be between 3°F and 5°F higher than today. · Average Summer temperature (based on county-wide data): could be between 2°F and 3°F higher than today. · Days above 90°F (based on county-wide data): 10 to 16 days · Heat Index above 105°F: 5 days · Spring will arrive sooner, summers will grow hotter, and the weather will becoming more extreme with swings between above-average winter temperatures to extreme cold with large snowfall events. · Figure 4 is an approximate climate representation of a similar region as future greenhouse gas emissions are realized.
Intense Precipitation: · The 25-year recurrence interval, 24-hour rainfall at North Kingstown is: 6.03 inches · The 100-year recurrence interval, 24-hour rainfall at North Kingstown is: 7.60 inches	***Intense Precipitation***: Within the Northeast U.S., from 1996 to 2014, the amount of intense rainfall (heaviest 1% of all daily events) was about 50% higher than the period of 1901 to 1995. The frequency and intensity of intense rainfall is expected to increase.
Sea Levels and Coastal Flooding: (FEMA Flood Insurance Study, Revised July 19, 2023) Flood Stillwater Elevation (South to North*): · 10% AEP: 5.4 to 6.1 ft NAVD88 · 2% AEP: 8.4 to 9.5 ft NAVD88 · 1% AEP: 10.6 to 12.1 ft NAVD88 · 0.2% AEP: 20.1 to 22.9 ft NAVD88 *Elevations increase further up Narragansett Bay due to a funneling effect	***Sea Levels and Coastal Flooding:*** There is very high confidence that sea levels near North Kingstown will increase, and the NOAA 2022 high projections are about 1.6 feet by the year 2050 (relative to the year 2000). Using this as a planning bound: · 10% AEP Flood Stillwater Elevation: 7.0 to 7.7 ft NAVD88 · 2% AEP Flood Stillwater Elevation: 10.0 to 11.1 ft NAVD88 · 1% AEP Flood Stillwater Elevation: 12.2 to 13.7 ft NAVD88 · 0.2% AEP Flood Stillwater Elevation: 21.7 to 24.5 ft NAVD88

Changes in average summer heat index—a measure of how hot it actually feels, given temperature and humidity—could strongly affect quality of life in the future for residents of the Northeast. Red arrows track what summers could feel like in the region over the course of the century under the higher-emissions scenario. Yellow arrows track what summers in these states would feel like under a lower-emissions scenario. (Source: Confronting Climate Change in the US Northeast, 2007)

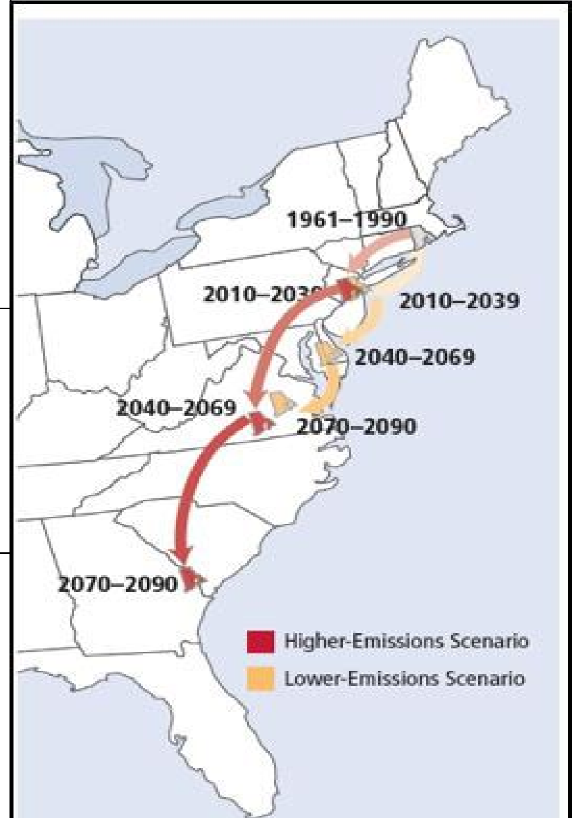


Figure 4: Latitudinal Changes in Regional Climate (Source: RI Executive Climate Change Coordinating Council, 2020)

SECTION 5: NATURAL HAZARD MITIGATION STRATEGIES

The North Kingstown Local Planning Team (LPT) prepared an updated mitigation strategy to reduce the potential losses identified in the risk assessment (see **Section 4** and **Attachment 3**) based on the town's existing mitigation capabilities and community's ability to improve these capabilities in the future. This strategy includes the following four elements as per 44 Code of Federal Regulations (CFR) part 201.6:

1. Hazard Risk Mitigation Goals
2. Hazard Mitigation Implementation and Progress (**Attachment 12**)
3. Existing Hazard Mitigation Capabilities
4. Hazard Risk Mitigation Measures/Actions

This updated strategy serves as a roadmap for the next 5 years that builds upon the extensive mitigation and climate adaptation work carried out over the last five years based on the 2019 HMP Update. In the 2019 HMP Update existing capabilities and actions included in elements 1 and 4 above were combined into a single comprehensive table (Table 13 of the 2019 update). To better differentiate between these complementary elements, this Plan Update present elements 3 and 4 as separate tables relative to the type of natural and climate related hazard. It is important to note that a majority of the new measures and actions outlined in this HMP Update focus on the highest ranked hazards due to the potential impacts these hazards may have on the town, but other hazards are incorporated where they are known to be highly disruptive.

1. HAZARD RISK MITIGATION GOALS

The North Kingstown Local Planning Team (LPT) met on July 23, 2024 to review proposed hazard mitigation goals. In consideration of feedback provided by the LPT and Planning Commission, the LPT endorsed the following for goals for this Plan Update.

Mitigation Goals

1. Preserve, restore, and enhance the natural resources and environment in North Kingstown to promote resilient ecosystems against natural hazard impacts.
2. Reduce the vulnerabilities of our built environment - our communities, infrastructure, buildings, and historic and cultural resources.
3. Develop and implement plans and policies that encourage resilient natural systems, built environments and communities.
4. Create a coordinated approach to mitigation planning and action through education, communication, and outreach.

2. HAZARD RISK MITIGATION GOAL DETAILS

The North Kingstown Local Planning Team (LPT) has documented the progress made by the town over the last 5 years based on the actions outlined in the 2019 HMP Update. Based on the input provided by team members the LPT identified progress made on 30 of the 37 mitigation action items outlined in Table 13 of the 2019 HMP Update (see pages 116 through 123 at the following link):

https://northkingstownri.gov/DocumentCenter/View/3284/North-Kingstown-HMP-FINAL-APPROVED-PLAN-2019).

It is important to note that many of the following mitigation action items continue to be ongoing activities which are included as existing capabilities presented in **Attachment 12 - Table 1** and as mitigation actions/measures in **Table 4** of this HMP Update.

Natural Hazard Mitigation Plan Implementation, Maintenance, & Review

ANNUAL REVIEW OF MITIGATION EFFORTS & PLAN IMPLEMENTATION: From 2019 to 2024, the town's lead agencies reported on implementation of the mitigation actions outlined in the Plan Update annually through the town's annual report.

5-YEAR REVIEW & UPDATE NATURAL HAZARD MITIGATION PLAN: The town prepared this HMP Update from April of 2024 through November of 2024.

CAPITAL IMPROVEMENT PROGRAM: From 2019 to 2024, the town participated in annual updates to the 5-year capital improvement programs at the State, Regional, and municipal levels that resulted in funding hazard mitigation actions. These projects include, but are not limited to the following (Capital Improvement Plan (CIP) FY 2023- FY 2027):

- Water Main Condition Assessment
- Sewer Updates
- Replacement of Water Main in Saunderstown Village
- Facility/Town Wide Security Upgrade
- New Police/Fire Station/Communications Center (29/35)

GRANTS: the town successfully received funding from The Municipal Resilience Program (MRP) to help improve the infrastructure within the State of Rhode Island for the following projects: $24k grant - Roger Williams Drive End of Road Retrofit: to mitigate erosion and the impacts of the stormwater flow by removing unnecessary pavement and installing grassy areas, a sediment forebay, and a sand filter. $647k grant - Wickford Waterfront Improvements: to implement low impact stormwater management with enhanced green infrastructure to adapt to changing coastal conditions, mitigate stormwater runoff, and address high tide flooding at the municipal waterfront parking lot, known as the Brown Street Parking Lot, in Wickford Village. Applied for an Ocean State Climate Adaptation and Resilience (OSCAR) Fund in 2024 to relocate and redesign the existing seawall and installing stormwater control measures on the town beach campus. The town supported Historic New England seeking a Certified Local Government (CLG) grant for Casey Farm improvements to accessibility and stormwater management in early 2024. $450k grant - Southeast New England Program (SNEP) to improve its decentralized wastewater systems in 2023. North Kingstown received RIDEM Climate Resilience 2020 and RI Commerce Corp. Main Street RI Streetscape Improvement Grants for Wickford Waterfront Improvements.

IMPLEMENTATION: North Kingstown's Building and Zoning Official is responsible for following and administering the requirements of the NFIP for implementing the substantial improvement/ substantial damage provisions after an event. The Official has been trained on the NFIP requirements. The Building and Zoning Official is responsible for damage assessment and enforcing FEMA regulations for rebuilding following a natural disaster incident, but does not have other responsibilities, such as tracking and compiling Letters of Map Change (LOMC).

For an event that caused damage, the Building Official coordinates with the Town's EMA Director to assess the damages. When the permit applications are filed to correct the damage, FEMA regulations are assessed based on the estimated cost to repair and any other work included in the application. Depending on how the assessment placed the damage correction/improvement the FEMA regulations would be applied to each property, including elevating structures and retrofitting to withstand future damages.

BUILDING CODE: North Kingstown uses the Rhode Island State Building Code through the Building Code Commission to control construction, reconstruction, repair, removal, demolition, and inspection of all structures. The Code requires new construction and substantial improvements to meet the minimum NFIP criteria.

Planning & Regulatory Standards

FLOOD ENFORCEMENT: From 2019 through 2024 the town enforced flood standards through existing codes, adhering to the new definition for building height adopted in 2020, and continues to protect lands subject to flooding and erosion to direct development away from these hazardous areas.

STORMWATER MANAGEMENT: The town continues to follow state stormwater management and low impact development regulations in review of land development applications. The town participated in a training with the Southeast New England Program (SNEP) focused on building understanding of stormwater management techniques and capacity to develop solutions to identified stormwater problems.

WATER SUPPLY: The town continues to implement the regulations outlined in the towns groundwater recharge and wellhead protection overlay district. The groundwater ordinance was updated in 2022 to address things such as density and land uses allowed the groundwater area. The RIDEM has published new groundwater wellhead and recharge area mapping that was adopted in the new ordinance update.

DESIGN STANDARDS: The town is also looking to amending the subdivision regulations to better address low impacts development standards, including green infrastructure. The Historic District Commission (HDC) application process balances preservation of historic integrity and protection of property from flood damage. The town has placed more emphasis on utilizing the STORMTOOLS program to help property owners determine design life for structures.

SHELTERS: The North Kingstown Emergency Operations Plan (EOP) was updated in 2021 and utilizes the South Kingstown High School as a regional shelter.

COASTAL RESOURCES: The Harbor Management Plan was amended and adopted locally in 2017 and by the RI Coastal Resources Management Council in November 2020.

Information Systems, Data Management & Analysis

GEOGRAPHIC INFORMATION SYSTEM: The town utilized the GIS mapping program and maintains a database of many items within the town such as voting districts, zoning, wetlands, the effective FEMA FIRM panels, elevation contours, recreation areas, and open space parcels. The protected open space parcels within SFHA's are also housed in a digital format and updated as new parcels are added.

RESEARCH SEA LEVEL RISE IMPACTS: The town continues to utilize the inundation mapping completed by the University of Rhode Island, RI Sea Grant and the Coastal Resources Center for the Town of North Kingstown. The mapping identifies various inundation scenarios including a 1', 3', and 5' sea level rise and how those scenarios will impact not only evacuation routes but also local infrastructure as well as private property. Additionally, the town promotes and utilizes STORMTOOLS, which is intended to illustrate the predicted level of inundation due to storm surge and sea level rise.

RISK ASSESSMENT: The town provides information on the town website that provides property owners with information related to protecting people and property from hazards, insuring your property, and building responsibly. The town also created a hazard mitigation webpage, found at the following address, and has links to the current plan, maps, and other hazard mitigation resources: https://www.northkingstownri.gov/835/Hazard-Mitigation-Plan . Flooding information and resources can be found at the town webpage: https://www.northkingstownri.gov/212/Flooding-Flood-Insurance-and-Community-R and provide details on property protection actions, flood hazards, flood insurance, and other resources.

BUILDING PERMITS: The town continues to maintain a digital repository of all elevation certificates (ECs) by year. All ECs are scanned and entered by year into the individual assessor's lot folder. As part of the yearly CRS recertification, the building permits issued in the SFHA are tabulated as well.

Physical & Infrastructure Improvements

DAM REPAIR: The Silver Spring dam was repaired in 2022.

WASTEWATER INFRASTRUCTURE: The town has installed sewers along the Route 1 corridor and within a portion of Wickford village. The town received grant funding from the SNEP and USEPA to upgrade decentralized wastewater systems to improve coastal water quality and mitigate pollution from traditional septic systems in four other coastal neighborhoods including Poplar Point, Shore Acres, Mount View, and the Hamilton Plat.

STORMWATER INFRASTRUCTURE: The town partnered with USGS to install a new tide gauge in Wickford Harbor. The town received a grant from the RI Infrastructure Bank to address the impacts of stormwater runoff, flooding, erosion, and future sea level rise at the end of the Roger Williams Drive right-of-way. The installation allows sediment in the runoff to settle out before discharging into the nearby cove and was completed in June 2024.

BRIDGE EVALUATION: The bridge on Brown Street in Wickford Bridge is listed in the STIP for improvement starting in 2028 to address transportation and resiliency needs. The town continues to inspect municipally owned bridges and work with the RIDOT on inspection and needed repairs to local bridges on state roads. The RIDOT State Transportation Improvement Program (STIP) includes several NK bridge reconstruction projects. The town continues to maintain trees along local roadways.

TRANSPORTATION INFRASTRUCTURE: The projects listed on the TIP for Federal Fiscal Year 2023-2031 are for bridges repairs, resurfacing, drainage improvements, safety, and sidewalks. Some of the listed projects, including the Wickford Village Sidewalk and Resiliency Enhancements as well as the Curbing and Sidewalks along West Main Street, including drainage improvements, will address mitigation and resiliency.

Public Information and Outreach

PLANNING: Informational brochures are also available in the Building and Planning Departments, the North Kingstown Chamber of Commerce, the Department of Public Works (DPW), as well as the North Kingstown Free Library.

FLOODING: The town distributes information about where residents can access flooding information and the impacts of flooding in a yearly newspaper ad and one of the quarterly "Puddle" publications that is distributed in the water bills, mailed to all water customers. The Planning Department also had a table and display at the Wickford Art festival to provide information and resources to attendees. This included mapping of the SFHA and evacuation maps. The North Kingstown Department of Senior/Human services distributes information about flooding and hurricane preparedness to their clients.

EVACUATION PLANNING: The town has and will continue to coordinate with neighboring towns to ensure that evacuation routes are compatible.

STORMWATER MANAGEMENT: The town participated in training with the Southeast New England Program (SNEP) focused on building understanding of stormwater management techniques and capacity to develop solutions to identified stormwater problems. Green infrastructure components were a central theme throughout this training. The town's target model site for the stormwater improvements was a direct outfall at the town beach. Based on this training, the town is working to amend subdivision regulations to better address low impacts development standards, including green infrastructure. Yearly inspections are conducted by the town's Stormwater Specialist.

AIRPORT PLAN: The Rhode Island Airport Corporation (RIAC) completed a Strategic Business Plan in 2022 on which the town supported seawall improvements in Quonset.

OUTREACH: Public outreach is completed through the town's web site, social media posts, library, the Puddle, and local newspapers to inform residents about flood insurance and their vulnerability to flood damage. The Quonset Development Corporation coordinates outreach and communication with the tenants inside the Quonset Business Park.

Actions to Reduce Risk and Minimize Impacts During Natural Hazard Events

GREEN INFRASTRUCTURE: The town has finalized the design for the Wickford Waterfront Project and received permits from the regulatory agencies. The project has a goal of making the waterfront more resilient. One component of this project is to implement low impact stormwater management with enhanced green infrastructure to mitigate storm water runoff and high tide flooding.

SHORELINE ADAPTATION: The town has worked with CRMC and Save the Bay on a shoreline adaptation project at the end of the Roger Williams Drive right of way to incorporate green infrastructure as a means of addressing stormwater management. The North Kingstown Beach Revitalization project has also been in progress with the RI DEM for wall construction, parking area finishing, and landscaping improvements to the Town Beach.

DAM SAFETY: In December 2023, the town partnered with Save the Bay to apply to the Rhode Island Coastal and Estuary Habitat Restoration Fund to examine dam removal alternatives at the Rodman Mill Dam. A CRMC Habitat Restoration Grant was awarded for detailed studies and design to support remediation/ action to remove the dam, and more money will be pursued for implementation in the future.

WATER SUPPLY: The town is considering the acquisition of a parcel in the northern portion of town within the wellhead protection area. The town also adheres to an odd-even watering schedule to address excessive lawn watering.

LAND ACQUISITION: The town advanced an assertive land acquisition plan to reserve vacant land subject to Natural Hazards from 2019 through 2024 that, along with State, Land Conservancy of North Kingstown, private, and non-profit organizations included the acquisition of the following properties:

- Little Yellow Farm (LYF), 6/25/2019 (purchase); - 5 acres of open space of a vegetated peninsula on Gilbert Stuart Road that extends into Carr Pond;
- Aceto Property, 8/6/2021 (purchase) – 63 acres of State Fish & Wildlife land along Gilbert Stuart Road;
- Cruickshank Property, 2022 (easement and donation) – 355 acres of State Natural Resources Conservation Service (NRCS) and Audubon land along Tower Hill Road;
- D'Ambra Property, 2022 (purchase) – 125 acres of State land along Pendar Road/ Silver Spring; and
- SalSame Property (AP 4, Lot 21), 2021 – 10 acres off Weeden Farm Road is now owned by the Land Conservancy of North Kingstown (LCNK).

TREE MAINTENANCE: The town participated in the Municipal Resilience Program (MRP) in 2022 and the need to better maintain trees along roadways rose to the top as high priority. The North Kingstown Conservation Commission is conducting an update to the town's existing street tree inventory.

HISTORIC PROPERTIES: In 2023, the town met with the U.S. Army Corps of Engineers to discuss their coastal storm risk management feasibility study. The Wickford Historic District is one of their study areas. The project is aimed at helping reduce future flooding risks and understanding how mitigation measures impact historic properties.

DAM WORK: The Slocum Road Upper dam was inspected in 2020, and the RIDEM issued a notice to the owners in August 2021 who are actively working to resolve the issue.

WILDFIRE: Outdoor burning of any kind is not permitted in spring (April/May) due to the high risk of brush fires.

UNDERGROUND UTILITIES: The town continues to require underground utilities in new subdivisions and has engaged with National Grid (now would be RI Energy) to discuss the potential for either undergrounding utilities or moving the utilities to one side of the road along the Post Road Corridor.

3. EXISTING HAZARD MITIGATION CAPABILITIES

North Kingstown has an organization structure in-place to plan for and respond to natural disasters (see Key Contacts in **Attachment 8**). **Attachment 12 - Table 1** summarizes the updated 2019 plan existing natural hazard mitigation actions, goals, and capabilities currently in place in North Kingstown. Because of the number of existing public and private entities involved in natural hazard mitigation, the LPT used this list as a catalyst for preparing a more comprehensive inventory of future mitigation capabilities over the next five years, shown in **Table 4,** presented on the following pages.

MITIGATION ACTION BENEFITS

High: Action will support compliance with a legal mandate or, once completed, will have an immediate impact on the reduction of risk exposure to life and property.

Medium: Once completed, action will have a long-term impact on the reduction of risk exposure to life and property, has a substantial life safety component, or project will provide an immediate reduction in the risk exposure to property.

Low: Long-term benefits of the action are difficult to quantify in the short term.

MITIGATION ACTION COSTS

High: (over $75,000): Would require an increase in revenue via an alternative source (i.e., municipal bonds, grants, fee increases) to implement. Existing funding levels are not adequate to cover the costs of the proposed project.

Medium: ($15,000—$75,000): Could budget for under existing capital budget but would require a reapportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.

Low: (Less than $15,000): Possible to fund under existing budget. Project is or can be part of an existing ongoing program or would not require substantial effort to initiate or appropriate funds.

MITIGATION ACTION PRIORITIZATION

Based on an evaluation of the results of the benefit/cost review, the LPT prioritized each mitigation action and strategy using the following qualitative rating system of high, medium, and low.

High Priority: An action that has benefits that exceed cost, has funding secured or is an ongoing project. High priority actions can be completed in the short-term or mid-term (1 to 5 years) or are projects that are long-term projects that can be initiated in the short-term and will have large positive impacts once completed.

Medium Priority: An action that has benefits that exceed costs, and for which funding has not yet been secured, but is eligible for funding. Actions can be completed in the short- or mid-term, once funding is secured, or are projects that are long-term projects that can be initiated in the short-term and will have large positive impacts once completed.

Low Priority: An action that will mitigate the risk of a hazard that has benefits that do not exceed the costs or are difficult to quantify, for which funding has not been secured, that is not eligible for grant funding, and for which the timeline for completion is long-term or uncertain. Low priority actions may be eligible for grant funding from other programs that have not yet been identified. Financing is unknown, and they can be completed over the long term.

The LPT prioritized the mitigation action plan based on the near-term effects and a benefit/cost review of the proposed actions as presented in **Table 4** on the following pages. In addition to the benefit/cost review results based on the elements outlined above, **Table 4** provides details for each action relative to the agencies responsible for leading and coordinating the implementation of each action and potential funding sources.

MITIGATION ACTION GOALS

The towns overarching mitigation action goals are listed and described below.

1. Preserve, restore, and enhance the natural resources and environment in North Kingstown to promote resilient ecosystems against natural hazard impacts.

This goal aims to create mitigation actions that promote natural resource resiliency, through actions such as land acquisition, green infrastructure, and water supply protection.

2. Reduce the vulnerabilities of our built environment - our communities, infrastructure, buildings, and historic and cultural resources.

This goal encompasses work to develop and improve resilient design and construction standards, and identify and protect vulnerable, cultural, and historic assets.

3. Develop and implement plans and policies that encourage resilient natural systems, built environments, and communities.

This goal of improved resiliency can be accomplished through town and state support of hazard mitigation goals through planning and funding.

4. Create a coordinated approach to mitigation planning and action through education, communication, and outreach.

Here, the objective is to strengthen resilience support networks through coordinate hazard mitigation mapping, data, and research by increasing public knowledge of hazards and mitigation measures.

Codes for Table 4 (following pages):

Responsible Agencies	
CRMC = RI Coastal Resources Management Council	DPW = Dept. of Public Works
EDAB = Economic Development Advisory Board	EMA = Emergency Management Agency
FEMA = Federal Emergency Management Agency	FHA = Federal Highway Administration
FTA = Federal Transit Admin.	HDC = Historic District Commission
HUD = Dept. of Housing & Urban Development	NOAA = National Ocean. & Atmospheric Administration
NWS = National Weather Service	RIDEM = RI Department Environmental Management
RIEMA = RI Emergency Management Agency	RIDOT = RI Department of Transportation
USACE = US Army Corp. of Engineers	URI-CI = University of Rhode Island – Coastal Institute
USGS = US Geological Survey	

Potential Funding Sources
BRIC = Building Resilient Infrastructure and Communities
CIP = Capital Improvement Program
CDBG-DR = Community Development Block Grant (Disaster Recovery) (HUD)
EMGP = Emergency Management Performance Grant (FEMA)
EPA = Environmental Protection Agency
FMA = Flood Mitigation Assistance (FEMA)
GRIP (US DOE) = Grid Resilience and Innovation Partnerships (US Dept. of Energy)
HMGP = Hazard Mitigation Grant Program (FEMA)
HGSP = Homeland Security Grant Program (FEMA)
LCNK = Land Conservancy of North Kingstown
MRP = Municipal Resilience Program (RIIB)
NBEP = Narragansett Bay Estuary Program
NFWF = National Fish and Wildlife Foundation
NRCS = Natural Resources Conservation Service (USDA)
OSCAR = Ocean State Climate Adaptation and Resilience Fund (RIDEM)
RIIB = Rhode Island Infrastructure Bank
RIPTA = Rhode Island Public Transit Authority
SNEP = Southeast New England Program Network
SS4A = Safe Streets and Roads for All (RIPTA and USDOT)
STIP = Statewide Transportation Improvement Program (FTA)
TNC = The Nature Conservancy
USDA = United States Department of Agriculture
USDOT = US Dept. of Transportation

Table 4: Hazard Mitigation Goals and Actions for the Town of North Kingstown

Goal	Strategy	Action No.	Actions	Source	Hazard(s) Addressed	Responsible Agencies	Benefits	Costs	Est. Project Costs	Priority	Potential Funding Sources	Timeline
GOAL: Preserve, restore, and enhance the natural resources and environment in North Kingstown to promote resilient ecosystems against natural hazard impacts.	Promote land management strategies	1	Open Space Acquisition of lands within SFHA areas with a priority on the protection of open space landward of sensitive features to help create a buffer to storm surge drainage and erosion.	2019 LHMP (Action 1.1)	Inundation; Coastal and Fluvial Erosion; Storm Surge	Planning	High	High	High	High	TNC, SNEP, NRCS, LCNK, RIIB, RIDEM, Audubon	Ongoing
		2	Evaluate new technologies promoting "green infrastructure" solutions that are available and could be applied to increase stormwater infiltration upstream and reduce runoff.	2019 LHMP (Action 5.1)	Stormwater	Planning, DPW	Medium	Low	Medium to High	Medium	EPA, SNEP, RIIB, RIDEM	1-3 years
		3	Employ living shoreline solutions for select areas including low wave energy environments such as tidal marsh borders and river mouths to reduce risk of wave damage and maintain town beaches and work with CRMC to re-nourish local beaches.	2024 LHMP 2019 LHMP (Action 5.10)	Inundation; Coastal Erosion	Planning, DPW, Parks & Rec, Local beach associations	High	Medium	Medium to High	Medium	HMGP, NBEP, RIIB, SNEP, NOAA, TNC, RIDEM, OSCAR	3-5 years
	Promote drought resilience	4	Continue to Protect the town water supply from contamination and drought and promote safe drinking water through the increased monitoring and review of activities allowed in Groundwater Overlay Areas and through the Purchase of Development Rights (PDR) and Transfer of Development Rights (TDR) to direct development outside of the GW Overlay zones.	2019 LHMP (Action 5.6)	Drought	Water Dept.	High	Medium	Medium	High	RIDEM	Ongoing
		5	Perform actions to provide adequate access to forested parcels and a local source of water.	2019 LHMP (Action 5.11)	Drought	Water Dept.	High	Medium	Medium	Medium	Town Budget	1-3 years
GOAL: Reduce the vulnerabilities of our built environment - our communities, infrastructure, buildings, and historic and cultural resources.	Develop resilient design and construction standards	6	Continue to enforce Building Code Compliance for land uses and structures in SFHA and those prone to other potential hazards to residents in accordance with updated legislation, ordinances, and State Building Code requirements as part of the building permitting process to reduce risk to structures and facilities from Snowfall, Ice Storms, Earthquake, and Flooding.	2019 LHMP (Action 1.2)	All Hazards	Building Department	High	Low	Low	High	Town budget	Ongoing
		7	Identify the "design life" of critical facilities at the time of construction and maintain data to allow for clear planning horizons to be defined for the development of phasing plans for implementation and prioritizing funding from federal and state grants and through the municipal CIP by utilizing the STORMTOOLS mapping program to reduce future risk from all hazards including Snowfall, Ice Storms, Earthquake, and Flooding.	2019 LHMP (Action 1.4)	All Hazards	Building Department, DPW	High	Low	Low	High	Town budget	3-5 years
		8	Promote OWTS upgrades through potential grants and determine feasibility of sewering neighborhoods and commercial centers in SFHA with storm surge and sea level rise impacts.	2019 LHMP (Action 5.2)	Inundation; Storm Surge	DEM, DPW, Planning, Building Department	High	Low	Medium	High	EPA, RIDEM, NFWF	1-3 years
		9	Work with the Quonset Development Corporation to ensure new and existing development at Quonset Point meets State Building Code requirements.	2019 LHMP (Action 6.1)	All Hazards	State Building Official	High	Medium	Medium	Medium	Quonset Development Corporation	Ongoing

Goal	Strategy	Action No.	Actions	Source	Hazard(s) Addressed	Responsible Agencies	Benefits	Costs	Est. Project Costs	Priority	Potential Funding Sources	Timeline
		10	Supplement CRS application to earn a class 7 rating.	2019 LHMP (Action 7.1)	Inundation; Storm Surge	Planning, DPW, Building Department	High	Low	Low	Medium	Town budget, FEMA	5 years
	Incorporate flood resilience in transportation planning, engineering, and programming	11	Inspect municipally owned bridges and work with the RIDOT via the State Transportation Improvement Program to inspect state-owned bridges for structural integrity to determine individual vulnerability to damage in a hazard event. Records will be maintained to allow for the prioritization of funds for bridges which may have to be retrofitted to prevent failure from hazards such as Snowfall, Ice Storms, Earthquake, and Flooding.	2019 LHMP (Action 5.4)	All Hazards	RIDOT	Medium	Low	Low	Medium	RIDOT, USDOT	3-5 years
		12	Create an emergency response plan in the event of bridge collapse. Hussey Bridge, Brown Street Bridge, Babbit Farm Bridge over Cocumscussoc Brook, the Hamilton Mill Bridge on Boston Neck, Bridges over Hunt River, and all other bridges, to reduce risks from Earthquakes and Flooding.	2019 LHMP (Action 5.5)	All Hazards	EMA, RIDOT, RIEMA	High	Low	High	Medium	Town budget	1-3 years
		13	Stormwater: Analyze the existing stormwater infrastructure to identify the need for additional catch basins, pump stations, tide gates, and green infrastructure to protect against intense precipitation and coastal flooding, such as within the Wickford Historic District.	2024 LHMP	Inundation; Storm Surge; Sea Level Rise	DPW, Stormwater	High	Medium	Medium	High	EPA, RIDEM, SNEP, RIIB, NBEP	3-5 years
	Identify and protect vulnerable structures and critical infrastructure	14	Complete database updates of: 1) building permits and elevation certificates issued within the SFHA 2) parcels within the HDC, the SFHA and projected sea level rise areas 3) open space parcels and public parks to help identify trends and patterns and to protect assets in the town.	2019 LHMP (Action 1.7)	Inundation; Storm Surge; Sea Level Rise	Planning, Building, CRMC, URI-CI	High	Medium	Medium	Medium	Town budget	1-3 years
		15	Complete an assessment of municipal structures located in SFHA that are utilized by vulnerable populations and retrofit as needed.	2019 LHMP (Action 2.1, 4.2)	Inundation; Storm Surge; Sea Level Rise	Planning, Building, DPW	Medium	Medium	Medium	Medium	Town budget	3-5 years
		16	Evaluate shelter sites (existing and potential) on an annual basis. Shelter from damage due to Hail, Ice, Earthquake, Snowfall, Wind, Flooding.	2019 LHMP (Action 3.4)	All Hazards	DPW	High	Low	Low	Medium	Town budget	Annually
		17	Move utility lines underground for public safety by prioritizing lines in coastal areas and requiring that all utilities for new residential development to be installed underground to reduce risk of damage from Lightning, Hail, Snowfall, Ice Storms, and Flooding.	2019 LHMP (Action 5.7)	Inundation; Wind; Winter Hazards	DPW, RIDOT	High	High	High	Medium	FEMA	5+ years
		18	Evaluate, purchase, and install a generator for back-up power for Public Buildings/ key town assets, where necessary. Action will reduce blackouts from Lightning, Hail, Snowfall, Ice Storms, and Flooding.	2024 LHMP	All Hazards	DPW	Medium	Medium	Medium to High	Medium	BRIC, HMGP, CIP, US DOE (if new GRIP funding)	1-3 years
		19	Evaluate whether generators are needed for back-up power at private telecommunications facilities such as North Kingstown Information Technology (NKIT) operations. Will mitigate against damage from Lightning, Hail, Snowfall, Ice Storms, and Flooding.	2024 LHMP	All Hazards	EMA	Medium	Low	Low	Medium	FEMA, CIP	1-3 years

Goal	Strategy	Action No.	Actions	Source	Hazard(s) Addressed	Responsible Agencies	Benefits	Costs	Est. Project Costs	Priority	Potential Funding Sources	Timeline
		20	Encourage privately owned gas stations to install and maintain emergency back-up generators.	2024 LHMP	All Hazards	EMA, Planning, Building	Medium	Low	Low	Medium	HGSP, DOE	1-3 years
		21	Road Evaluation: Evaluate roads at least annually to develop plans for improvement or elevation for emergency access and evacuation, especially under future sea level rise scenarios. Identify strategies and coordinate with Neighboring towns where roadways run along town borders. Develop conceptual plans and prioritization for pursuing engineering, design, and construction funding of identified roadways.	2024 LHMP 2019 LHMP (Action 3.1)	All Hazards	DPW, RIDOT	High	Medium	Medium to High	High	FHWA, RIDOT, USDOT, SS4A	Annually
		22	Repetitive Loss Area Analysis (RLAA). Perform a formal RLAA to identify the impact to the town's NFIP insurance rate due to repetitive loss. The results from the RLLA will help further support town and property owner resilience and mitigation activities, including acquiring, relocating and/or flood mitigation of RL properties, particularly in Wickford Village.	2024 LHMP	Inundation	Planning, Building, CRMC	Medium	Low	Low to Medium	High	FEMA, Land acquisition bonds, Land Bank, RIDEM, FMA	Ongoing
		23	Encourage Repetitive Loss Property Owners to pursue flood mitigation funding for actions such as elevation or acquisition of structures where appropriate on a voluntary basis.	2024 LHMP	Inundation	Planning, Building, CRMC	Medium	Low	Low to Medium	High	FEMA, Land acquisition bonds, land bank, RIDEM, FMA	Ongoing
		24	Firefighting Infrastructure Analysis: Evaluate existing firefighting infrastructure to identify needs for improvement to cover gaps in availability.	2024 LHMP	Fire Hazards	Fire Dept., DPW	High	Low	Low	High	FEMA EMPG, HMGP, Joint Fire Science Program, RIDEM	1-3 years
		25	Maintain adequate supply of sand, salt, and other road treatment materials for use on roadways under Hail, Snowfall, and Ice Storm conditions.	2024 LHMP	Winter Hazards	DPW	High	Low	Low	High	Town budget	Annually
		26	Continue to maintain viable evacuation routes through the implementation of the Town's Tree Maintenance Plan which prioritizes maintaining those trees running along evacuation routes and roads offering single access to coastal and flood prone neighborhoods and encourage routine inspections for trees that are a potential storm threat.	2019 LHMP (Action 3.2)	All Hazards	DPW	High	Low	Low	High	Town budget	Annually
	Protect cultural and historic resources	27	Utilize the municipal web site and direct mailings as outreach to Historic District (HD) property owners in Wickford located within the SFHA to educate and assist with the long-term balance of preservation with protection from future flood damage.	2019 LHMP (Action 1.6)	Inundation; Storm Surge; Sea Level Rise; Coastal Erosion	Planning, Building, DPW	Medium	Low	Low	High	Historic Preservation Fund	1-3 years
		28	Retrofitting flood prone homes located within the Historic District and other historical buildings and structures in town.	2019 LHMP (Action 5.8)	Inundation; Storm Surge; Sea Level Rise; Coastal Erosion	Planning, Building Department	Medium	Low	High	Medium	FEMA	3-5 years
	Improve dam resilience	29	Continue to monitor, update, and evaluate town owned and private dams in accordance with Emergency Action Plans (EAPs). EAP's will be regularly updated through public outreach with dam owners to ensure Notification Flow Charts are kept current, risk awareness is properly communicated, and maintenance responsibilities understood. The North Kingstown Public Safety Director is responsible for outreach	2019 LHMP (Action 5.3)	Dam Failure	DPW, RIDEM, Building Department	High	Low	Low	High	Town budget	Annually

Goal	Strategy	Action No.	Actions	Source	Hazard(s) Addressed	Responsible Agencies	Benefits	Costs	Est. Project Costs	Priority	Potential Funding Sources	Timeline
			to HHPD owners when there are concerns with storm events and/or potential dam failure. This information will be reviewed and updated annually.									
		30	Update zoning, flood zone, building, and development regulations to restrict development in the high hazard potential dam failure inundation zones.	2024 LHMP	Dam Failure	DPW, RIDEM, Building Department	High	Low	Low	High	Town budget	Annually
GOAL: Develop and implement plans and policies that encourage resilient natural systems, built environments, and communities.	Support floodplain management.	31	Create policy to direct development away from areas subject to erosion and flooding from gale-force winds, storm surge, and sea level rise.	2019 LHMP (Action 1.5)	Inundation; Coastal and Fluvial Erosion; Sea Level Rise, Storm Surge, High Winds	Planning, Building, DPW	High	Low	Low	High	Town Budget	3-5 years
	Align town and state programs to support hazard mitigation goals	32	Implement recommendations based on the findings of the climate adaptation strategies at the local level to help North Kingstown make informed decisions and build an increased resilience and reduce risk to coastal hazards and climate change.	2019 LHMP (Action 8.2)	Inundation; Coastal and Fluvial Erosion; Sea Level Rise, Storm Surge, High Winds	Planning	High	High	High	Medium	Town Budget	3-5 years
		33	Continue to coordinate with state agencies and educational institutions to identify new or innovative strategies that have been successfully implemented in other locations to address emerging problems.	2019 LHMP (Action 8.4)	All Hazards	Planning, Building Department	Medium	Low	Low	Medium	Town Budget	Ongoing
		34	Continue to participate in National Flood Insurance Program (NFIP) (or other) training offered by the State and/or FEMA that addresses flood hazard planning and management.	2024 LHMP	Inundation; Fluvial Erosion	DPW, Planning	High	Medium	Medium	High	Town Budget	Annually
	Develop solutions to fund hazard mitigation	35	Implement projects using state and local funding. Participate in a workshop to identify resilience plans and projects for Rhode Island's Municipal Resilience Program (MRP) funding.	2019 LHMP (Action 8.3)	All Hazards	Planning	High	Medium	Medium to High	High	TIP, CIP, MRP	Ongoing
		36	Grant Application Plan (GAP). Prepare a detailed application plan for grant opportunities, including FEMA Hazard Mitigation Grant, USACE, NOAA, HUD, RIDOT, and EPA programs. Include a benefit-cost analysis for each opportunity including the three FEMA Hazard Mitigation Assistance (HMA) grant programs: HMGP, BRIC, and FMA.	2024 LHMP	All Hazards	Planning, Finance, all eligible/affected departments	High	Low	Low to Medium	High	FEMA, USACE, NOAA, HUD, EPA, RIDOT, CIP	1-3 years
	Support local hazard mitigation planning	37	The town will research feasibility of a recovery and reconstruction ordinance that will expedite rebuilding after a natural hazard event.	2019 LHMP (Action 3.6)	All Hazards	Planning, Building, DPW	High	Low	Medium to High	Medium	FEMA	3-5 years
		38	Continue to implement the Storm Preparedness Plan to mitigate the effect of storms on boats, marina, infrastructure, and docks and by preparing harbor and shoreline areas for storm events.	2019 LHMP (Action 5.9)	Inundation; Sea Level Risel; Storm Surge; High Winds	Harbor Commission	Medium	Low	Low	Medium	Town Budget	Ongoing
		39	Coordinate closely with RI Airport Corporation and the Army National Guard through the master planning process to assess the need for improvements at Quonset airport to prevent or mitigate flood damage from coastal storms.	2019 LHMP (Action 6.2)	Inundation; Coastal and Fluvial Erosion; Sea Level Rise; Storm Surge; High Winds	DPW, RIDOT	High	High	High	Medium	RIDOT, USDOT	1-3 years

Goal	Strategy	Action No.	Actions	Source	Hazard(s) Addressed	Responsible Agencies	Benefits	Costs	Est. Project Costs	Priority	Potential Funding Sources	Timeline
		40	Local Hazard Mitigation Plan (Tracking and Updates). The North Kingstown Planning Dept. will monitor and evaluate progress in implementing action items in this Plan and include those accomplishments in its annual report to the town. The town will also reconvene its multi-agency Committee every 5 years to update the Plan.	2024 LHMP	All Hazards	Planning	High	Low	Low	High	Staff time, HMGP	Annually - 5 years
	Increase local capacity to improve resilience	41	Coordinate Evacuation Plans with Neighboring towns to ensure each town's evacuation routes are compatible.	2019 LHMP (Action 3.3)	All Hazards	DPW, Police Department	High	Low	Low	Medium	Town Budget	1-3 years
		42	Temporary Housing Assessment. Evaluate the need for safe post disaster housing for residents displaced by flood or other natural disaster.	2024 LHMP	All Hazards	Planning, Social Services, EMA	Medium	Medium	Low to Medium	Medium	HUD, FEMA, Red Cross	1-3 years
		43	Immobile Evacuees Planning: Review annually the program to evacuate persons without means of transportation, including registration and house numbering. Also identify refuges of last resort (RLR) for evacuees who are unable to reach a designated shelter.	2024 LHMP	All Hazards	Social Services, EMA, Police, Private nursing home partners	High	Low	Low	Medium	FEMA, USDOT, RIDOT, RIPTA, Red Cross, RIEMA	Annually
		44	Develop a cooperative strategy for municipal officials/facilities.	2019 LHMP (Action 4.3)	All Hazards	Building Department, DPW	High	Low	Medium	Medium	Town Budget	Annually
GOAL: Create a coordinated approach to mitigation planning and action through education, communication, and outreach.	Coordinate hazard mitigation mapping, data, and research	45	Maintain a database with record of flood impacts on municipal properties and structures to better plan for improvements and reduce risk to the town's assets.	2019 LHMP (Action 4.1)	Inundation	Planning, Building Department	Medium	Low	Low	Medium	Town Budget	Ongoing
		46	Participate in reviews of regulatory floodplain maps updates and revisions.	2024 LHMP	Inundation; Coastal and Erosion; Sea Level Rise; StormSurge	Planning, DPW, FEMA, USGS	High	Medium to High	Low	High	FEMA	Ongoing
		47	Incorporate the procedures for tracking high water marks following a flood into emergency response plans. Also utilize the Quonset and Wickford tide gauges.	2024 LHMP	Inundation; Sea Level Rise; Storm Surge	DPW, Planning, NWS, RIEMA, USGS	Medium	Low	Low	Medium	FEMA, Silver Jackets (USACE)	Ongoing
	Increase public knowledge and literacy of hazards and mitigation	48	Education and Outreach to residents and community stakeholders to 1) promote owner participation in mitigation efforts to protect their property; 2) educate public on how the town uses conservation planning, regulations to mitigation natural and climate related hazards; 3) educate residents and community stakeholders at high risk to impacts from natural hazards on the hazards relative to where they live; and 4) Inform citizens and business owners of impacts of storm surges and rising sea levels. Publish and make these available to educate and raise awareness to those citizens impacted. Plan and Raise awareness via the municipal web site and CodeRED for the Safe Evacuation of Tourists, Residents & Business Owners during Hazard Events, local information sessions and distribution of information at town hall, libraries, chamber of commerce, and direct mailings to schools and day-care facilities located in hazard areas.	2024 LHMP; 2019 LHMP (Action 1.3, 1.8, 8.1)	All Hazards	Planning, Conservation Commission, EMA, Social Media Managers	High	Low	Low	High	HMGP, Staff Time	Annually

Goal	Strategy	Action No.	Actions	Source	Hazard(s) Addressed	Responsible Agencies	Benefits	Costs	Est. Project Costs	Priority	Potential Funding Sources	Timeline
		49	Conduct Natural Hazard Mitigation Training on an annual basis using FEMA and NDPTC training modules, support materials, and guidance.	2024 LHMP	All Hazards	All eligible staff (Planning, DPW, Building, Fire, Police)	High	Low to Medium	Low to Medium	High	Free courses, grants	Annually
		50	Wildfire Education: Conduct public education and outreach to the public on potential wildfire hazards caused by campfires & open-air burning.	2024 LHMP	Wildfire	Fire Dept, DPW, Planning	High	Low to Medium	Low	Medium	EMPG, HMGP, Joint Fire Science Program, RIDEM	Ongoing
		51	Protect Vulnerable Populations by: Organize outreach to vulnerable populations to educate citizens on the dangers of extreme heat & cold, and the steps they can take to protect themselves when extreme temperatures occur.	2024 LHMP	Extreme Temperatures	Social Services, EMA, Private nursing home partners	High	Medium	Medium	Medium	FEMA, RIDEM	Ongoing
	Strengthen networks that support resilience	52	Actively involve flood prone businesses in Quonset Point in the outreach process to inform of natural hazards, primarily hurricanes and protection of their property and employees.	2019 LHMP (Action 6.3)	Inundation; Coastal Erosion; SLR; Storm Surge; High Winds	DPW, RIDOT	Medium	Low	Low	Medium	RIDOT	1-3 years
		53	Local Social Resources Impacts Analysis. Identify local resources to assist with those populations (i.e. elderly, disabled, non-English speakers), who may frequent, reside, or work in North Kingstown. Seek grants to provide funding for developing more detailed data to assist in the social – demographic analysis of how North Kingstown will be affected by natural hazards.	2024 LHMP	All Hazards	Social Services	High	Medium	Low to Medium	Medium	HUD, FEMA	1-3 years

SECTION 6: REGIONAL AND INTER-COMMUNITY RELATIONSHIPS

Some hazard mitigation issues are strictly local. The problem originates primarily within the municipality and can be solved at the municipal level. Other issues are inter-community issues that involve cooperation between two or more municipalities. There is a third level of mitigation which is regional; involving a state, regional or federal agency or an issue that involves three or more municipalities.

The North Kingstown Planning Commission is the primary town agency responsible for long-range planning of land development in town. Feedback to the North Kingstown Planning Commission was ensured through the participation of a North Kingstown Planning Commission member on the Local Planning Team (LPT). In addition, the public meetings were held during regularly scheduled North Kingstown Planning Commission meetings. As a part of developing this natural hazard mitigation plan update, the town coordinated with the Rhode Island Emergency Management Agency (RIEMA) to update pertinent repetitive loss properties and NFIP claim related details for the town. The LPT also included the participation of other key local, regional, and state entities. Neighboring communities were provided an opportunity to provide input via email, the standard means of communication for local planning departments to request feedback from their colleagues. Two public meetings were held in May and June of 2024, the target was to get feedback from the council/commission, and residents. Meeting participation and plan input was sought by: emailing the plan to neighboring communities; posting about the meetings on social media and the town website; required notifications in the format of posting the agenda per state law; and posting survey flyers around town, on the town website, and social media. The town will continue to collaborate with local, regional, and state agencies as a part of the implementation of actions outlined in this plan. Below is an overview of the regional partners and facilities, and intercommunity considerations for this plan.

REGIONAL PARTNERS

In many communities, mitigating natural hazards, particularly flooding, is more than a local issue. The drainage systems and shoreline protection structures that serve these communities are a complex system of storm drains, outfalls, roadway drainage structures, on-site septic systems, revetments, sea walls, groins and other facilities owned and operated by a wide array of agencies including but not limited to the Town of North Kingstown, Neighborhood Beach Associations, Rhode Island (RIDEM), Rhode Island Department of Transportation (DOT), Coastal Resources Management Council (CRMC), Land Conservancy of North Kingstown, Narrow River Land Trust, and the U.S. Army Corps of Engineers. The planning, construction, operations, and maintenance of these structures are integral to the flood hazard mitigation efforts of communities. These agencies must be considered as regional partners in hazard mitigation. These agencies also operate under the same constraints as communities do including budgetary and staffing constraints and numerous competing priorities. Section 5 of the Plan Update includes several mitigation actions where several of these agencies will participate in moving hazard mitigation efforts forward in collaboration with the town. Implementation of these actions will require that all parties work together to develop solutions.

REGIONAL FACILITIES WITHIN NORTH KINGSTOWN

Major facilities owned, operated and maintained by federal, state, regional or private entities in North Kingstown include: State Routes 1 (Boston Post Road), State Routes 1A (Boston Neck Road), Route 2, Route 4, Route 102, Route 138, Route 403, Municipal Office Building, Lakeside Nursing and Rehabilitation Center, Bayview Rehabilitation at Scalabrini, Cold Spring Community Center, Quonset Business Park, Roberts Health Center Inc, Wickford Junction Station, Army Air Support Facility, North Kingstown High School, and substations located in North Kingstown.

INTERCOMMUNITY CONSIDERATIONS

Portions of North Kingstown, as well as its surrounding communities are close to build-out, but some parcels may undergo significant re-development in the future. To avoid impacts from any residential and commercial development, communication between North Kingstown and the surrounding communities, including input in the review processes, is vital. In the event of a natural hazard, communications regarding evacuation routes and mutual aid agreements must be open with neighboring towns such as Warwick and East Greenwich and are assisted by planning prior to events.

SECTION 7: PLAN ADOPTION AND IMPLEMENTATION

Adopting, implementing, monitoring, evaluating, and updating the Town's Local Natural Hazard Mitigation Plan Update are necessary steps to sustaining a viable plan that will assist the community in becoming more resilient to natural hazards long into the future. An overview of how the town will carry out each of these tasks is outlined in the following sections.

PLAN ADOPTION

The Draft Plan was provided to the town on September 19, 2024 for review and distribution to the public, and local, regional, and state stakeholders. The town provided input to the planning consultant on October 25, 2024. A Revised Draft Plan was provided to the town on December 5, 2024. The town posted the Draft Plan on the town website on January 14, 2025 for public review and input. Based on feedback provided the town revised Hazard Mitigation Plan (HMP) Update.

The town submitted the HMP Update to the Rhode Island Emergency Management Agency (RIEMA) and the Federal Emergency Management Agency (FEMA) for review. The town received a revisions request from RIEMA on February 20, 2025 and provided a revised HMP Update to RIEMA addressing the requested revisions on March 28, 2025. Upon receiving conditional approval of the HMP Update by FEMA, the Plan Update was presented and approved by the Town of North Kingstown on August 18, 2025. A copy of the plan adoption letter is included in the front of this plan. FEMA approved the Plan Update effective August 20, 2025 through August 19, 2030.

PLAN IMPLEMENTATION

The implementation of the Plan commences upon its formal adoption by the Town Council and official approval by RIMEA and FEMA. Section 5 details the mitigation strategy that prioritizes the various actions identified to reduce the impacts from future natural hazards. A local hazard mitigation working group (including the LPT) will be responsible for overseeing the implementation of the plan.

In addition, the Local Planning Team (LPT), that includes town officials as presented in Section 2, will identify existing planning documents and regulations where relevant policies and actions outlined in this Plan Update may be incorporated to improve the potential for the implementation of mitigation actions across related programs and agencies. Relevant programs, policies, and/or regulations may include updates to existing policies and regulations such as the following:

- Updates to the Rhode Island State Building Code
- Groundwater ordinance Sec. 21-186, March 14, 2022
- North Kingstown Zoning Regulations, March 30, 2020 including Section 21-188 Special Flood Hazard Overlay District
- North Kingstown Ordinances, May 27, 2021, including Section 7-116 Harbor Management Commission

PLAN MONITORING AND EVALUATION

Who: The North Kingstown Planning Department under the Director of Planning and Development, will administer monitoring, evaluating, and updating the plan, and collaborate with the LPT to ensure their participation.

How: The Planning Department will monitor the status of mitigation actions (Section 5, Table 4) through an internal tracking system using Excel. The town's lead agencies will continue to report on implementation of the mitigation actions outlined in the Plan Update annually through the town's annual report to the town council.

The Planning Department will:

- Track the progress of the HMP Mitigation Actions.
- Reconvene the Local Hazard Mitigation Committee (LHMC) annually to monitor, evaluate, update, and integrate the plan.
- Share HMP progress with the public, at least once a year.
- Make all monitoring information publicly available.
- Notify the public when new information has been posted or updated.
- Provide the public opportunities to give input on this information.

- Discuss how mitigation actions are or are not meeting 2024 HMP Goals and where improvements or adjustments may be needed (e.g., re-prioritization of projects, integrating with other planning processes more effectively, adding new data to climate projections, etc.)

When: Monitoring and evaluation will take place on an ongoing basis. Twice a year, in March and October, the LPT through the Planning Department will hold a Hazard Mitigation Plan progress meeting with invitations sent to RIEMA and stakeholders. Separately or in conjunction with one of the bi-annual meetings, the LPT led by the Planning Department, will coordinate a meeting to review the Plan progress over the last year and formally update the status of Mitigation Actions utilizing the excel spreadsheet. In advance of this meeting, the LPT members will have access to a shared document where all members can collaborate to review the status of mitigation actions and identify any new mitigation actions that may be under consideration or in progress. This Plan review will include an evaluation of hazard mitigation activities such as ongoing projects, changes in developing new mitigation actions resulting from a natural disaster event, changes in local, State, and federal regulations that may impact the implementation of future projects, and modification of existing actions. As a part of this process, the working group will evaluate and assess the effectiveness of the action items outlined in the plan have been in achieving the plan goals and objectives. The results of this evaluation will be posted to the town website to gather public input on the progress of the Plan as well as to provide the public with the opportunity to provide additional mitigation activities for the working group's consideration.

A review and evaluation of the town's HMP Update will be conducted on a 5-year basis in compliance with the 2000 Disaster Mitigation Act and Part 201.6 of 44 Code of Federal Regulations (CFR). In the event of a major disaster event impacting the Town of North Kingstown, the town may update the plan at that time with actions to address unexpected impacts resulting from damages to the community, if needed.

FEDERAL AND STATE FUNDING SOURCES

Several of the proposed hazard mitigation projects and actions may be eligible activities for funding under the three FEMA Hazard Mitigation Assistance (HMA) Grant Programs. The FEMA HMA Grant Programs include two non-disaster mitigation grant programs that include the Pre-Disaster Mitigation, Building Resilient Infrastructure and Communities (BRIC) and Flood Mitigation Assistance (FMA) grant programs, and one disaster mitigation grant program that is the Hazard Mitigation Grant Program (HMGP) which includes the HMGP Post-Fire for Fire Management Assistance declarations issued on or after October 5, 2018. State and a summary of federal funding sources are presented in **Attachment 5**.

ATTACHMENT 1: COMMUNITY PROFILE

Community Profile Overview

This section of the Plan presents details about the town assets which categorically include:

· People

· Support, High Occupancy, and Vulnerable Population facilities;

· Essential Facilities including emergency response, police, fire, hospitals, etc.;

· Lifeline Systems including water, wastewater, electrical power, etc.;

· High Potential Loss Facilities, including high hazard dams; and

· Transportation Infrastructure.

Demographic Overview

Per the United States Census Bureau 2020 Census (2020):

Population: 27,732
Population change since 2000: 1,246 (+4.7%)

Age and Sex:

Percent female / male:
51.6% / 48.4%

persons <5 years:	4.2%
persons <18 years:	18.4%
persons ≥ 65 years:	20.8%

Race:

White alone:	89.5%
Black or African Amer. alone:	0.7%
Amer. Indian or Alaska Native alone:	0.1%
Asian alone:	3.2%
Two or more races:	5.8%
Hispanic or Latino:	3.3%
White alone, not Hispanic or Latino:	88.2%

Health:

With disability, under 65 years (2018-2022):	5.5%
Persons w/o health insurance, under 65 years:	2.2%

Education:

High school graduate or higher (age 25+):	96.6%
Bachelor's degree or higher (age 25+):	49.2%

Economy:

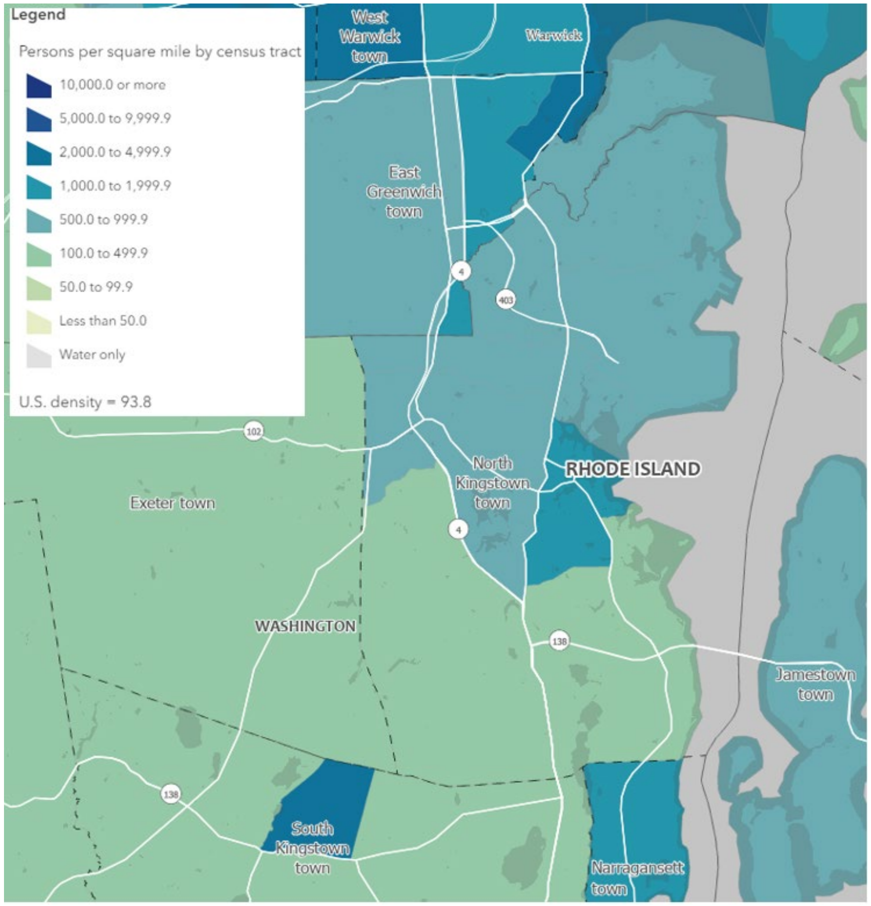
In civilian labor force, total, age 16+ (2018-2022):	66.3%
In civilian labor force, female, age 16+(2018-2022):	60.1%

Income and Poverty:

Median household income:	$116,053
Per capita income:	$55,950
Persons in poverty:	6.4%

Family and Living Arrangements:

Households:	11,341
Persons per Household:	2.42
Language spoken at home other than English, age 5 years+:	6.4%
Median house cost:	$444,200
Percent owner-occupied:	76.4%
Population Density:	642.4/sq.mile



Attachment 1 - Figure 1: Population Density

The town has a total area of approximately 58.3 square miles that includes 43.6 square miles of land and 14.8 square miles of water. It is a suburban waterfront community, located 15 miles South of Providence, Rhode Island.

Demographics

Development in the town varies from the large industrial/business park in Quonset to the turf farms and low-density residential areas of Slocum to historic coastal village of Wickford.

Based on the U.S. Census Bureau (2020) Decennial Census, the population per square mile is 642.4, which is lower than the average for Rhode Island as a whole (1,061.4) and higher than Washington County (394.3) (**Attachment 1 - Figure 1**).

The number of residents has increased from 26,486 in the 2010 US Census to 27,732 in 2020. North Kingstown includes a largely white population, representing about 88.2% of all residents. Hispanics or Latinos make up the largest, single minority group at 3.3% of all residents.

The population includes 18.4% of residents under the age of 18, 60.8% between the ages of 18 to 64, and 20.8% who are 65 years or older.

There are 11,341 households, with an average household size of 2.42. North Kingstown has 7.3% of its housing units classified as vacant, which is almost one third the percentage in Washington County (21.7%). A housing unit is classified as vacant by the U.S. Census if no one is living in it at the time of the interview, or if the unit is entirely occupied by persons who have a usual residence elsewhere (seasonal housing units).

The median household income in North Kingstown was $116,053, which is above the median average of $81,370 for Rhode Island and above the median average of $99,510 for Washington County. Poverty is at 6.4% which is lower than both the State of Rhode Island rate of 10.8% and the County rate of 6.5%.

Housing costs are $444,200 for the median value, owner-occupied housing unit compared to the State of Rhode Island at $343,100 and Washington County at $436,000. 76.4% of the housing units are owner-occupied compared to 62.7% for Rhode Island and 76.8% for Washington County.

North Kingstown's scenic coastline has attracted residential, waterfront commercial, and other development for many years. Coastal buildings are primarily residential with more than 3,000 homes and businesses in coastal flood or storm surge areas. Most of these areas are close to being fully built out, and it is expected that existing land uses will generally continue. More recently, development has moved towards the western portion of the town and along Post Road, as the available land on the coast has become mostly developed.

Social Vulnerability

The term Social Vulnerability describes how resilient a community is to external stresses, such as natural hazards, on human health. The Social Vulnerability Index (SVI) employs U.S. Census Bureau variables to identify neighborhoods that may need additional support in preparing for hazards or recovering from disasters and is a useful tool for emergency response planners and public health officials. The U.S. Census Bureau uses data to determine the social vulnerability of every census tract (census tracts are subdivisions of counties for which the Census Bureau collects statistical data). The SVI ranks each tract on 15 social factors, including poverty, lack of vehicle access, and crowded housing, and groups them into four related themes: 1) Socioeconomic status; 2) Household Characteristics; 3) Racial & Ethnic Minority Status; and 4) Housing Type & Transportation. Each tract receives a separate ranking for each of the four themes, as well as an overall ranking.

2020 Census Tracts 44009050104, 44009050103, 44009050102, 44009050301, 44009050302, 44009050401, 44009050402 are included within the Town of North Kingstown.

The Social Vulnerability Index (SoVI) for 6 out of the 7 census tracts within North Kingstown are categorized as Low, however tract 44009050103, which includes Quonset Point is categorized as High, as shown in **Attachment 1 - Figure 2**.

The ranking for each of the four themes listed above was identified using the SVI Interactive Map for SVI Year 2020 (https://svi.cdc.gov/map.html). The rankings are summarized in **Attachment 1 - Table 1**.

Attachment 1 - Table 1: North Kingstown Social Vulnerability Profile Analysis

Theme	SVI	Description
Socioeconomic	0.02 – 0.59	Low to Medium-High
Household Characteristics	0.08-0.96	Low to High
Racial & Ethnic Minority	0.05 – 0.34	Low to Medium
Housing / Transportation	0.04 – 0.75	Low to High

https://svi.cdc.gov/map.html

Centers for Disease Control and Prevention/ Agency for Toxic Substances and Disease Registry/ Geospatial Research, Analysis, and Services Program. Social Vulnerability Index 2020 - Last Reviewed: December 1, 2022.

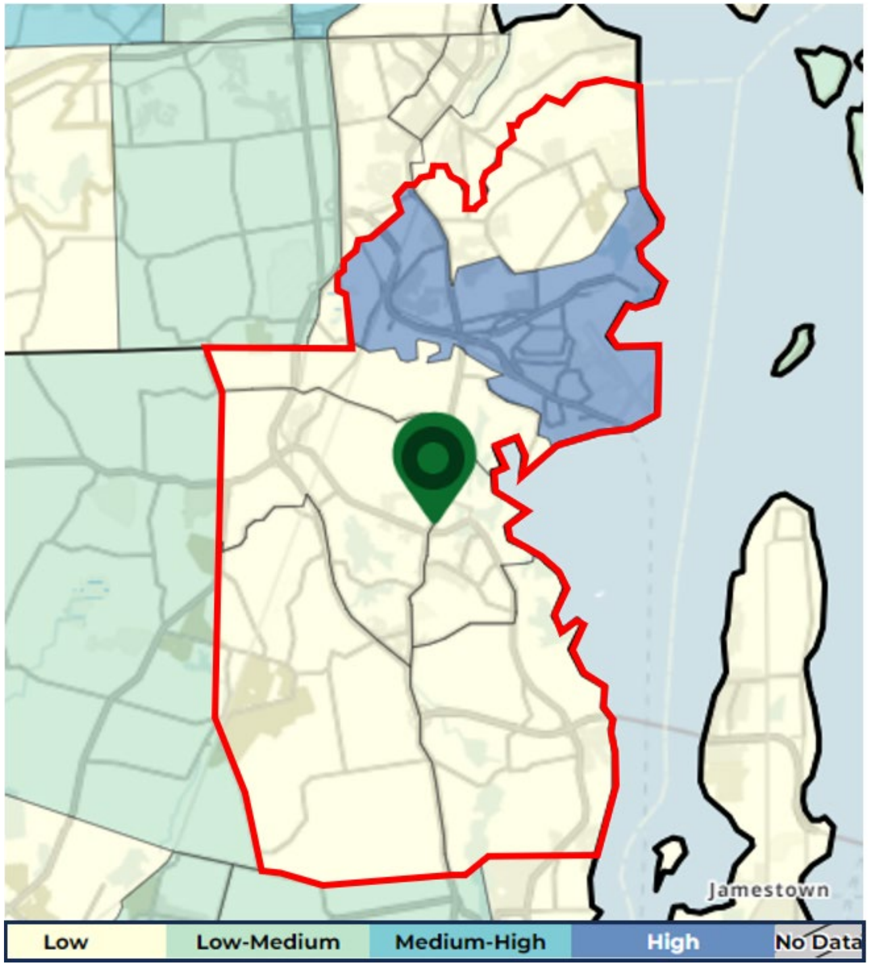
Support, High Occupancy, and Vulnerable Populations

There are few Support, High Occupancy, and Vulnerable Populations, outside of the Quonset census area (44009050103) in North Kingstown. The North Kingstown School Department consists of eight schools, which include five elementary schools from Pre-K through grade 5, two middle schools including grades 6 through 8 and one high school for grades 9 through 12 (**Attachment 1 - Figure 3**). The schools are listed below:

- North Kingstown High School – 150 Fairway Drive;
- Hamilton Elementary School – 25 Salisbury Avenue;
- Stony Lane Elementary School – 825 Stony Lane;
- Quidnesset Elementary School – 166 Mark Drive;
- Fishing Cove Elementary School – 110 Wickford Point Road;
- Forest Park Elementary School – 50 Woodlawn Drive;
- Wickford Middle School – 250 Tower Hill Road;
- Davisville Middle School – 200 School Street;
- Davisville Academy – 50 East Court; and
- West Bay Christian Academy – 475 School Street.

There are also several localized Childcare and Daycare Programs within the town. They are the following:

- Early Learning Centers of Rhode Island – 2299 Tower Hill Road;
- Childrens Learning Express – 7535 Post Road;
- Curious Minds Early Learning Center – 690 Boston Neck Road;
- Sunshine Child Development – 11 Iafrate Way;
- Cadence Academy Preschool – 4094 Quaker Lane;
- Glowing Years Child Care – Hornet Road;
- South County Montessori School – 1239 Tower Hill Road; and
- Little Friends Academy – 118 Greenmeadow Circle.



Attachment 1 - Figure 2: Social Vulnerability Index

Centers for Disease Control and Prevention/ Agency for Toxic Substances and Disease Registry/ Geospatial Research, Analysis, and Services Program. Social Vulnerability Index 2020 Database. data-and-tools-download.html. Accessed on 4/18/2024.

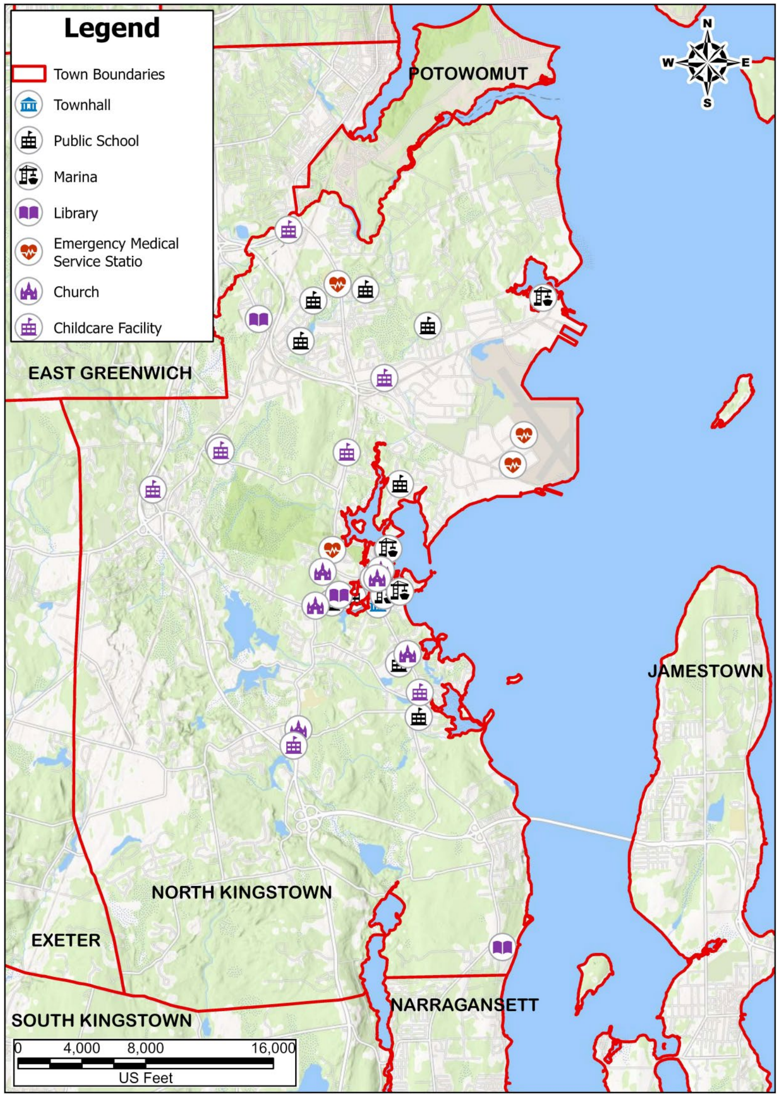
The nearest hospitals are Newport Hospital in Newport, South County Hospital in Wakefield, and Kent Hospital in Warwick. There are several elderly housing and assisted living residences within North Kingstown, including: 6101 Post Road, 6200 Post Road, Krzak Road, Fisher Drive, Walter Drive, State Street, and Union Drive. The North Kingstown Senior Association (NKSA) is dedicated to enhancing the social, recreational, and educational opportunities for all North Kingstown seniors. There are also several Elderly Rehabilitation Centers, including; Bayview Rehabilitation at Scalabrini – 860 North Quidnessett Road, Roberts Health Center – 25 Roberts Way, South County Nursing and Rehabilitation Center – 740 Oak Hill Road.

Land Use (Existing)

North Kingstown's scenic coastline has attracted residential, waterfront commercial, and other development for many years. Coastal buildings are primarily residential with more than 3,000 homes and businesses in coastal flood or storm surge areas. Most of these areas are close to being fully built out, and it is expected that existing land uses will generally continue. More recently, development has moved towards the western portion of the town and along Post Road, as the available land on the coast has become mostly developed.

The only remaining large tract of developable land in the coastal area is the Quonset Business Park (QBP) under the control of the Quonset Development Corporation (QDC). This 3,200-acre area includes an airport, a seaport, retail area, several recreational facilities, and is the primary location for industrial land uses in town. Of this acreage, 1,143 acres have been developed (leased and sold) and 84 acres are under agreement or short-term lease. There are approximately 178 acres still available in the park for future industrial/commercial development. The park has over 12 million square feet of existing buildings with an additional 450,000 square feet of buildings under construction. The park currently employs 14,890 people and is home to over 250 business. It is projected that by 2030 total employment at build out will be approximately 17,000 jobs.

According to town GIS data, North Kingstown is approximately 28,124 acres (27,904 acres of land), broken down by general land use category as shown in **Attachment 1 - Table 2** and presented in **Attachment 1 - Figure 4**. About 5.2% (by area) of the land in the town is identified as Sewered Urban Developed, 37.2% is identified as Urban Development, and 6.2% is identified as Non-urban Developed. About 5.6% of land is identified as Reserve and 3.6% is identified as Prime Farmland. Two of the largest portions of land cover in North Kingstown are Conservation/ Limited and Major Parks & Open Space, covering about 38% of space by area.



Attachment 1 - Figure 3: Support, High Occupancy, and Vulnerable Population Facilities

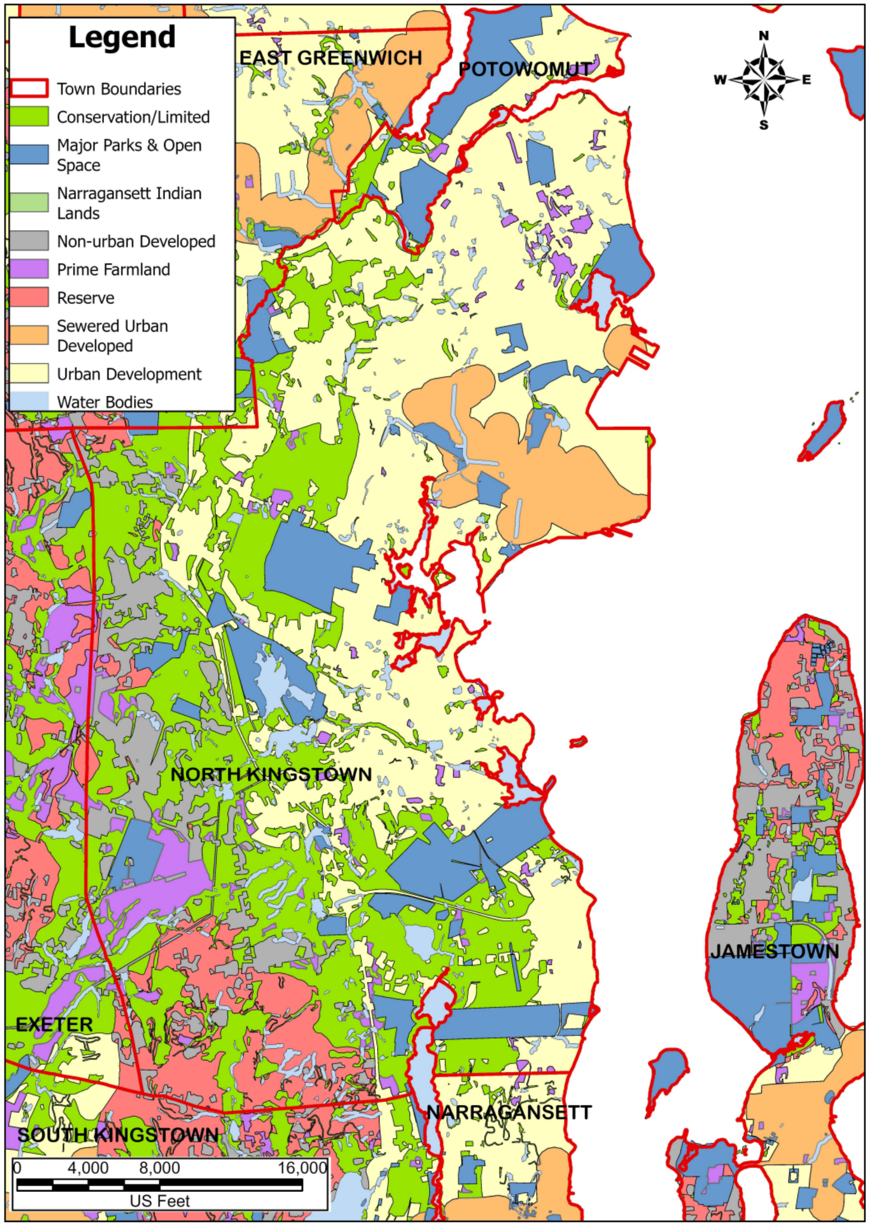
Open Space:

Today, there are 8,643 acres of land preserved as open space through such mechanisms as residential compound development, cluster development, planned village development and public spaces including the Town Beach, Ryan Park, Signal Rock Park, Yorktown Park, McGinn Park, Feurer Park, Rome Point, Wilson Park, Cocumscussoc State Park, Calf Pasture Point, and the municipal golf course. In total, these represent approximately 30 percent of the town's land area as shown in **Attachment 1 - Figure 5**.

The Town of North Kingstown has an active and long-standing open space preservation program for the entire community. The town works collaboratively with several local and state agencies to protect farmland, wetlands, shorelines, woodlands, wildlife, trails, and open spaces of North Kingstown. As part of this open space preservation program a sizeable amount of land in the special flood hazard area has been protected as well. The town has approximately 4,900 acres total land area in the SFHA (A, AE, or V zones) and 1,900 acres protected land in the SFHA. The parcels with portions of land in the X zone or entirely outside of the floodplain are not included. Only those areas of preserved open space that intersect with the A, AE or V zones were included. The town has protected 1,250 acres of open space in the Wellhead Protection Area overlay district, and 4,414 acres of open space in the Groundwater Recharge overlay district.

The town continues to work towards protecting additional lands in town working collaboratively with the Land Conservancy of North Kingstown (LCNK), Narrow River Land Trust, Rhode Island Department of Environmental Management (RIDEM) Agricultural Land Preservation Commission, US Department of Agriculture (USDA)/ Natural Resources Conservation Service (NRCS), the Washington County Land Trust Coalition, the Rhode Island Land Trust Coalition, the Nature Conservancy, the Rhode Island Forest Conservators Organization and others to protect farmland, wetlands, shorelines, woodlands, wildlife, trails, and open spaces of North Kingstown.

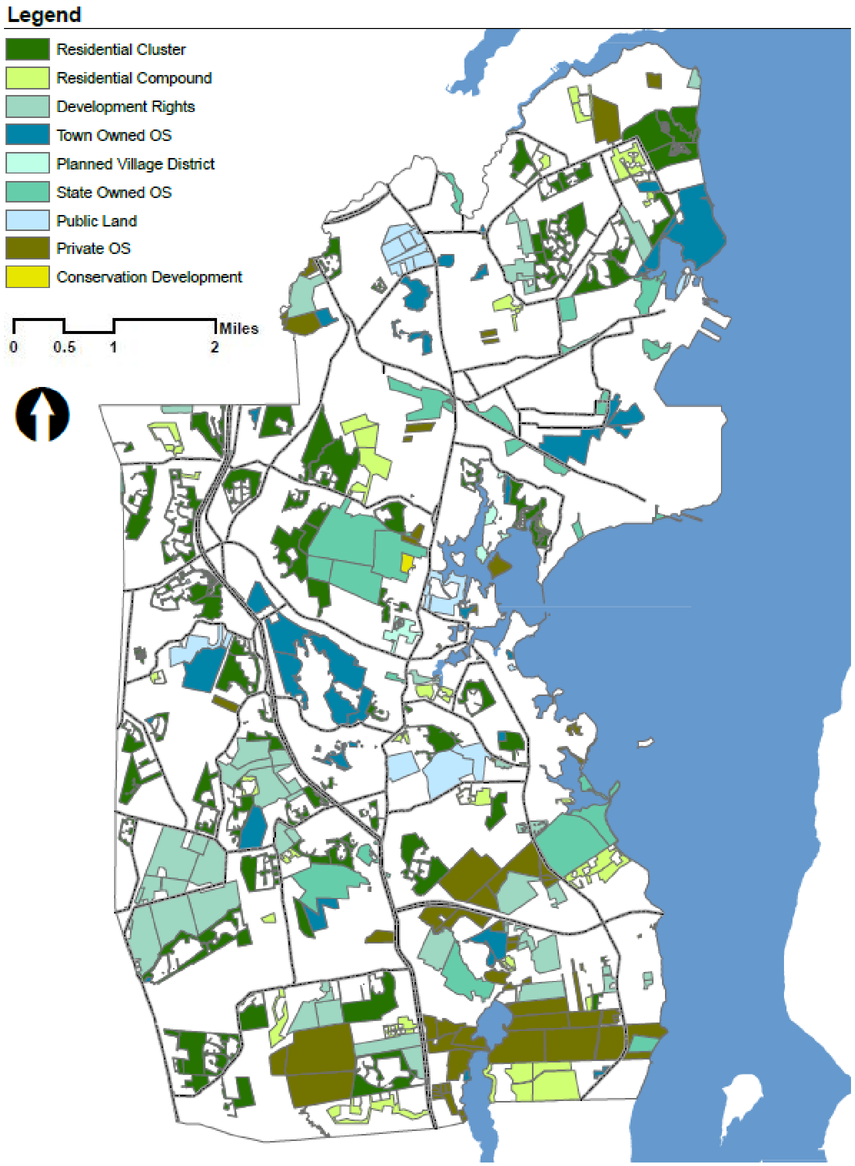
Notable local open space and recreational lands within the Town of North Kingstown are presented on **Attachment 1 - Table 3**.



Attachment 1 - Figure 4: Existing Land Use

Attachment 1 - Table 2: Land Use / Land Cover (RIGIS)

Land Use / Land Cover	Acres Total	Acres (%)
Conservation/ Limited	7,679	27.3%
Major Parks & Open Space	2,990	10.6%
Non-urban Developed	1,734	6.2%
Prime Farmland	1,006	3.6%
Reserve	1,571	5.6%
Sewered Urban Developed	1,461	5.2%
Urban Development	10,469	37.2%
Water Bodies	1,215	4.3%
TOTAL	28,124	



Attachment 1 - Figure 5: Open Space Land

Attachment 1 - Table 3: Open Space /Recreational Lands in North Kingstown

Owner Type	Area (acres)
Town Owned	1,004
State Owned	1,139
Public Land	415
Development Rights	1,468
Private Open Space	1,563
Residential Cluster	2,347
Residential Compound	670
Planned Village District	24
Conservation Development	13

Land Use (Existing) (Cont.)

In 2023, the RI Department of Environmental Management (DEM) permanently protected of 125 acres of forested land with some wetland habitat in North Kingstown for public recreational use, including hunting. The DEM received a $1.25 million grant from the US Fish and Wildlife (USFWS) Wildlife Restoration Program to complete the purchase of the property. The property abuts a spur of Silver Spring Lake, in the village of Saunderstown, between Congdon Hill and Pendar Roads.

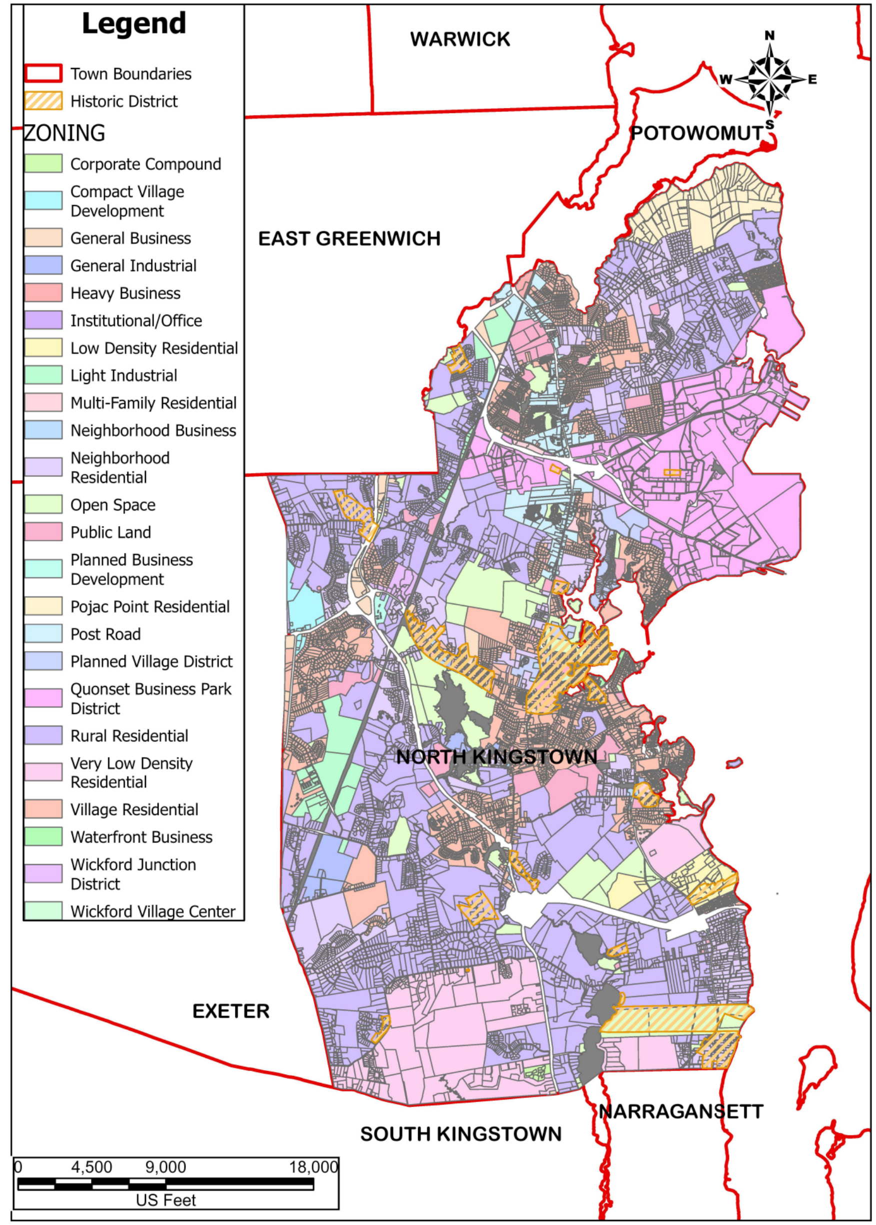
The town also worked with State, Land Conservancy of North Kingstown, private, and non-profit organizations the acquisition of the following vacant land properties:

- Little Yellow Farm (LYF), 6/25/2019 (purchase); - 5 acres of open space of a vegetated peninsula on Gilbert Stuart Road that extends into Carr Pond;
- Aceto Property, 8/6/2021 (purchase) – 63 acres of State Fish & Wildlife land along Gilbert Stuart Road;
- Cruickshank Property, 2022 (easement and donation) – 355 acres of State Natural Resources Conservation Service (NRCS) and Audubon land along Tower Hill Road;
- D'Ambra Property, 2022 (purchase) – 125 acres of State land along Pendar Road/ Silver Spring; and
- SalSame 2021 - 10 acres Land Conservancy of North Kingstown (LCNK)

Land Use (Future)

The town continues to work towards protecting additional lands in town working collaboratively with the Land Conservancy of North Kingstown (LCNK), Narrow River Land Trust, Rhode Island Department of Environmental Management (RIDEM) Agricultural Land Preservation Commission, US Department of Agriculture (USDA)/ Natural Resources Conservation Service (NRCS), the Washington County Land Trust Coalition, the Rhode Island Land Trust Coalition, the Nature Conservancy, the Rhode Island Forest Conservators Organization, Audubon Society of Rhode Island, and others to protect farmland, wetlands, shorelines, woodlands, wildlife, trails, and open spaces of North Kingstown.

Zoning for the Town of North Kingstown can be found in **Attachment 1 - Figure 6**.



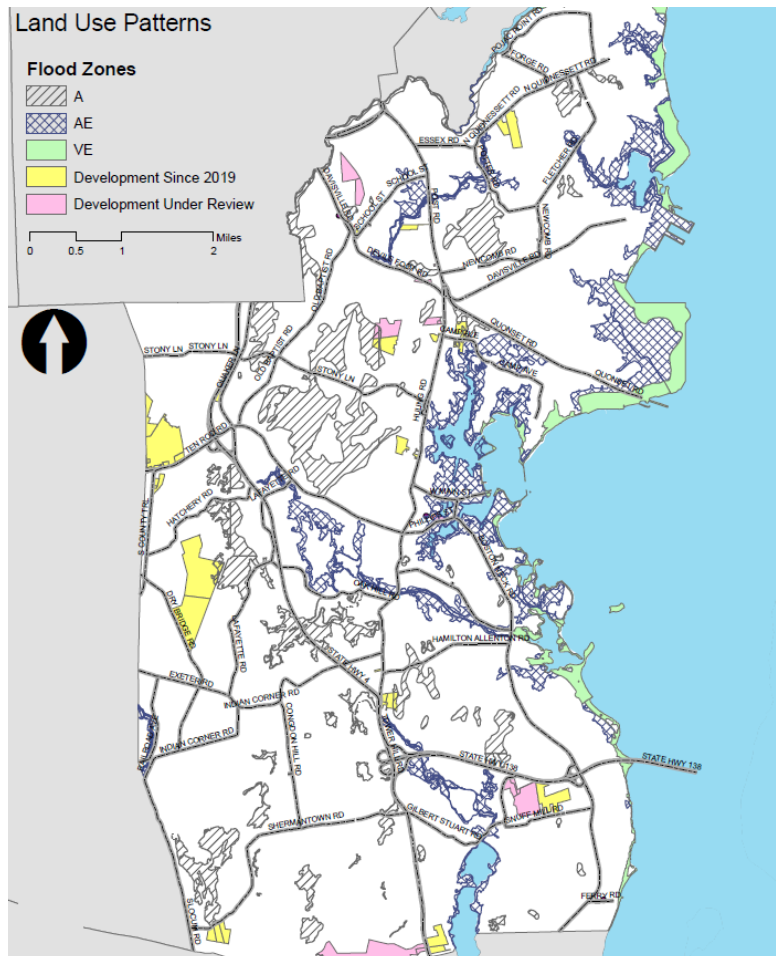
Attachment 1 - Figure 6: Zoning

Land Use Patterns

Since the hazard mitigation plan was adopted in 2019, there have been new residential, commercial and industrial development approved across North Kingstown. From a residential perspective, new housing has been approved with construction commencing in several different areas of town.

The largest recent developments underway include the Rolling Greens project off Ten Rod Road (212 residential bedrooms and 26,000 square feet of commercial space); continued construction within the Reynolds Farm development off Post Road (625 total residential units for the entire project); Pinewood Village off South County Trail (88 residential units); Tide Mill North and South off Camp Avenue (34 units across the two developments); Cottages at Weeden Farm off Tower Hill Road (14 residential units); Sanctuary Estates off North Quidnessett Road (14 residential lots); 250 Sachem off Post Road (20 residential lots); and Wickford Harbor Estates off Post Road (20 residential lots). There are other smaller residential developments approved and constructed since 2019 including Dusty Hollow off Shermantown Road (4 residential lots), Carriage Hill Farm off Tower Hill Road (3 residential lots); and Gilbert Lane residential subdivision off Snuff Mill Road (5 residential lots). By and large there is very little flood hazard area on any of these properties. The only portions of these residential developments where the SFHA may exist is in the open space areas associated with the developments. The residential structures are not located in the SFHA. From a commercial perspective, a new self-storage facility was approved off Quaker Lane and the Gooseneck Vineyard winery off Tower Hill Road was open and established. The Hollow Ridge winery off Tower Hill Road was also approved however construction has not commenced on the new facility. As with the residential developments, the commercial structures associated with these projects are not in the SFHA. Where the SFHA is found on the commercial properties, only portions of the surrounding open lands are in the SFHA. The primary industrial development established since 2019 is the Dry Bridge Road solar facility. A very small portion of the lot is in the SFHA.

There are also several projects in the review process. From a residential perspective, there are 57 residential units proposed in the former Wickford Elementary School and Olde Theater buildings off Phillips Street. While neither structure is in the flood zone, portions of each lot is in the SFHA. The Post Road Apartments project (77 residential units) is at the final stage of review. This property is not located in the SFHA. The Edge project (formerly Quonset Apartments - 56 residential units) is at the preliminary stage of review. There is no SFHA within this parcel. The WDIC development (78 residential units) is also at the preliminary stage of review. A portion of this parcel is in the SFHA however there are no buildings proposed in this area. From a commercial perspective, a McDonalds is proposed off Post Road with a small portion of the SFHA contained on this lot. Lastly, a 4MW solar energy system was approved off Firwood Drive. There is no SFHA on this parcel.



Attachment 1 - Figure 7: Land Use Patterns

Transportation Infrastructure

Although coastal, the geographic position of North Kingstown, in addition to its well- developed roadway system provides local and regional access to employment centers for residents. This roadway system has helped define the sense of place for North Kingstown's villages, neighborhoods, and commercial districts. Roads and highways are assigned by a functional classification system that is based upon the road's intended level of service. The five major classifications of roads present in North Kingstown are Freeway/Expressway, Principal Arterial, Minor Arterial, Collector, and Local.

According to North Kingstown roadway GIS files, there are approximately 265 miles of roads in North Kingstown, with 224 miles (85%) being town roadways. The remaining roadways are state and nationally owned.

North Kingstown has several main roadways including: Route 1, 1A, 2, and 4, which run north-south; and 102, 138, 403 which run east-west.

The Town of North Kingstown offers free transportation to residents, ages 55+ for services such as visiting the senior center and medical appointments. For individuals 60+ or with disabilities who meet certain criteria, non-emergency medical appointments in town or out of town medical appointments, therapy, cancer treatments, kidney dialysis, adult day care, physical therapy and meal site lunches, there are state transportation services available.

The Rhode Island Public Transit Authority (RIPTA) Bus Pass Program and Bus Routes also service the town.

Numerous bridges and culverts are located within town, as shown on **Attachment 1 - Figure 8**. Major (RIDOT and town) bridges are listed as follows in **Attachment 1 - Table 4**.

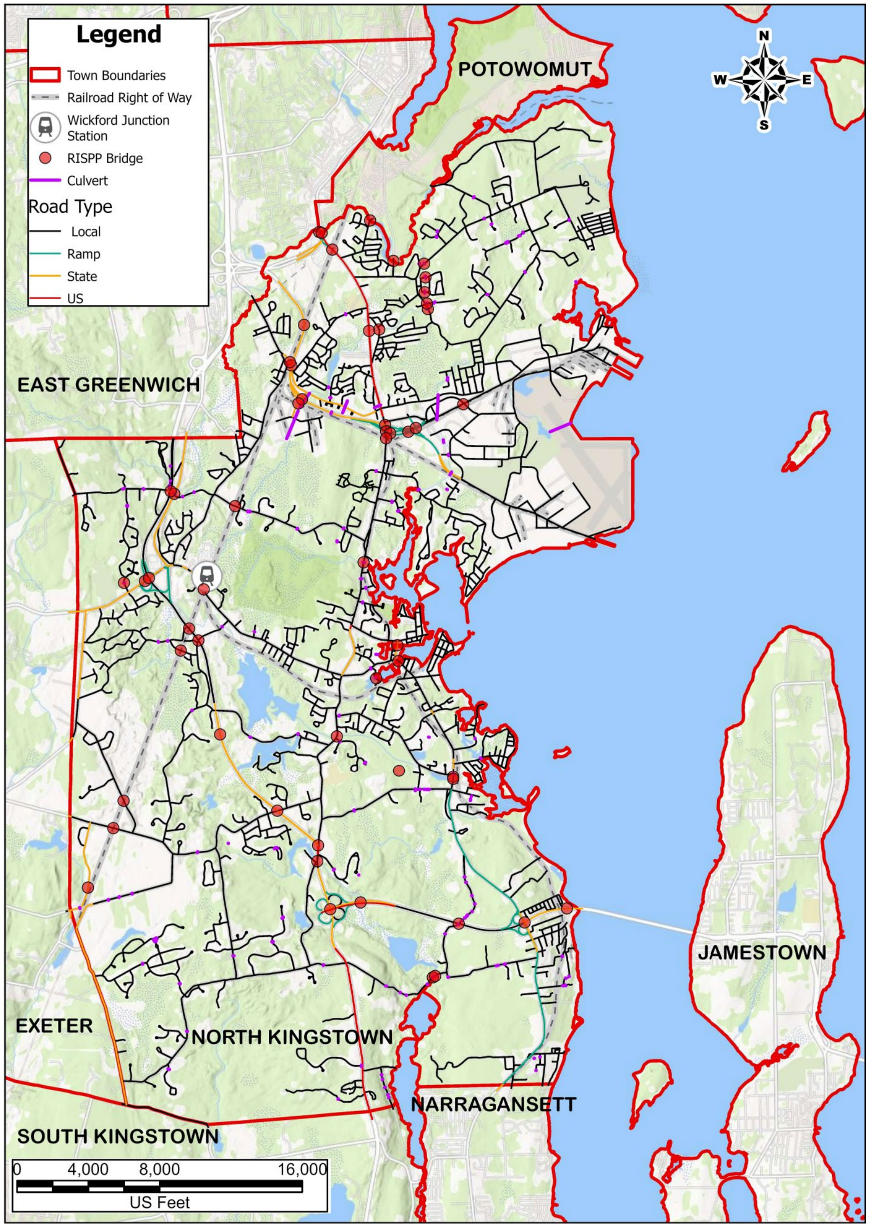
Wickford Junction is a commuter rail station with a 1,100-car parking garage, completed in April of 2012. The station is the southern end of the Massachusetts Bay Transportation Authority (MBTA) Commuter Rail for commuters to Providence and Boston. The Amtrack line also runs along this rail-line as transportation through the town.

The nearest airports to North Kingstown are the Quonset State Airport in North Kingstown and the Newport State Airport in Newport. The nearest international airports are Rhode Island T. F. Green International Airport and Boston Logan International Airport, approximately 17 and 75 miles from the town center, respectively.

The Port of Davisville Piers 1 and 2 has 4,500 feet of berthing space and over 230 acres of operating capacity. The Port is one of the top 10 automobile importers in the United States. The Rhode Island Fast Ferry Terminal is also located in Quonset and departs to Martha's Vineyard. These are critical for recovery shipments and economic recovery. Land at Quonset also has served in recovery operations as staging and stockpiling of debris and construction materials.

Attachment 1 - Table 4: RIDOT Bridges in North Kingstown

Bridge ID	Facility Carried	Feature Intersected	Owner
000601	US 1 Post Rd SB	Hunt River	State
000701	US 1 Post Rd	Amtrak	State
001001	US 1A Brown St	Academy Cove	State
001201	US 1A Bstn Nck Rd	Annaquatucket River	State
001501	US 1 Post Rd NB	Hunt River	State
001601	US 1 Post Rd	Sandhill Pond	State
003701	Gilbert Stuart Rd	Mattatuxet River	Town
024101	RI 2 Quaker Lane	Stoney Brook	State
024301	RI 4 Col Rodman Hy	Amtrack	State
036801	Austin Rd	Potowomut Pond	Town
036901	Devils Foot Rd	Amtrack	State
037001	Exeter Rd	Amtrack	State
076801	RI 4 NB & SB	Stony Lane, Scrbbltwn Brk	State
078301	Hatchery Rd	Amtrack	State
089501	Stony Lane	Amtrack	Town
089601	US 1 Tower Hill Rd	RI 138	State
099201	Potowomut Rd	Potowomut River	Town



Attachment 1 - Figure 8: Transportation Infrastructure

Essential Facilities and Lifeline Systems

Essential Facilities and Lifeline Systems in North Kingstown are presented in **Attachment 1 - Figure 9**. Essential facilities include facilities that provide critical services including public safety (e.g. police, fire, emergency shelters), health care, and town and regional services necessary for response during and after natural disasters. More information about these services is described below. Lifeline Systems include power generation and transmission, communication systems, potable water supply, and sanitary wastewater treatment.

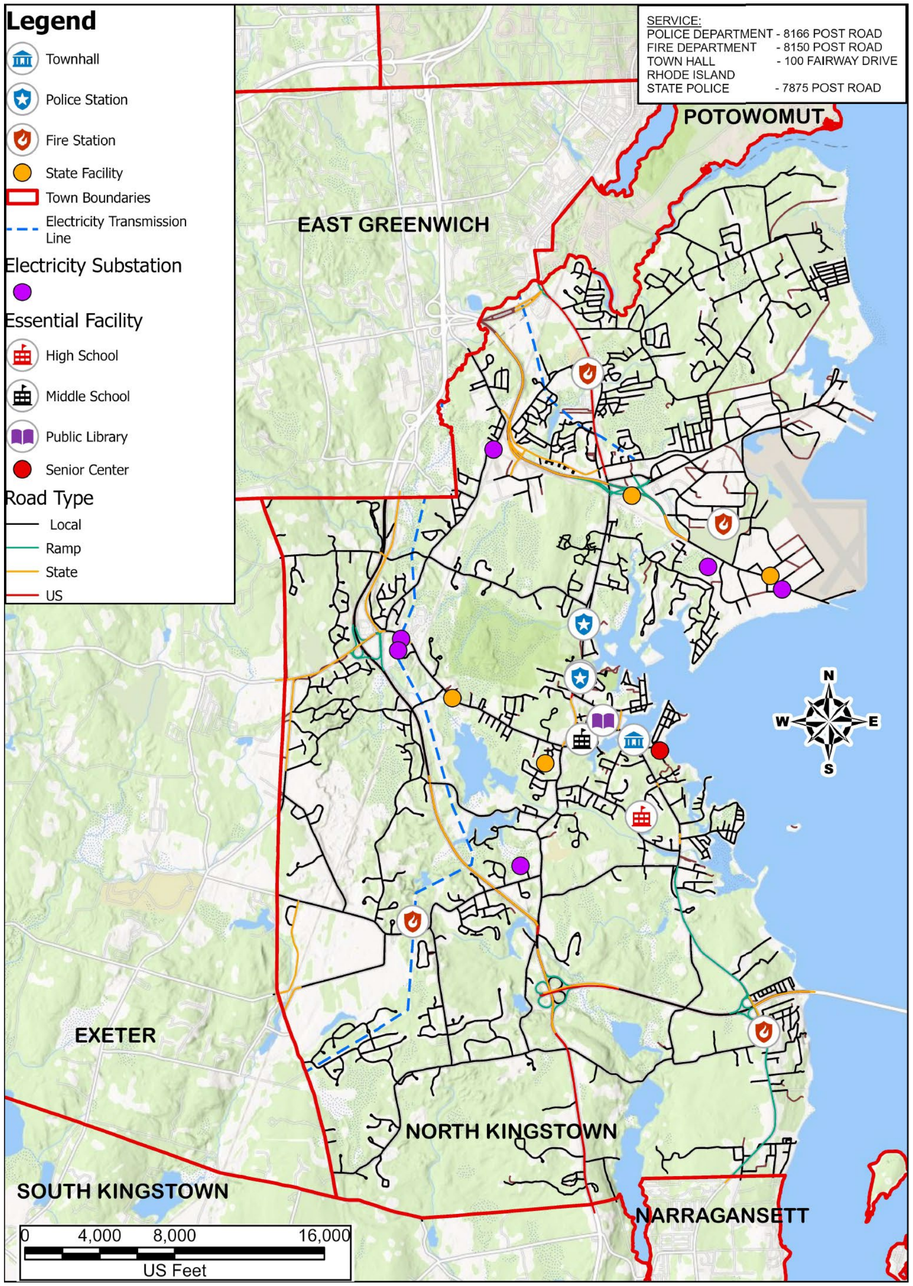
Public Safety and Health Care

Public safety within the Town of North Kingstown is the responsibility of the local Police Department, Fire Department, Building Department, Planning Department, and the Department of Public Works. The Police Department and the Fire Department share a public safety complex and are located at 8166 Post Rd and 8150 Post Rd, respectively. This location is the Public Safety Headquarters. Other fire station locations are: Station 2 -1865 Boston Neck; Station 3 - 6445 Post Rd; Station 5 - 131 Indian Corner; and Station 6 -545 Callahan Rd.

The Highway Department is located at 8150 Post Rd and 2050 Davisville Road. There is a highway satellite garage located at 480 Oak Hill Rd. There is also a Rhode Island State Police office located at 7875 Post Rd in North Kingstown. Emergency shelters are located at Davisville Middle School and Wickford Middle School, but Town Officials are hoping to expand emergency shelter options. South Kingstown High School is the primary regional shelter with a local shelter at the Wickford Middle School.

Utilities

Gas and electricity service in Washington County is provided by RI Energy, and phone service provided by various private utilities.



Attachment 1 - Figure 9: Essential Facilities and Lifeline Systems

Water Supply

North Kingstown, like most of Southern Rhode Island relies on extensive groundwater aquifers for water supply. The Town's water comes from three (3) different aquifers, the Hunt, Annaquatucket, and Pettaquamscutt. The average daily use is well below the safe yield levels and water is supplied to parts of both Narragansett and Jamestown. Volume II of the North Kingstown Water Supply System Management Plan deals extensively with emergency responses and mitigation actions for droughts, water contamination, supply disruption, and many other situations. Impermeable surfaces above the aquifer can severely restrict the amount of water infiltrating the ground and recharging the aquifer, exacerbating the effects of a drought.

Water Pollution Control

The town maintains six (6) wastewater pumping facilities, one at Wickford Point, Mark Drive, Camp Ave, Stony Lane, Intrepid, and Reynolds Farm, while the QDC has a wastewater facility in Quonset Point. All of these wastewater facilities are subject to flooding and storm surge presenting severe water contamination issues.

Wastewater treatment facilities and major sewer line locations are presented in **Attachment 1 - Figure 10**. Wastewater pumping facilities are located at Wickford Point, Mark Drive, Camp Ave, Stony Lane, Intrepid Drive, and Reynolds Farm.

For maintenance and inspection purposes, the town has been divided into four (4) wastewater management districts:

- **Wastewater District 1** - All properties served by a private well and Individual Sewage Disposal System (ISDS) or cesspool
- **Wastewater District 2** - All properties located in Zone 1 Groundwater Protection Areas and all properties located adjacent to poorly flushed coastal areas
- **Wastewater District 3** - All properties located in Zone 2 Groundwater Protection Areas and properties located in densely settles coastal areas

- **Wastewater District 4** - All other properties in North Kingstown served by ISDS or cesspools

The town also has an official wastewater facility plan with further details and mapping. It can be viewed here:

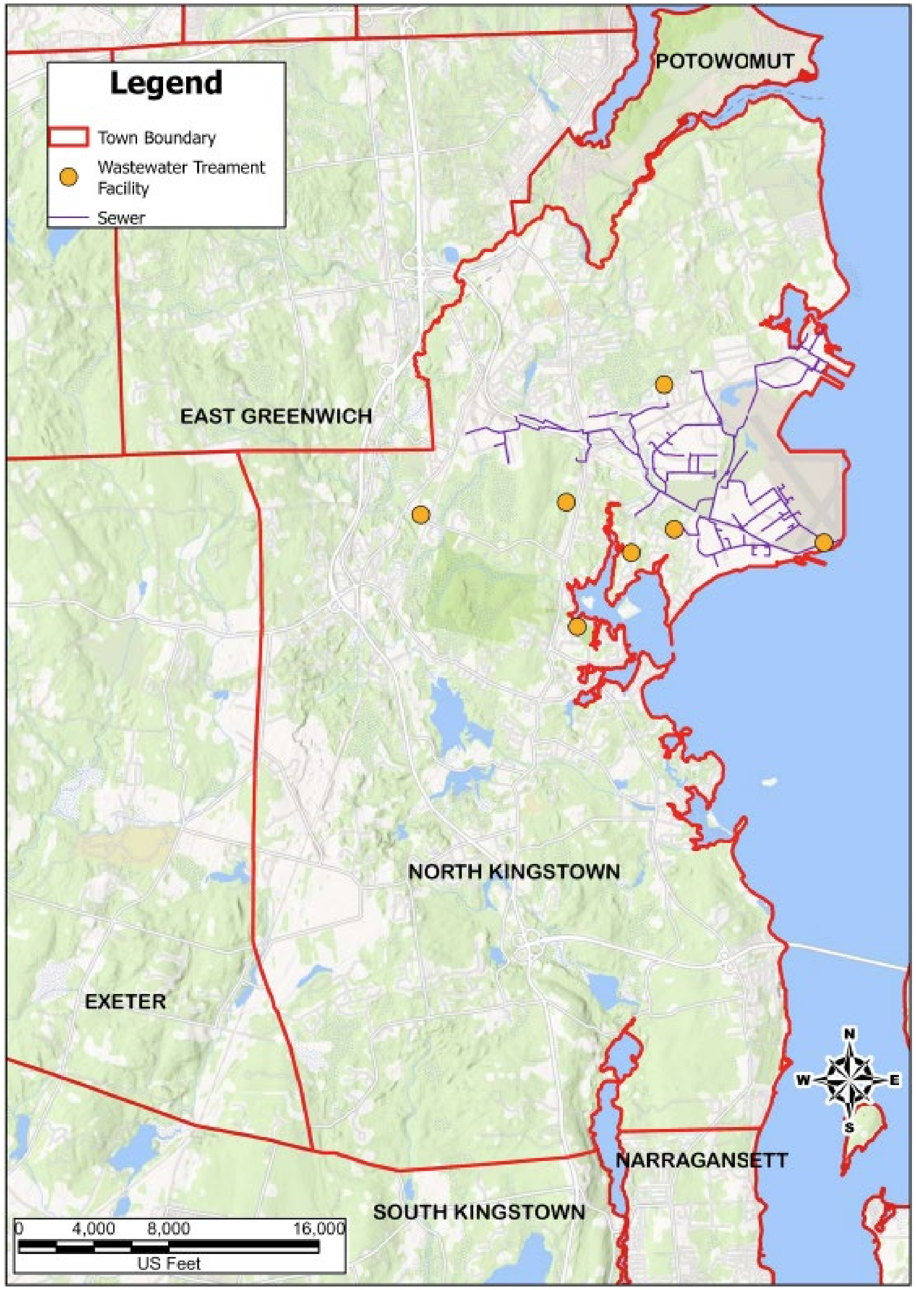
https://northkingstownri.gov/DocumentCenter/View/391/Wastewater-Management-Plan-PDF

Animals

The town contains the North Kingstown Animal Shelter and Support Foundation at 395 Hamilton Allenton Road which may also provide limited housing for animals.

If disasters entail large evacuations or local shelters exceed their capacity, back-up sheltering may be available from one or more of the following Rhode Island State Emergency Pet Shelters (RISEPS):

- Pawtucket Animal Shelter, Slater Park, 401 Newport Ave, Pawtucket, RI 02860. Phone: 401-729-7496.
- Potter League for Animals, 87 Oliphant Lane, Middletown, RI 02842. Phone: 401- 846-8276.
- South Kingstown Animal Shelter, 132 Asa Pond Road, Wakefield, RI 02879. Phone: 401-789-5515
- Westerly Animal Shelter, 33 Larry Hirsch Lane, Westerly, RI 02891. Phone: 401- 596-2022



Attachment 1 - Figure 10: Wastewater Treatment Facility and Sewers

High Potential Loss Facilities: Dams

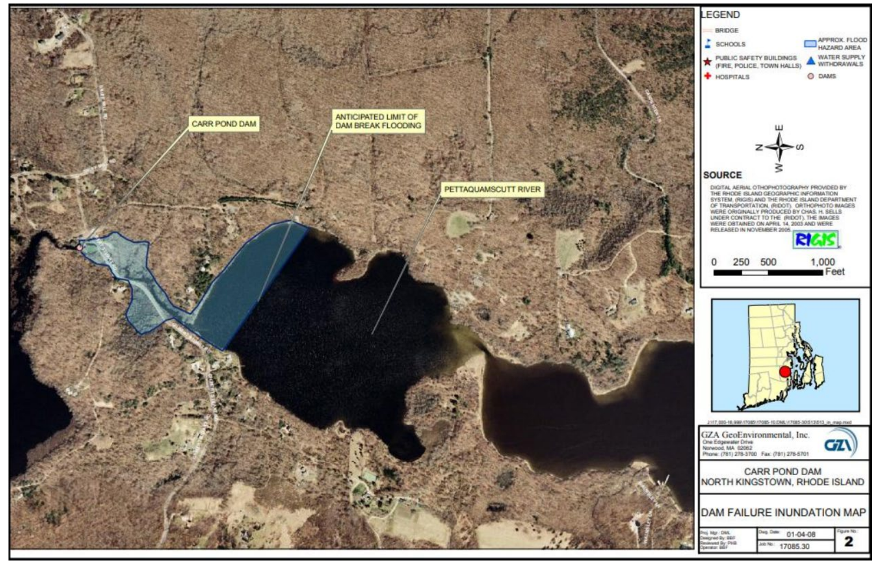
The Town of North Kingstown has a total of 23 dams, classified as either High, Significant or Low Hazard. An inventory of the town's dams can be found in the State's annual dam report entitled, "State of Rhode Island Department of Environmental Management 2023 Annual Report to the Governor on the Activities on the Dam Safety Program" and the 2024 RI Hazard Mitigation Plan. (https://dem.ri.gov/sites/g/files/xkgbur861/files/2024-05/damrpt23.pdf and https://riema.ecms.ri.gov/sites/g/files/xkgbur671/files/2024-02/2024%20RI%20Hazard%20Mitigation%20Plan%20FINAL%20_Reduced%20size.pdf). Dams are listed by town. One of these dams is listed under Warwick/North Kingstown. Of these, 6 are high hazard, 3 are significant hazard, and 14 are low hazard (**Attachment 1 - Table 5** and **Attachment 1 - Figure 12**).

Dams are classified by size and hazard ratings. The size classification provides a relative description of small, medium, or large, based on the storage capacity and height of the impounded water. The hazard classification relates to the probable consequences of failure or improper operation of the dam; however, it does not relate to the current condition or the likelihood of failure of the dam. The hazard classifications are defined in the Rhode Island Dam Safety Regulations as follows:

- **High Hazard** – means a dam where failure or mis-operation will result in a probable loss of human life.
- **Significant Hazard** – means a dam where failure or mis-operation will likely not result in loss of human life, but will cause major economic loss, disruption of lifeline facilities, or impact other concerns detrimental to the public's health, safety, or welfare.
- **Low Hazard** – means a dam where failure or mis-operation will not likely result in loss of human life or cause major economic loss.

Intense storms may produce a flood in a few hours or even minutes for upstream locations. Flash floods occur within six (6) hours of the beginning of heavy rainfall, and dam failure may occur within hours of the first signs of breaching. Other failures and breaches can take much longer to occur, from days to weeks, as a result of debris jams or the accumulation of melting snow.

Carr Pond Dam: A High Hazard dam in North Kingstown, shown below (**Attachment 1 - Figure 11**), is in the southern portion of North Kingstown, South of RI Route 138, near the border with the Town of Narragansett.



Attachment 1 - Figure 11: Dam failure inundation map for Carr Pond Dam (No. 513)

Rhode Island General Laws Section 46-19-9 requires the preparation of Emergency Action Plans (EAP) dams with High or Significant Hazard classifications. Local communities are responsible for completing these EAPs. The State worked with the Town in the development of all the EAPs by providing inundation mapping, and information generated from dam site surveys funded by federal grants. These EAP's were drafted and completed through a combined effort with the Town, State and private dam owners. The Town continues to work with private owners with periodic visual inspections, notice of storm events and reminders of their maintenance responsibilities. Carr Pond Dam and Rodman Mill Dam are two private structures with EAPs that have on-going outreach efforts with the Town. The Town's Public Safety Director is typically the lead in these efforts. The Town continues to maintain, monitor and adhere to the requirements of their EAP for the Town owned dam.

The Town has coordinated with RIDEM to obtain copies of EAPs for the high hazard potential dams. Additionally, dam failure inundation areas are publicly available through a RIDEM web viewer. Inundation areas were reviewed, and they largely overlap with mapped FEMA flood areas. Therefore, the impacts of dam failure are similar to that of flooding, covered in other sections.

The town will monitor, update, and evaluate town owned and private dams in accordance with the EAPs. Town Engineering staff will ensure that updated plans and structural assessments on dams are properly documented and incorporated into the EAPs. The Dam EAPs provide information on event response responsibilities and preventive actions.

Floodplain management is more effective for inundation zones as they overlap with FEMA's flood zones and are regulated by the Town's Floodplain Management Ordinance. The Planning Department is also responsible for promoting and expanding its (FEMA) Community Rating System (CRS) program that recognizes and encourages community floodplain management practices.

Hazard creep and cascading impacts from the Town's HHPD dams within the three associated watersheds are not significant, as described by their individual EAPs. However, these impacts and vulnerabilities will continue to be managed by the Town through its oversight of the EAP program, updated Planning and Zoning regulations, as well as policies and efforts consistent with the Town's Goal Statement regarding natural hazards.

RIEMA has approved Emergency Action Plans for all High and Significant Hazard dams North Kingstown:

- #444 Silver Spring Pond (High Hazard)
- #513 Carr Pond (High Hazard)
- #550 Hamilton (Significant Hazard)
- #553 Belleville Pond (Significant Hazard)
- #615 Rodman Mill (High Hazard)
- #693 Slocum Woods (High Hazard)
- #704 Secret Lake (Significant Hazard)
- #708 Shady Lea Mill (High Hazard)
- #710 Slocum Road Upper (High Hazard)

In order to address the risk due to dam failure, the EAPs should be regularly exercised and updated. Mitigation actions related to flooding are applicable to dam failure flooding, as the inundation areas are similar to that of flooding.

In Rhode Island, at the end of 2022, there were thirty-three dams with unsafe conditions need to be addressed. One dam, in North Kingstown, Dam No. 444 the Silver Spring Dam, was inspected in 2013. The Department of Environmental Management (DEM) owns the dam. In 2020, DEM's Division of Planning and Development (P&D) applied to the Dam Safety Program to repair the dam, which was approved in 2021. Repair work began in the spring of 2022 and completed in 2023.

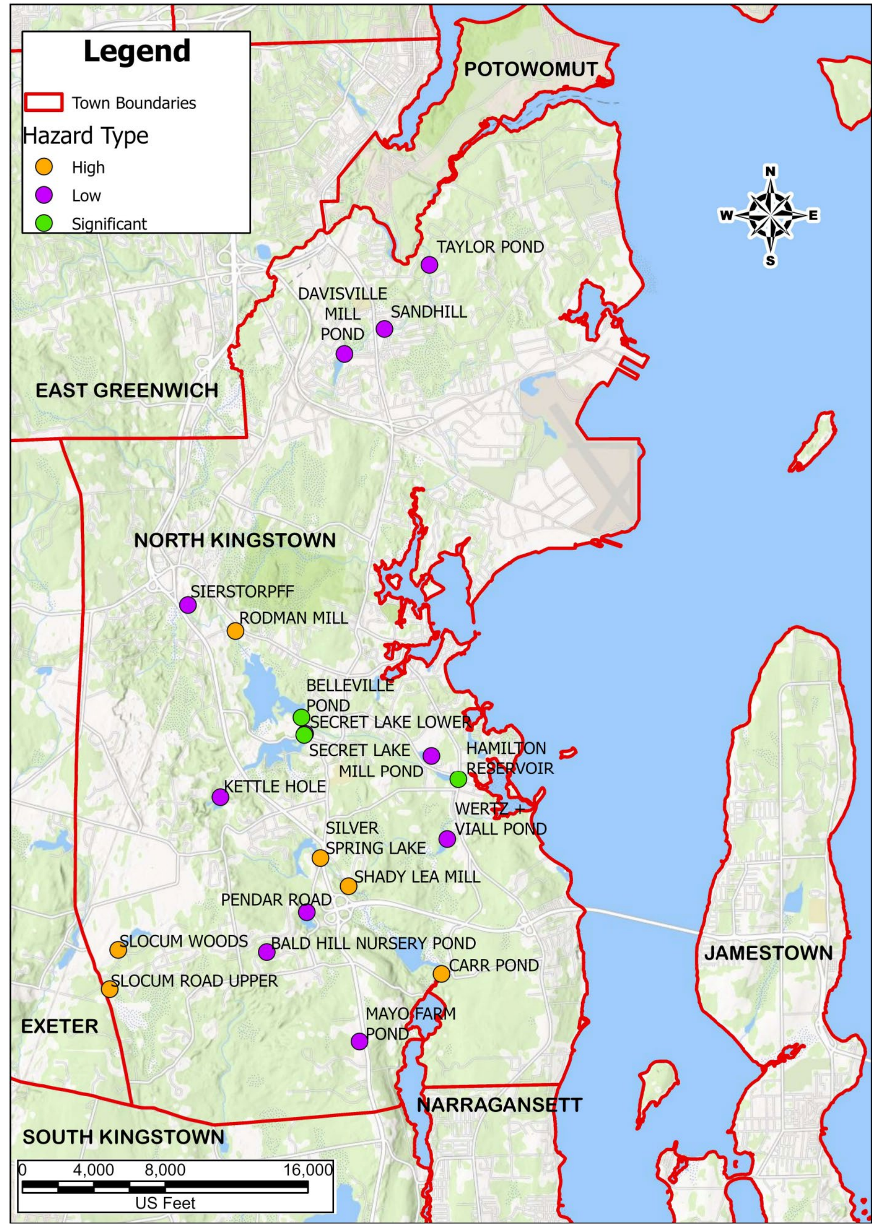
In 2022, nine dams with potentially unsafe conditions were identified as needing to be addressed. Of the nine dams falling under the High or Significant classifications in North Kingstown, seven are privately owned, with the Town and State responsible for one each. Dam number 710 (Slocum Road Upper) in North Kingstown was inspected in 2020, and the DEM issued a notice to the owners in August 2021. In November 2021, the owner's consultant submitted a report which indicated that they will be submitting a plan to address the potentially unsafe condition. In June 2022 the DEM approved a repair plan and in 2023, the repair work was completed.

Although dam # 296 is classified as a low hazard structure, it is important to note that this dam is in a state of disrepair and therefore has on-going efforts to repair or address the deficiencies. Those efforts include the submission of a grant application to the National Fish and Wildlife Foundation to begin a more comprehensive analysis of the dam and consideration for repair versus full removal option.

Dam safety information including basic dam data and downstream inundation areas due to dam failure is available from the state of RI online. In addition, the Town has copies of EAPs for high and significant hazard dams. In the event that dam repair / rehabilitation is planned, the dam owner is responsible for applying to RIDEM for necessary permits. The Town would be notified as part of that permit process. No specific outreach to RIDEM or local dam owners was necessary to complete this HMP.

Attachment 1 - Table 5: RI 2022 DEM Dam Inventory for North Kingstown

State ID	River/ Stream	Dam Name	Hazard
439	PETTAQUAMSCUTT RIVER-TRIB	MAYO FARM POND	LOW
444	MATTATUXET RIVER	SILVER SPRING LAKE	HIGH
471	WANNACHECOMECUT BROOK	WERTZ + VIALL POND	LOW
497	MATTATUXET RIVER - TRIB	BALD HILL NURSERY POND	LOW
513	MATTATUXET RIVER	CARR POND	HIGH
536	DUCK COVE BROOK-TRIB	MILL POND	LOW
550	ANNAQUATUCKET RIVER	HAMILTON RESERVOIR	SIGNIFICANT
551	POTOWOMUT RIVER	POTOWOMUT POND	LOW
552	SAND HILL BROOK	TAYLOR POND	LOW
553	ANNAQUATUCKET RIVER	BELLEVILLE POND	SIGNIFICANT
569	SAND HILL BROOK	DAVISVILLE MILL POND	LOW
615	ANNAQUATUCKET RIVER	RODMAN MILL	HIGH
693	CHIPUXET RIVER-TRIB	SLOCUM WOODS	HIGH
703	SAND HILL BROOK	SANDHILL	LOW
704	ANNAQUATUCKET RIVER-TRIB	SECRET LAKE	SIGNIFICANT
705	ANNAQUATUCKET RIVER-TRIB	SECRET LAKE LOWER	LOW
706	ANNAQUATUCKET RIVER	SIERSTORPFF	LOW
708	MATTATUXET RIVER	SHADY LEA MILL	HIGH
709	ANNAQUATUCKET RIVER-TRIB	KETTLE HOLE	LOW
710	CHIPUXET RIVER-TRIB	SLOCUM ROAD UPPER	HIGH
712	SILVER SPRING LAKE-TRIB	PENDAR ROAD	LOW
767	SODCO		LOW
296	POTOWOMUT RIVER	OLD FORGE MILL POND	LOW



Attachment 1 - Figure 12: Dams in North Kingstown

Stormwater Management

Areas with higher amounts of impervious surface and poor drainage are more vulnerable to urban/stormwater flooding. In North Kingstown, those areas include state roads like Post Road/Route 1 and Quaker Lane/Route 2. In addition, as part of the CRS program, the town has identified problematic drainage areas on town roads that may also be more susceptible to urban/stormwater flooding, including:

Street Name	Description
• Fletcher at Signal Rock	Catch basin at intersection
• Pine River Drive	Outfall behind #135
• Edmond Drive	NA
• Austin Road	By the bridge
• Austin Road	At Austing Meadows
• Forge Road	By the bridge
• Forge at N. Quidnessett	Intersection
• 640 N. Quidnessett	Rt-hand side of driveway
• Old Baptist Road	Basin by Blais Farm
• Old Baptist Road	Basin at midway
• Evergreen Road	4 basins
• Chaucer Drive	NA
• Dana Drive	#137
• School Street	Opposite Hancock "west"
• Potowomut	By the bridge
• Potowomut	On the bridge
• Highbank	Opposite Allen
• Lake Drive	At end by school
• Old Mill Lane	DBL basins on rt-hand side off road
• Sachem Road	2 at dead end
• Yorktown Park	Basin across the street
• Stillman Road	Roadway
• Plum Point Road	Roadway
• Walmsley Lane	Roadway
• River Road	Roadway
• Tomahawk Circle	Roadway
• Oak Hill Road	Roadway and culvert
• Village Hill	Roadway
• Terre Mar Drive	Roadway
• Duck Cove Road	Swale at #106
• Laurel Ridge Lane	Roadway
• Kings Grant	West side of curve, road south end
• Earle Drive	Roadway
• Elgin and Concord	Corner of road should be kept clear (tidal influence)
• West Main Street	140-154 catch basin system both sides of street
• West Main Street	Outfall behind #180
• West Main Street	Outfall behind funeral home
• West Allenton Road	#79/ #86 flooding both sides (monitor conditions)

These problematic areas listed above have been identified by the town's stormwater specialist. The "North Kingstown Standard Operating Procedure for Drainage Inspection/Maintenance" was developed to be proactive in addressing the problem areas, especially ahead of potentially significant weather events and subsequently after the inclement weather has passed. Department of Public Works crews go to these identified town road sites and make sure the infrastructure is cleared out and properly functioning; in doing so they have avoided flooding and property loss.

Hazardous Materials Facilities and Landfills

Per the Transfer Station Operating Plan Town of North Kingstown (Revised July 2020), "The North Kingstown Transfer Station presently handles up to 25 tons per day (TPD) of incoming solid waste. The facility contains a leaf and yard waste composting operation. The facility also has roll-off containers for the collection and separation of recyclables such as cardboard, bottles, cans, plastic containers, rigid plastics, tires, brush, white goods, walk-in containers for clean (recyclable) mattresses and box springs; drop-in collection bins for used books, slightly used clothing and shoes and the facility has an area for the collection of waste oil, car batteries and propane tanks." The transfer station is shown in **Attachment 1 - Figure 13.**

The Town of North Kingstown presently sends all of the town's municipal solid waste (MSW) to the Central Landfill in Johnston, RI.

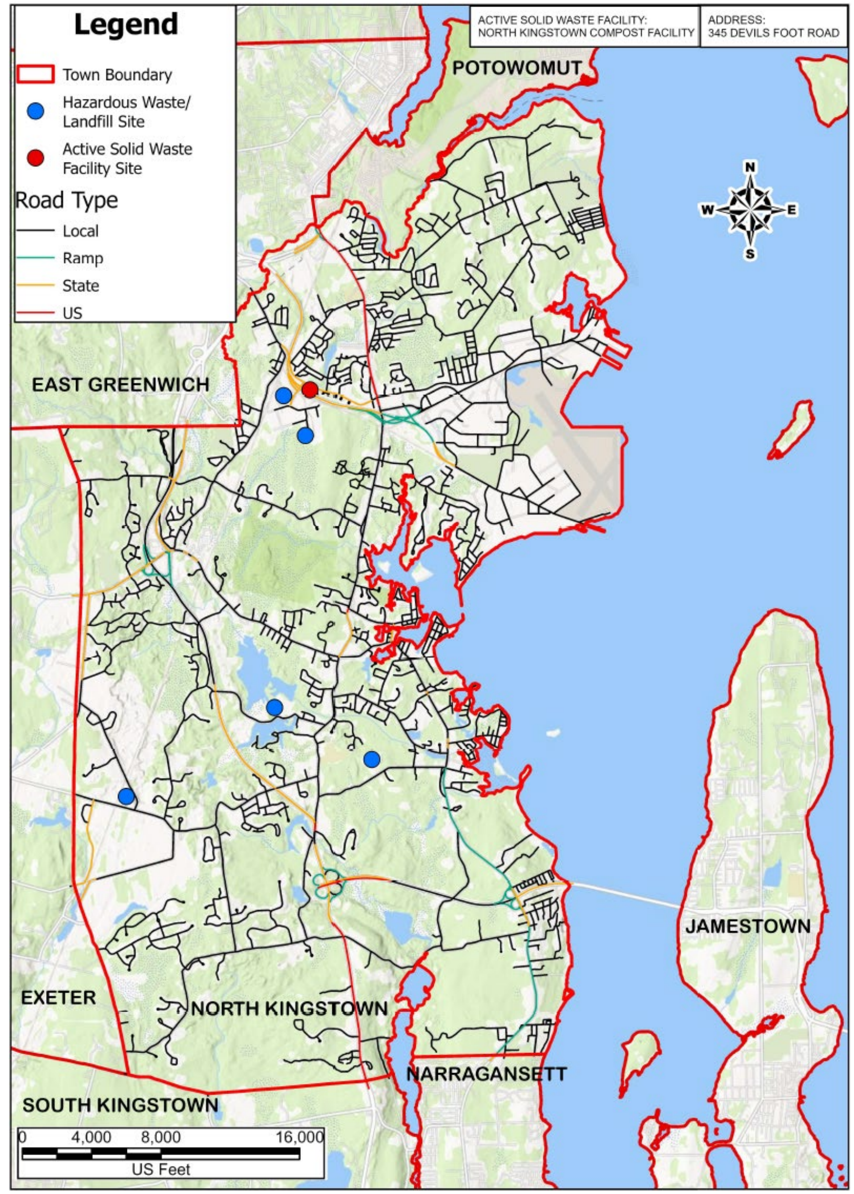
Hazardous waste management facilities are defined as facilities which receive hazardous wastes for treatment, storage, or disposal. North Kingstown contains many facilities that could be considered on this list, but it has been reduced to the larger facilities for this plan. The highest concentration of these facilities is located in the Quonset Business Park, which contains Tier 2 facilities, which have a reporting requirement under the Emergency Planning and Community Right-to-Know Act (EPCRA) where facilities must submit an annual report of hazardous chemicals on-site in quantities exceeding specific thresholds.

The town also has a **Hazardous Materials Plan,** which lists locations in the town where hazardous materials are stored and covers response and recovery in the event of a hazardous materials spill.

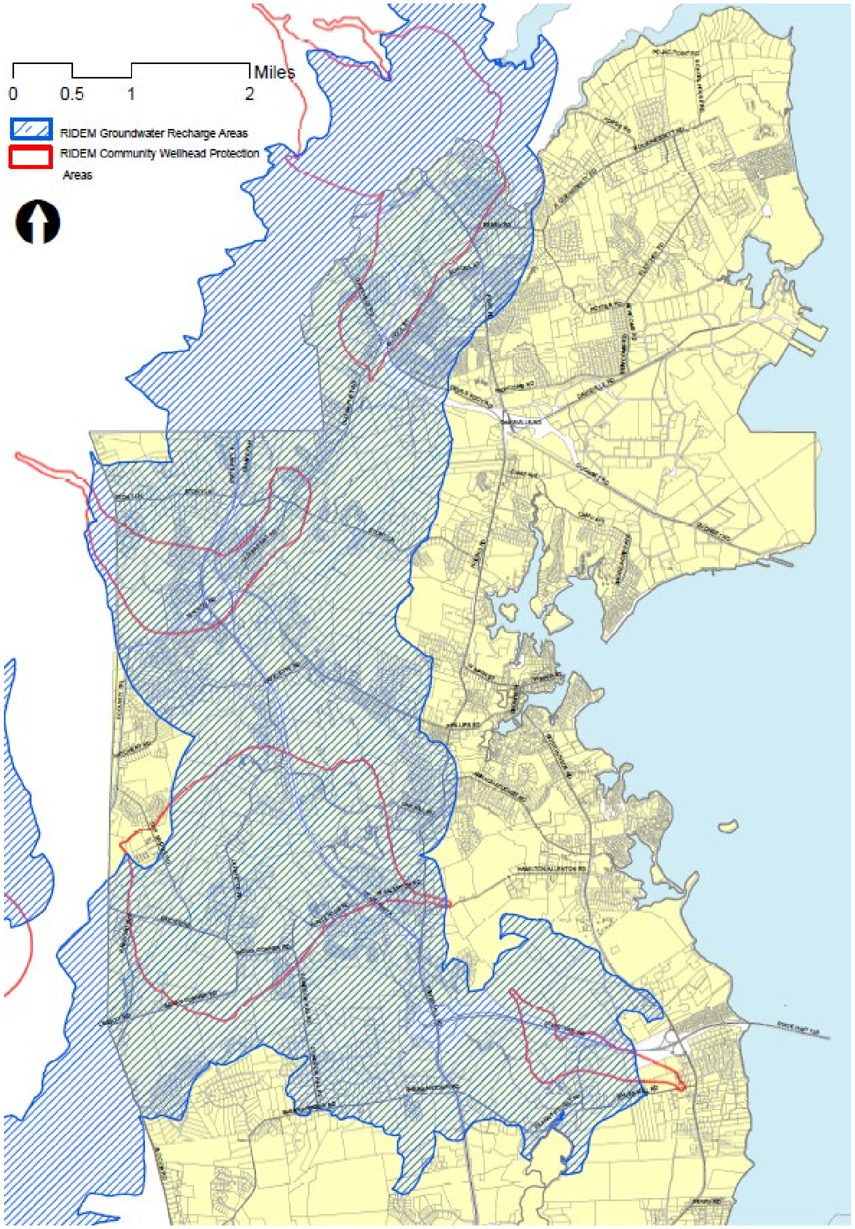
Natural Resources

Surface water systems within the town are the Hunts River, the Annaquatucket River, and Pettaquamscutt River, however the town also lies in part of the Narrow River Watershed and Wood-Pawcatuck Watershed (see **Attachment 1 - Figure 14**).

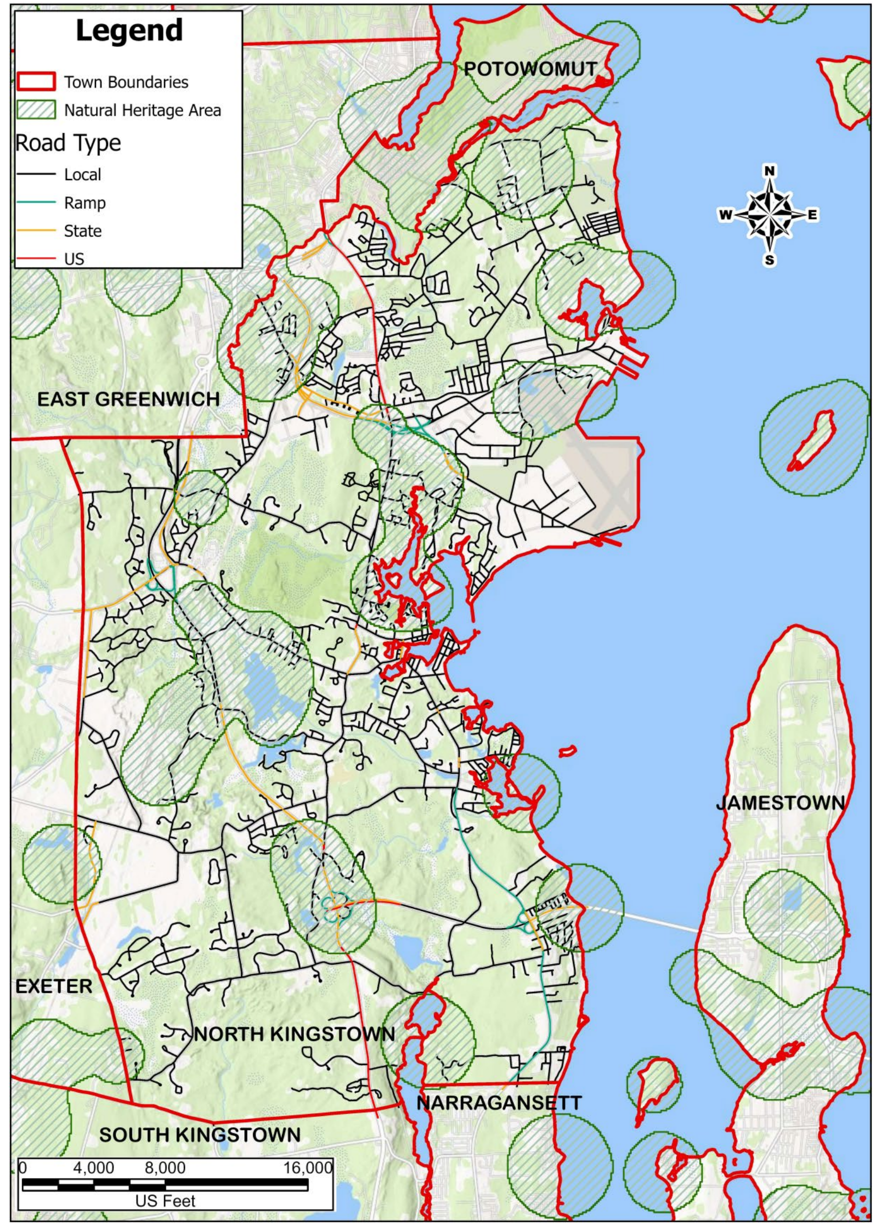
RI Natural Heritage Areas serves as an aid in the conservation of state listed rare, threatened, or endangered plant and animal species found in Rhode Island, as shown on **Attachment 1 - Figure 15**. When a species naturally part of Rhode Island's is in danger of elimination from the state, law (RIGL 20-37-2) allows the Department of Environmental Management (RIDEM) to list the species under the natural heritage list.



Attachment 1 - Figure 13: Hazardous Materials Facilities and Landfills



Attachment 1 - Figure 14: Water Resources



Attachment 1 - Figure 15: Natural Resources/ Endangered Species

Cultural and Historic Sites

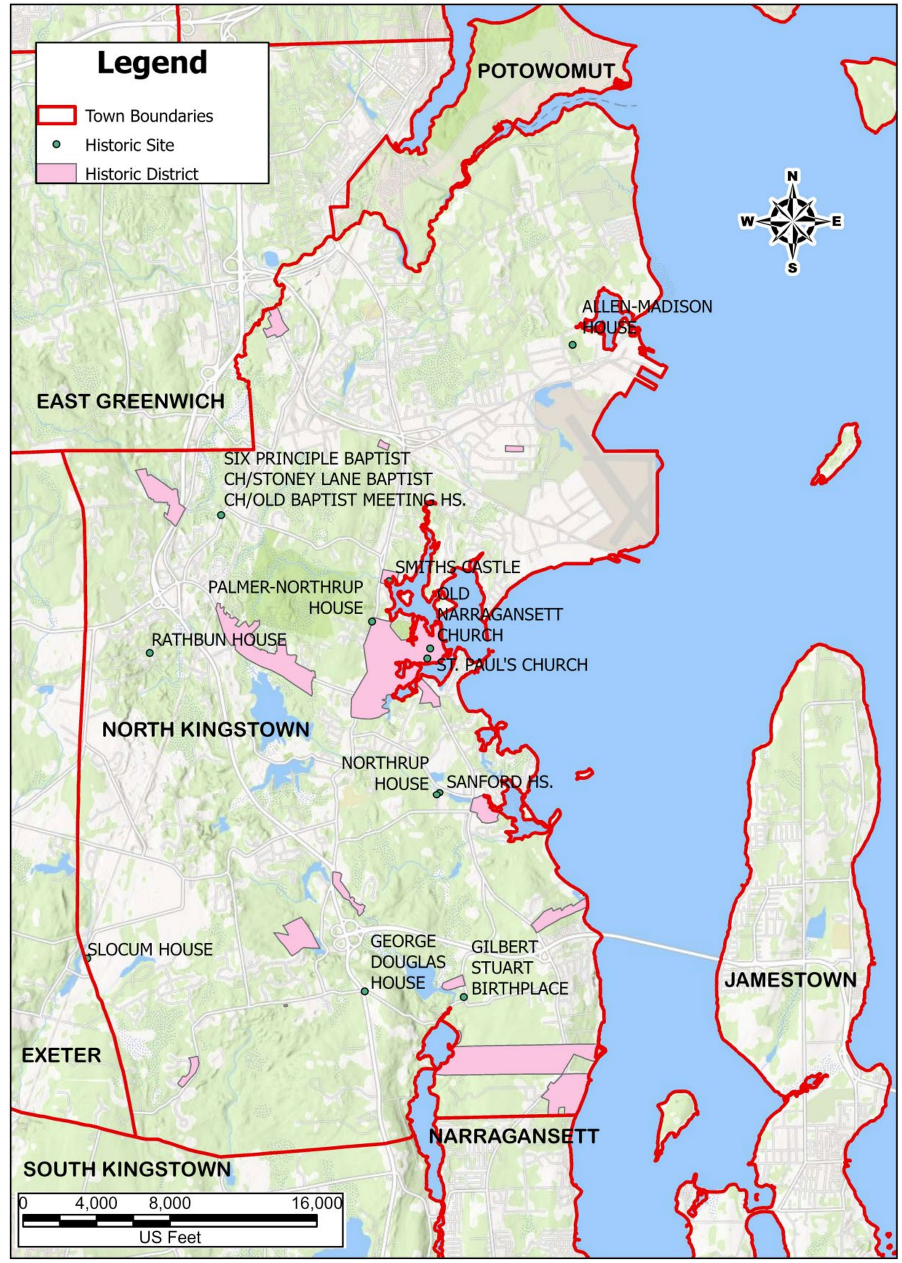
There are several inventoried sites from the National Register of Historic Places by the Rhode Island Historic Preservation & Heritage Commission, as shown in **Attachment 1 - Figure 16**.

There are a total of 24 different properties which include: St. Paul's Church, Old Narragansett Church, Smith's Castle/Cocumscossoc Site National Historic Landmark, Palmer-Northrup House, George Douglas House, Six Principle Baptist Church/Stony Lane Baptist Church, Esbon Sanford House, Stephen Northrup House, Allen-Madison House, Joseph Slocum House, Rathbun House, Gilbert Stuart Birthplace National Historic Landmark, Silas Casey Farm, Devil's Foot Cemetery Archaeological Site, (RI-694), Joseph Pierce Farm, YWCA site, Benoni Rose House, Ezekial Gardner House, Plum Beach Lighthouse, Poplar Point Lighthouse, David S. Baker Estate/Cedar Spring Farm, Old Narragansett cemetery, Spink Farm, and Lischio Site, RI-1000

There are 10 historic district areas in North Kingstown. These areas include: Davisville Historic District, Camp Endicott Historic District, Scrabbletown Historic and Archeological District, Lafayette Village Historic District, Wickford Historic District, Hamilton Mill Village Historic District, Shady Lea Historic District, Crowfield Historic District, Cedar Point Historic District, and Saunderstown Historic District.

Within the Wickford Historic District there are three (3) inventoried properties (**Attachment 1 - Figure 16**). Within the National Register Wickford Historic District, North Kingstown has the local historic district overseen by the Historic District Commission. Brown Street is not part of the local Historic District, but it is overseen by the Wickford Village Design Guidelines Committee.

Smith's Castle - Since 1678, North Kingstown RI
Credit: Photo by GZA GeoEnvironmental
"It was home to the Smith family, their heirs - the Updikes, and dozens of enslaved people for over a century-and-a-half. Smith's Castle is the oldest surviving plantation house in America and is recognized on the National Register of Historic Places." https://www.smithscastle.org/



Attachment 1 - Figure 16: Historic Resources

ATTACHMENT 2: NATURAL HAZARDS

NATURAL HAZARDS OVERVIEW

Natural hazards are **natural events** that threaten lives, property, and other assets. Within Rhode Island, natural hazards typically include:

- Severe Weather Hazards such as Hurricanes and Tropical Storms, Nor'easters, Lightning, Intense Rainfall, Hail, Heavy Snowfall, and Ice Storms.
- Climate-Related Hazards such as extreme heat and cold, drought, and wildfire.
- Geologic Hazards such as earthquakes, landslides, and tsunamis.

Severe weather hazards, including hurricanes, tropical storms and nor'easters can result in coastal flooding (storm surge and waves). These flood events will become worse in the future due to climate-related changes to sea level rise and storm intensity. Coastal flooding can result in the secondary hazard of shoreline change, particularly coastal erosion, which can undermine land areas eating away at property and destabilizing structures. Severe weather hazards can also result in high winds, lightning, hail, intense rainfall, and tornadoes.

Coastal Rhode Island is also vulnerable to tsunamis, a geologic hazard; however, the likelihood of a significant tsunami impacting coastal Rhode Island is considered very low.

Localized intense rainfall can result in urban flooding where existing stormwater management capacity is exceeded. It can also result in flash flooding of streams and rivers and exceedance of water reservoir dam capacity.

Hazard Probability

Natural hazards can often be predicted, including predicting their likelihood of occurrence. The probability of a specific natural hazard occurring is typically defined in terms of its annual exceedance probability (AEP). This refers to the probability that a hazard condition will be met or exceeded in any given year. In lieu of the AEP, the term recurrence interval (in years) is often used.

Climate Change

Climate change, a result of increased greenhouse gas emissions and secondary effects, will significantly impact certain natural hazards. There is high scientific consensus that coastal flooding in Rhode Island will become worse due to sea level rise. Storm intensity may also increase, resulting in increased flood elevations. There is high scientific consensus that climate change will result in increased rainfall intensity within Rhode Island as well as the frequency of extreme rainfall events. There is also scientific consensus that climate change will result in extended periods of extreme heat (heat waves) and cold.

NORTH KINGSTOWN NATURAL HAZARDS

GZA performed analyses and used the FEMA National Risk Index (NRI) to review multiple natural hazards and identified those hazards that are relevant to the town. These are presented in **Attachment 2 - Table 1**. These hazards are characterized in detail in the following pages.

Hazards are broken down by the (7) seven census tracts located within the town. They are referred to with a census number, but will also be referred to by the flowing community area names in this Plan (also reference **Attachment 2 - Figure 1**):

- Census tract 44009050102 - Davisville
- Census tract 44009050103 - Quonset
- Census tract 44009050104 - Quidnessett
- Census tract 44009050301 - Lafayette
- Census tract 44009050302 - Wickford
- Census tract 44009050401 - Slocum
- Census tract 44009050402 - Saunderstown

Attachment 2 - Figure 1: Census Tract Community Area Labels

Attachment 2 - Table 1: Natural Hazards applicable to North Kingstown

Severe Weather Hazards:	
Severe Wind:	
	Hurricanes/Tropical Storms
	Thunderstorms
	Tornadoes
Lightning	
Intense Rainfall	
Hail	
Flood:	
	Storm Surge
	Sea Level Rise
	Urban Drainage Flooding
	Shoreline Change
Severe Winter Weather:	
	Snowfall
	Ice Storms
Climate-Related Hazards:	
Extreme Temperature:	
	Extreme Heat
	Extreme Cold
Drought	
Wildfire	
Geologic Hazards:	
Earthquake	

SEVERE WEATHER HAZARDS: SEVERE WIND

SEVERE WIND

Severe wind (including high to extreme wind) will typically occur in the town as a result of: 1) tropical storms and hurricanes; 2) extratropical nor'easters; 3) severe thunderstorms; and 4) tornadoes. Severe thunderstorms and tornadoes are convective weather events. Extreme "straight line" convective wind events include microbursts, macrobursts, and derechos. Derechos are widespread, long-lived, and violent convectively induced "straight-line" windstorms associated with a fast-moving band of severe thunderstorms. "Thunderstorm winds", arising from convection are winds with speeds greater than 58 mph or winds of any speed producing, damage, injury, or fatality. Wickford harbor within North Kingstown experienced a derecho-based tsunami or a meteotsunami in June 2013 (source: NOAA Technical Report NOS CO-OPS 079).

Severe wind poses a threat to life, building structures, and essential facilities (e.g., electrical utilities) due to the effects of wind loads, flying debris, and/or downed trees and power lines. Severe wind will typically cause the greatest damage to lightly-constructed structures, in particular manufactured homes. Downed tree limbs can also cause property and vehicle damage, impact roadways, and in rare instances, cause loss of life. These storms may be accompanied by lightning, which can spark fires. During hurricanes and tropical storms, high winds can also occur coincident with intense rainfall and during nor'easters, high winds can occur coincident with snow (blizzards), rain and a snow/rain mix.

Wind speeds are categorized by the National Weather Service (NWS) based on potential for structure damage and public health risk, with a distinction between sustained (1-minute duration) wind speeds and gust (3 second duration) wind speeds:

- Wind Advisory: 1) sustained winds of 31 to 39 mph for an hour or more; and/or 2) wind gusts of 46 to 57 mph for any duration.
- High Wind Watch/Warning: 1) sustained winds of 40 mph for one hour or more; or 2) wind gusts of 58 mph or higher for any duration.
- Hurricane Warning: sustained winds of 74 mph or higher or frequent (for more than 2 hours) gusts of 74 mph or greater associated with a tropical cyclone.
- Extreme Wind: 1) surface winds of 115 mph or greater associated with a derecho or sustained hurricane winds.
- Severe Thunderstorm Watch/Warning: winds of 58 mph or higher and/or hail 1-inch in diameter or larger.

The Rhode Island State Building Code, Section 1609.3 provides a table (Table 1608.1) of wind gusts as a basis for structure design.

North Kingstown Design Wind Speeds for Buildings and Other Structures

The Rhode Island State Building Code wind speed design requirements for North Kingstown (in terms of 3-second gust) are:

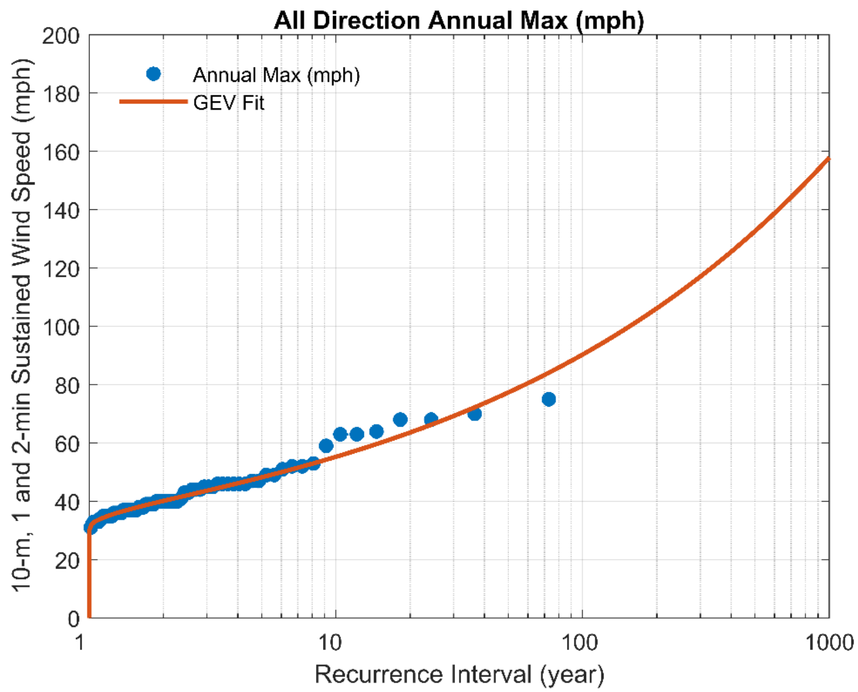
- Risk Category I: 119 mph - 300-year recurrence interval;
- Risk Category II: 129 mph - 700-year recurrence interval; and
- Risk Categories III-IV: 138/141 mph - 1,700-year recurrence interval.

The regulatory 3 second gust speeds applicable to North Kingstown are shown in **Attachment 2 - Table 2**.

Attachment 2 - Table 2: ASCE 7-16 Wind speed Mean Recurrence Intervals (3-second peak gust in mph)

Mean Recurrence Interval (years)	3-second Gust (mph)
10	76
25	87
50	101
100	106
300	118
700	129
1,700	137

GZA performed an extreme value statistical analysis of historical wind data (sustained 1 minute, 10-meter wind speeds) at the nearby T. F. Green International Airport in Warwick, RI. The results are presented in **Attachment 2 - Figure 2**.



Attachment 2 - Figure 2: Mean 1-minute sustained wind speed based on GZA Extreme Value Analysis of T. F. Green International Airport Wind Data

Historical Occurrence at North Kingstown and Vicinity

During 1996 through January 2024, Washington County and surrounding areas had 73 days with high winds with estimated 40 to 86 and resulting in 0 deaths, 1 injury, and $550,200 in property damage. (Source: NOAA Storm Events Database https://www.ncdc.noaa.gov/stormevents/)

Estimated Probability of Occurrence at and near North Kingstown

The results indicate the following High Winds probability at and near North Kingstown:

- High Winds: near 100% AEP or 1 year recurrence interval
- Hurricane wind speeds or greater: +/- 2.3% AEP or 43-year recurrence interval (about 1/43 in any given year). Note that the Hurricane of 1938 was not included in the airport data set, which would increase the chance of experiencing sustained Hurricane wind speeds or greater.
- Extreme Wind: less than 0.3% AEP or 300-year recurrence interval

FEMA National Risk Index - Strong Wind in North Kingstown

The National Risk Rating, Score, Annualized Frequency, and Expected Annual Loss (EAL) for Strong Wind in North Kingstown is presented in the Tables below.

- Census tract 44009050102 - Davisville
- Census tract 44009050103 - Quonset
- Census tract 44009050104 - Quidnessett
- Census tract 44009050301 - Lafayette
- Census tract 44009050302 - Wickford
- Census tract 44009050401 - Slocum
- Census tract 44009050402 - Saunderstown

Attachment 2 - Table 3: FEMA National Risk Index - Strong Wind in North Kingstown

Community - Area	Rating	Score
44009050102 - Davisville	Very Low	18.9
44009050103 - Quonset	Relatively Low	40.4
44009050104 - Quidnessett	Very Low	22.1
44009050301 - Lafayette	Relatively Low	26.9
44009050302 - Wickford	Very Low	20.8
44009050401 - Slocum	Very Low	24
44009050402 - Saunderstown	Very Low	18.1
Town-Wide:	**Very Low**	**Average: 24.5**

Attachment 2 - Table 4: FEMA National Risk Index Annualized Frequency - Strong Wind in North Kingstown (Period of Record: 1986-2021 (34 years))

Community - Area	Annualized Frequency
44009050102 - Davisville	1.3 events per year
44009050103 - Quonset	1.1 events per year
44009050104 - Quidnessett	1.1 events per year
44009050301 - Lafayette	1.3 events per year
44009050302 - Wickford	1 event per year
44009050401 - Slocum	1.2 events per year
44009050402 - Saunderstown	0.8 events per year
Town-Wide Average:	1.1 events per year

Attachment 2 - Table 5: FEMA National Risk Index Expected Annual Loss (EAL) - Strong Wind in North Kingstown

Rank	Community - Area	EAL Value	Score
1	44009050103 - Quonset	$4,436	37.0
2	44009050301 - Lafayette	$3,063	31.6
3	44009050401 - Slocum	$2,774	30.3
4	44009050104 - Quidnessett	$1,929	26.2
5	44009050102 - Davisville	$1,436	23.6
6	44009050302 - Wickford	$1,389	23.4
7	44009050402 - Saunderstown	$1,084	21.7
	Town-Wide:	**Total: $16,111**	**Average: 27.7**

Climate Change Effects and Severe Wind Occurrence

The attribution of high wind events to climate change is uncertain. There is moderate scientific consensus, that the intensity and frequency of intense hurricanes could increase within southern New England due primarily to the increase in sea water temperature along the East Coast. There is lower confidence, and less understanding, in the attribution of increased extratropical nor'easters and thunderstorms frequency and intensity to climate change.

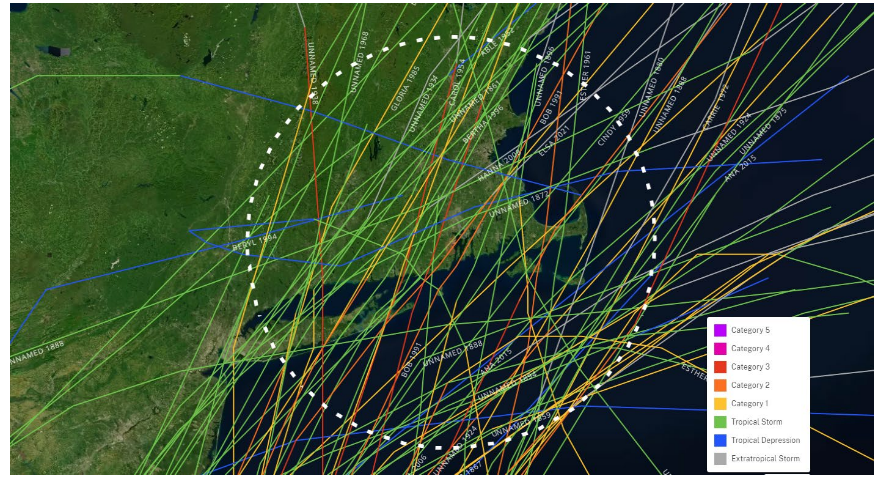
HURRICANES

Hurricanes, tropical storms and tropical depressions are tropical cyclones (rotating low pressure weather systems that have organized thunderstorms but no pressure fronts - a boundary separating two air masses of different densities). Tropical cyclones with maximum sustained surface winds of less than 39 miles per hour (mph) are called tropical depressions. Those with maximum sustained winds between 39 mph and 73 mph are tropical storms. Hurricanes are tropical cyclones with sustained wind speeds of 74 mph or higher.

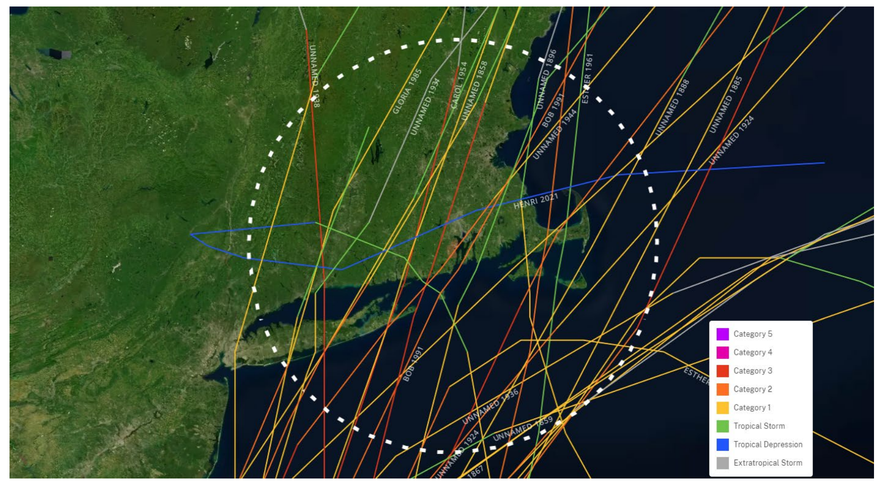
East Coast hurricanes originate in the Atlantic basin, which includes the Atlantic Ocean, Caribbean Sea, and Gulf of Mexico. A six-year rotating list of names, updated and maintained by the World Meteorological Organization, is used to identify these storms. "Hurricane Season" begins on June 1 and ends on November 30, although hurricanes can, and have, occurred outside of this time frame (NOAA National Ocean Service).

The Saffir-Simpson Hurricane Wind Scale is a 1 to 5 rating, or category, based on a hurricane's maximum sustained winds. The higher the category, the greater the hurricane's potential for property damage (NOAA National Ocean Service). A major hurricane (Categories 3, 4, and 5) has sustained wind speeds of 111 mph or higher on the Saffir-Simpson Hurricane Wind Scale.

Historic hurricane and tropical storm tracks which have passed within 100 nautical miles of North Kingstown are presented in Figure 2-2 (source https://coast.noaa.gov/hurricanes/). Historic hurricane tracks which have passed within 100 nautical miles of North Kingstown from 1851 to 2024 are presented in **Attachment 2 - Figure 4**. A distance of 100 nautical miles is a reasonable representation of hurricanes that have the potential to cause flooding within Narragansett Bay.



Attachment 2 - Figure 3: Hurricanes and Tropical Storms within 100 nautical miles of North Kingstown (Source: NOAA Historical Hurricane Tracks mapping tool https://oceanservice.noaa.gov/news/historical-hurricanes/)



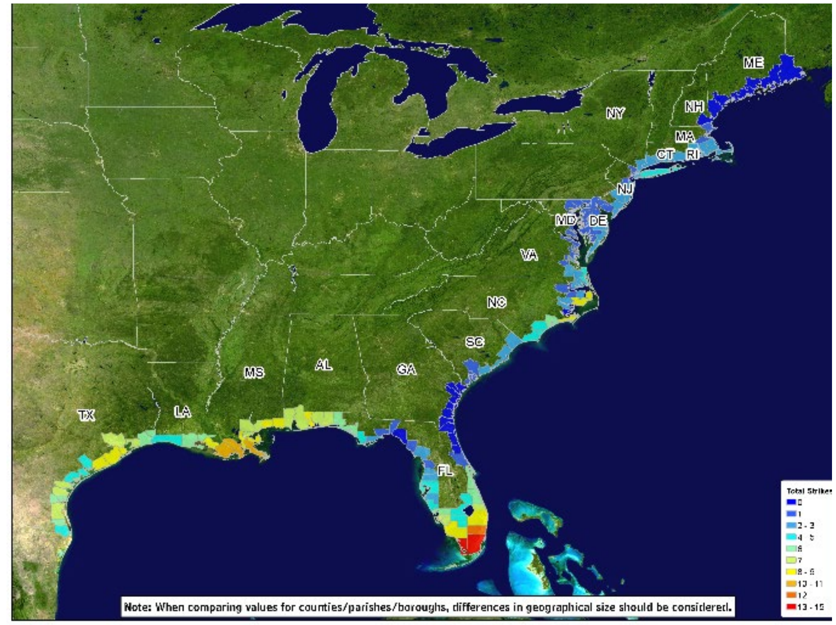
Attachment 2 - Figure 4: Hurricanes within 100 nautical miles of North Kingstown

30 hurricanes have tracked within 100 nautical miles during NOAA's period of record, including the following significant hurricane. The Hurricane of 1938 was a major hurricane (> Category 3) at landfall near New Haven, CT.

Attachment 2 - Table 6 summarizes the top ten water levels at the NOAA Newport, RI tide station relative to NAVD88. The highest observed water levels resulted from hurricanes, with the highest documented flood water level observed during the Hurricane of 1938. The top observed water levels at Newport have resulted from five hurricanes, one tropical storm – Nor'easter (The Perfect Storm) and four Nor'easters.

Attachment 2 - Table 6: Top ten water levels at the NOAA Newport, RI Tide Station (Established: Sep 11, 1930)

Name	Date	Water Elevation (ft, NAVD88)
Great Hurricane of 1938	9/21/1938	11.27
Hurricane Carol	8/31/1954	8.57
Hurricane Sandy	10/29/2012	6.13
Hurricane Bob	8/19/1991	5.79
Great Atlantic Hurricane	9/14/1944	5.77
Blizzard of 1978	1/9/1978	5.41
Nor'easter	12/23/2022	5.21
Nor'easter	1/13/2024	5.15
The Perfect Storm	10/31/1991	5.08
Nor'easter	11/30/1963	5.07



Total number of major hurricane strikes by counties/parishes/boroughs, 1900-2010

Attachment 2 - Figure 5: Hurricane Strikes (source - NOAA)

Attachment 2 - Table 7 - Hurricane tracks within 20 miles of North Kingstown

Name	Date	Category	Path (relative to North Kingstown)
1858	9/16/1858	H1	West
1869	9/08/1889	H3	West
1944	9/15/1944	H2	Through
Carol	8/31/1954	H3	West
Bob	8/19/1991	H2	East

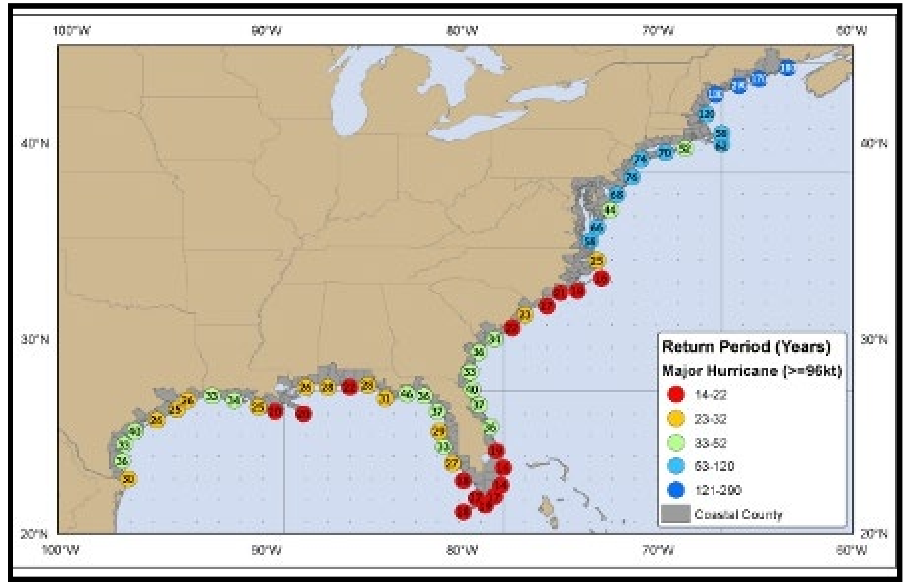
Historical Occurrence at North Kingstown and Vicinity

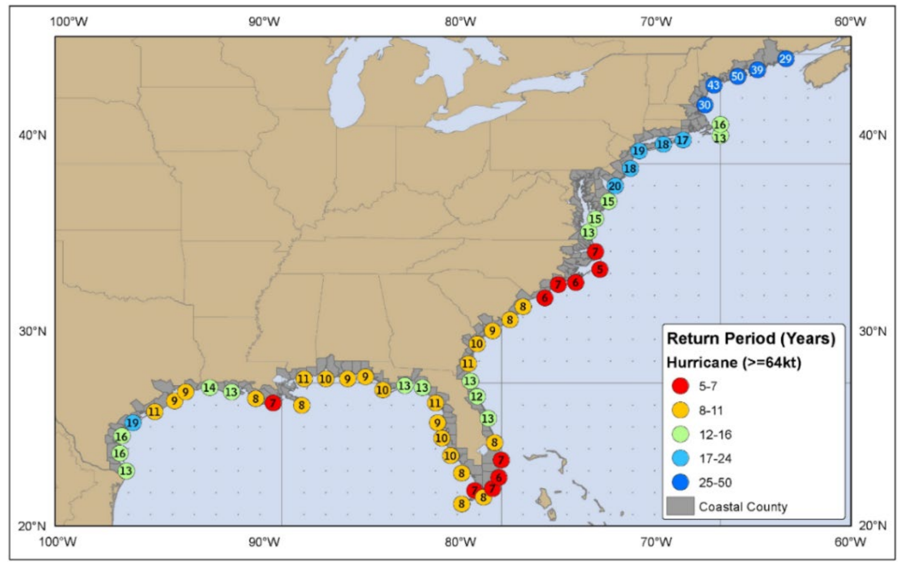
Hurricane recurrence intervals reflect the frequency at which hurricanes can be expected to occur within a given distance of a given location. The total number of hurricane strikes along the southern New England coastline between 1900 and 2010 is about 2 to 3 (**Attachment 2 - Figure 5**). **Attachment 2 - Figure 6 and Figure 7** show hurricane recurrence intervals (aka return periods) for hurricanes passing within 50 miles of various locations. In the vicinity of North Kingstown, the hurricane passing recurrence interval is about 17 years. In simpler terms, this means that a hurricane is likely to pass near North Kingstown, on average, about 6 times per 100 years. In the vicinity of North Kingstown, the recurrence interval for major hurricanes striking or passing near (Cat 3 and above) is about 52 years. **Attachment 2 - Figure 8** shows the zones of origin and tracks for different months during the hurricane season. These figures depict average conditions. Hurricanes can originate in different locations and travel much different paths from the average. Regardless, they provide a good sense of the general pattern of hurricane tracks. The likelihood of a hurricane tracking near North Kingstown is much greater during the months of August through October.

Estimated Probability of Occurrence at and near North Kingstown

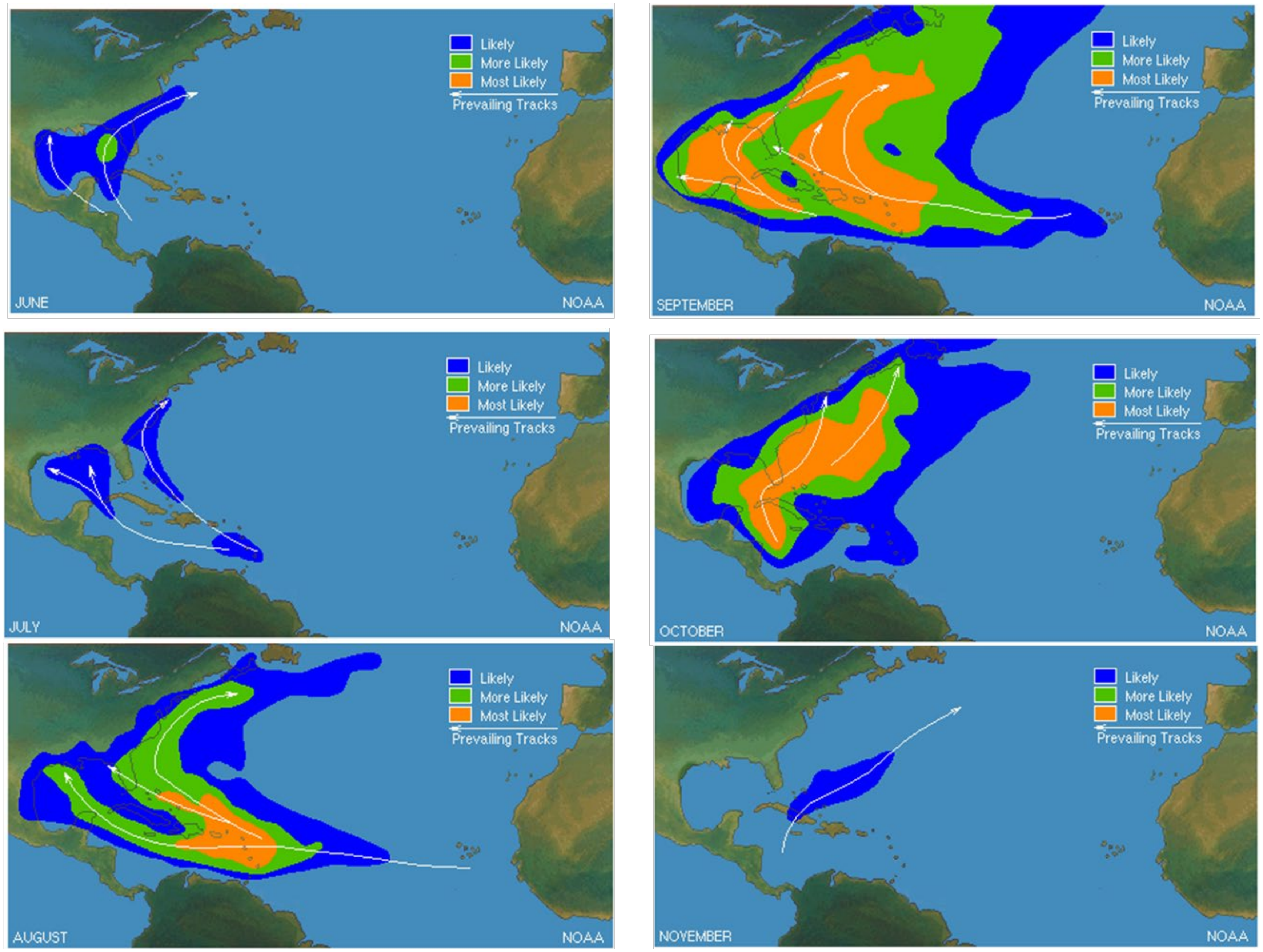
The results indicate the following hurricane strike probability at and near North Kingstown:

- All Hurricanes: 6% AEP or 17-year recurrence interval
- Major (> Cat 3) Hurricanes: 2% AEP or 52-year recurrence period





Attachment 2 - Figure 6 and Attachment 2 - Figure 7: Hurricane Recurrence Interval (all hurricanes - top and major hurricanes - bottom) (Source: https://www.nhc.noaa.gov/climo/#bac)



Attachment 2 - Figure 8: Hurricane Origin and Track Probability by Month

THUNDERSTORMS

A thunderstorm is characterized by lightning and thunder and usually produces gusty winds, heavy rain, and sometimes hail. Cumulonimbus clouds produce lightning, which locally heats the air to 50,000 degrees Celsius, which in turn produces an audible shock wave, known as thunder. Tornadoes can also be generated during these events. Three basic ingredients are required for a thunderstorm to form: moisture, rising unstable air (air that keeps rising when given a nudge), and a lifting mechanism. Every thunderstorm has an updraft (rising air) and a downdraft (sinking air). Sometimes strong downdrafts known as downbursts can cause tremendous wind damage, similar to that of a tornado. A small (< 2.5-mile path) downburst is known as a "microburst" and a larger downburst is called a "macroburst."

The peak season for severe thunderstorms in the Northeast U.S. is June through August, although thunderstorms also occur in the Spring and Fall, and thunder can occur during winter snowstorms. Hazards from thunderstorms include high to extreme winds, lightning, torrential downpours, and hail. Thunderstorms can spawn tornadoes and cause flash floods, downed trees and power lines, power outages, and mudslides. Roads may become impassable due to flooding, downed trees, or a landslide. Power lines may be downed due to high winds, and services such as water or phone may not be able to operate without power. Lightning can cause severe damage and injury. Fatalities are uncommon but can occur.

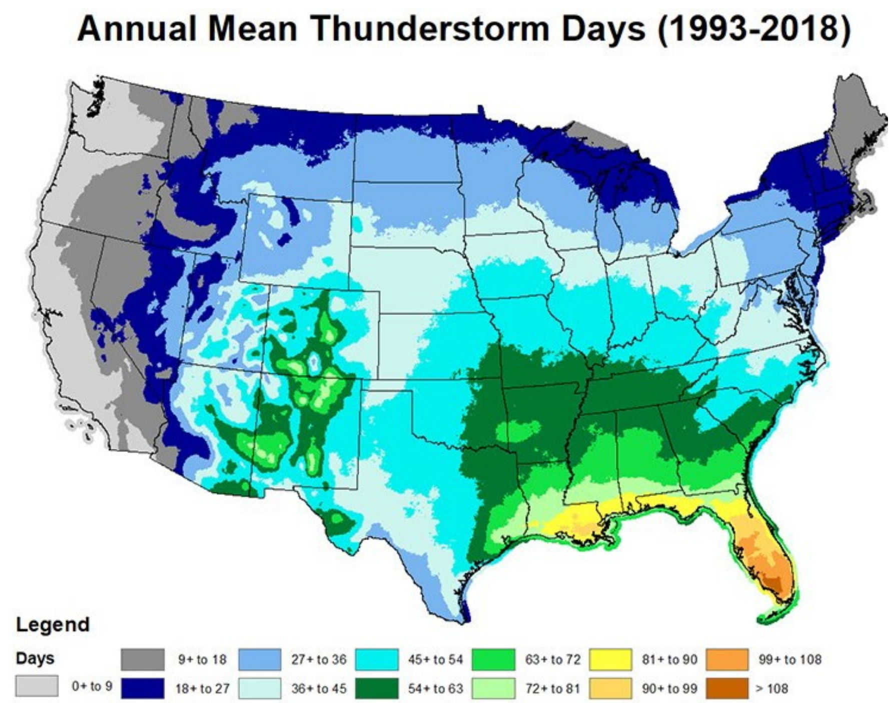
Attachment 2 - Figure 9 shows the average number of thunderstorm days throughout the U.S. including that Rhode Island experiences around 20 thunderstorm days each year.

An average thunderstorm is 15 miles across and lasts 30 minutes; severe thunderstorms can be much larger and longer. According to the National Weather Service:

- a severe thunderstorm is a thunderstorm that produces a tornado, winds of at least 58 mph (50 knots or ~93 km/h), and/or hail at least 1" in diameter; and
- An approaching severe thunderstorm is a thunderstorm with winds equal to or greater than 40 mph (35 knots or ~64 km/h) and/or hail of at least ½"

Observed structural wind damage may imply the occurrence of a severe thunderstorm. Hail of 1" or greater can damage property such as plants, roofs, and vehicles. http://www.weather.gov/bgm/severedefinitions

Derechos: Based on climatology, Rhode Island is located in a zone where derechos are predicted to occur about 1 every four years (typically during April to August).



Attachment 2 - Figure 9: Annual Mean Thunderstorm days in Contiguous U.S. (1993-2018) (Source: https://www.noaa.gov/jetstream/thunderstorms)

Historical Occurrence at North Kingstown and Vicinity

Between 1950 and 2024, Washington County had 51 events with Thunderstorm (convective) winds with 22 of these events resulting in damage, reference: NOAA Storm Events Database. These events caused $922,250 in damage. For this database, thunderstorm winds are defined as speeds of at least 58mph or of any speed producing a fatality, injury, or damage.

Estimated Probability of Occurrence at and near North Kingstown

The results indicate the following thunderstorm wind probability at and near North Kingstown (within Washington County):

- Thunderstorm Winds within Washington County: 69% AEP or minimum of 1- to 2- year recurrence interval (51 events over 74 years)

TORNADOES

A tornado is a violently rotating column of air that has contact with the ground and is often visible as a funnel cloud. The destruction caused by tornadoes ranges from light to catastrophic depending on the intensity, size, and duration of the storm. Typically, tornadoes cause the greatest damage to structures of light construction, including residential dwellings and particularly manufactured homes. Tornadoes are more likely to occur during the months of March through May and tend to form in the late afternoon and early evening.

Since 2007, tornadoes have been categorized according to the Enhanced Fujita scale:

Attachment 2 - Table 8: Enhance Fujita Scale for Tornadoes

Scale	Wind speed estimate mph	km/h	Potential damage
EF0	65–85	105–137	Minor damage. Peels surface off some roofs; some damage to gutters or siding; branches broken off trees; shallow-rooted trees pushed over. Confirmed tornadoes with no reported damage (i.e., those that remain in open fields) are always rated EF0.
EF1	86–110	138–177	Moderate damage. Roofs severely stripped; mobile homes overturned or badly damaged; loss of exterior doors; windows and other glass broken.
EF2	111–135	178–217	Considerable damage. Roofs torn off well-constructed houses; foundations of frame homes shifted; mobile homes completely destroyed; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground.
EF3	136–165	218–266	Severe damage. Entire stories of well-constructed houses destroyed; severe damage to large buildings such as shopping malls; trains overturned; trees debarked; heavy cars lifted off the ground and thrown; structures with weak foundations are badly damaged.
EF4	166–200	267–322	Devastating damage. Well-constructed and whole frame houses completely leveled; cars and other large objects thrown and small missiles generated.
EF5	>200	>322	Incredible damage. Strong-framed, well-built houses leveled off foundations are swept away; steel-reinforced concrete structures are critically damaged; tall buildings collapse or have severe structural deformations; some cars, trucks, and train cars can be thrown approximately 1 mile (1.6 km).

Prior to 2007, tornadoes were categorized according to the Fujita Tornado Intensity Scale:

Attachment 2 - Table 9: Original Fujita Tornado Intensity Scale

Scale	Wind Speed Estimate (mph)	Potential Damage
Category F0:	Gale tornado (40-72 mph)	Light damage. Some damage to chimneys; break branches off trees; push over shallow-rooted trees; damage to sign boards.
Category F1	Moderate tornado (73-112 mph)	Moderate damage. The lower limit is the beginning of hurricane wind speed; peel surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off the roads.
Category F2	Significant tornado (113-157 mph)	Considerable damage. roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light-object missiles generated.
Category F3	Severe tornado (158-206 mph)	Severe damage. Roofs and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted; heavy cars lifted off ground and thrown.
Category F4	Devastating tornado (207-260 mph)	Devastating damage. Well-constructed houses leveled; structure with weak foundation blown off some distance; cars thrown and large missiles generated.
Category F5	Incredible tornado (261-318 mph)	Incredible damage. Strong frame houses lifted off foundations and carried considerable distance to disintegrate; automobile sized missiles fly through the air in excess of 100 yards; trees debarked; incredible phenomena will occur.

Tornadoes can also occur anywhere in Rhode Island, although relatively infrequently. Between 1950 and 2024, there were 19 tornado events within Rhode Island including 11 days with damage, 3 days with injury or death and, resulting in $4.995M in damages. The data for this period for the State is presented below:

Attachment 2 - Table 10: Rhode Island Tornado Data for the period of 1950 to 2024

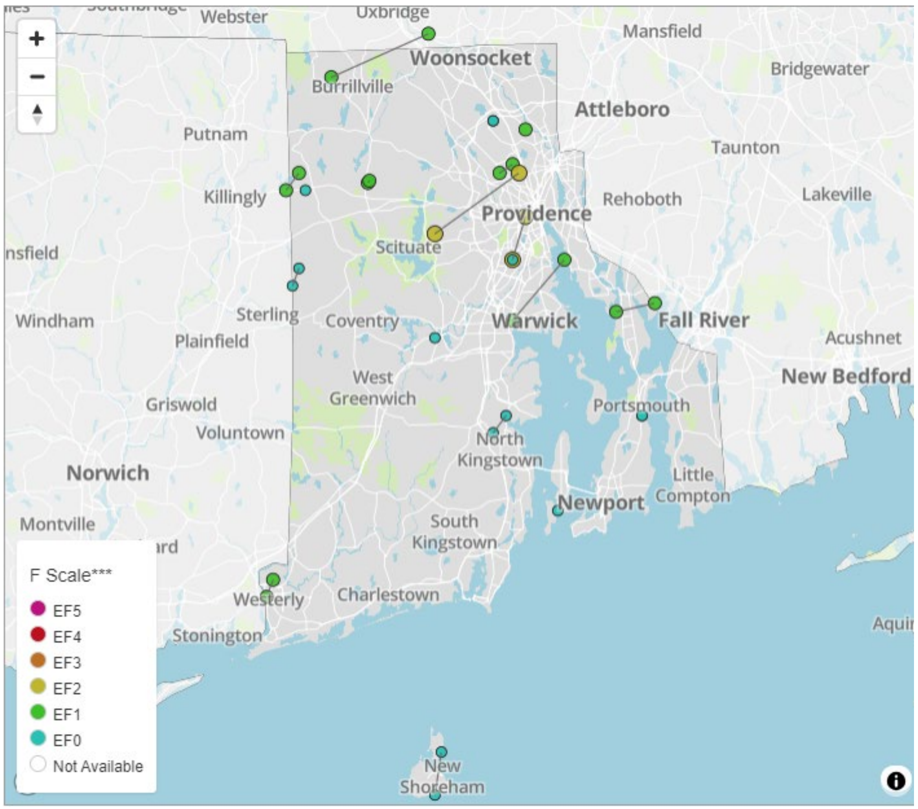
Magnitude	No of Days with Event	No. of Injuries	No. of Deaths	Property Damage
F0/EF0	9	3	0	$380,000
F1/EF1	8	0	0	$1,865,000
F2/EF2	2	21	0	$2,750,000
F3/EF3	0	0	0	0
F4/E4	0	0	0	0

Magnitude	Avg. No of Events/year	Avg. No. of Injuries/Event	Avg. No. of Deaths/Event	Avg. Property Damage/Event
All	0.26	1.2	0	$262,895
F0/EF0	0.12	0.33	0	$42,222
F1/EF1	0.11	0	0	$233,125
F2/EF2	0.03	10.5	0	$1,375,000
F3/EF3	0	0	0	0
F4/E4	0	0	0	0

Details for Washington County are presented in **Attachment 2 - Table 11.** The tornadoes were generally weak. A total of 2 days with tornadoes were reported in Washington County for the period of record between 1950 and 2024, according to the NOAA Storm Events Database. These tornadoes ranged in severity from EF0 to EF1. All (3) three of the tornadoes on record occurred between 2012 and 2021, in the months of August and November.

Attachment 2 - Table 11: Washington County, Rhode Island Tornado Data for the period of 1950 to 2021

Date	Location	Fujita	Fatalities	Injuries	Length(miles)
08/10/2012	Block Island, Washington County, RI	EF0	0	0	3.8
11/13/2021	Westerly, Washington County, RI	EF1	0	0	1.1
11/13/2021	North Kingstown, Washington County, RI	EF0	0	0	1.5



Attachment 2 - Figure 10: Location of Rhode Island Tornadoes

(Source: https://data.burlingtonfreepress.com/tornado-archive/rhode-island/)

SEVERE WEATHER HAZARDS: LIGHTNING

LIGHTNING

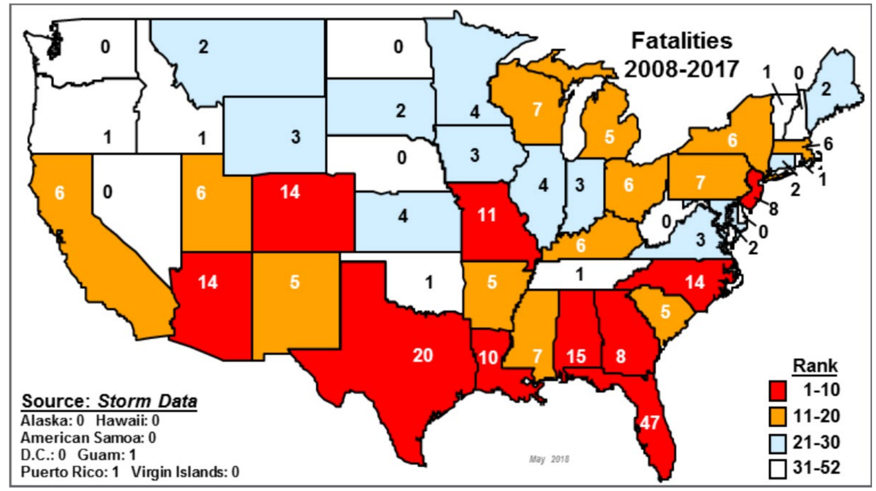
Lightning is the second most common storm-related killer in the United States. It causes several billion dollars in property damage each year and kills several dozen people. It is a frequent cause of wildfires and costs airlines billions of dollars per year in extra operating expenses.

Lightning is a giant spark of electricity in the atmosphere between clouds, the air, or the ground. In the early stages of development, air acts as an insulator between the positive and negative charges in the cloud and between the cloud and the ground. When the opposite charges build up enough, this insulating capacity of the air brakes down and there is a rapid discharge of electricity that we know as lightning. The flash of lightning temporarily equalizes the charged regions in the atmosphere until the opposite charges build up again. Lightning can occur between opposite charges within the thunderstorm cloud (intra-cloud lightning) or between opposite charges in the cloud and on the ground (cloud-to-ground lightning). Lightning can travel more than 10 miles from a thunderstorm. Thunder sound doesn't typically travel that far, so if you can hear thunder, you are close enough to a storm to be struck by lightning.

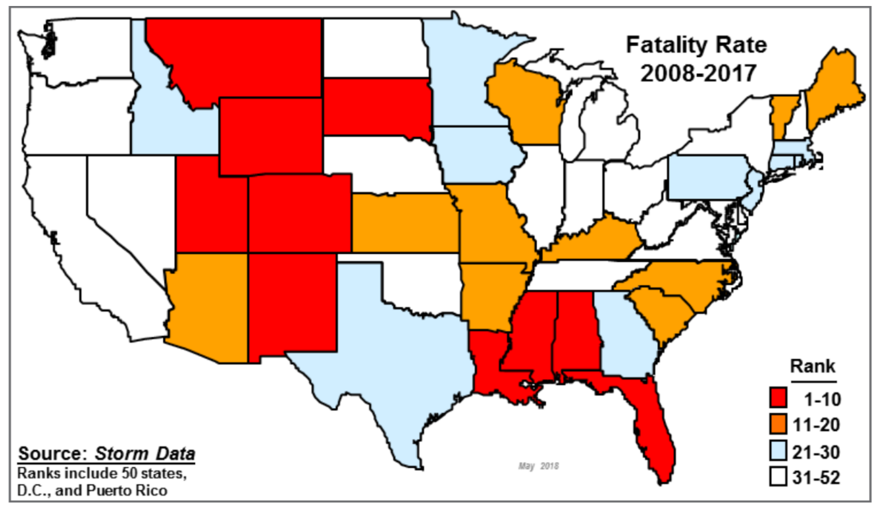
Rhode Island, including Washington County, has a relatively moderate risk associated with Lightning strikes relative to other states and counties. **Attachment 2 - Figure 11** and **Attachment 2 - Figure 12** show the number of fatalities and relative fatality rates by state. In Rhode Island, there has been 1 Lightning fatality during the period of 2008 and 2017 (an average of around 0.1 per year).

Historical Occurrence at North Kingstown and Vicinity

Washington County has a relatively moderate risk to lightning strikes and experienced 158 events from 1991-2012 (22 years). This is represented by an annualized frequency of 11.6 events per year (Reference, FEMA National Risk Index). Since 2001, 8 Lightning events have resulted in about $52,000 in property damage, 0 injuries and 1 death. Reference, NOAA Storm Events Database.



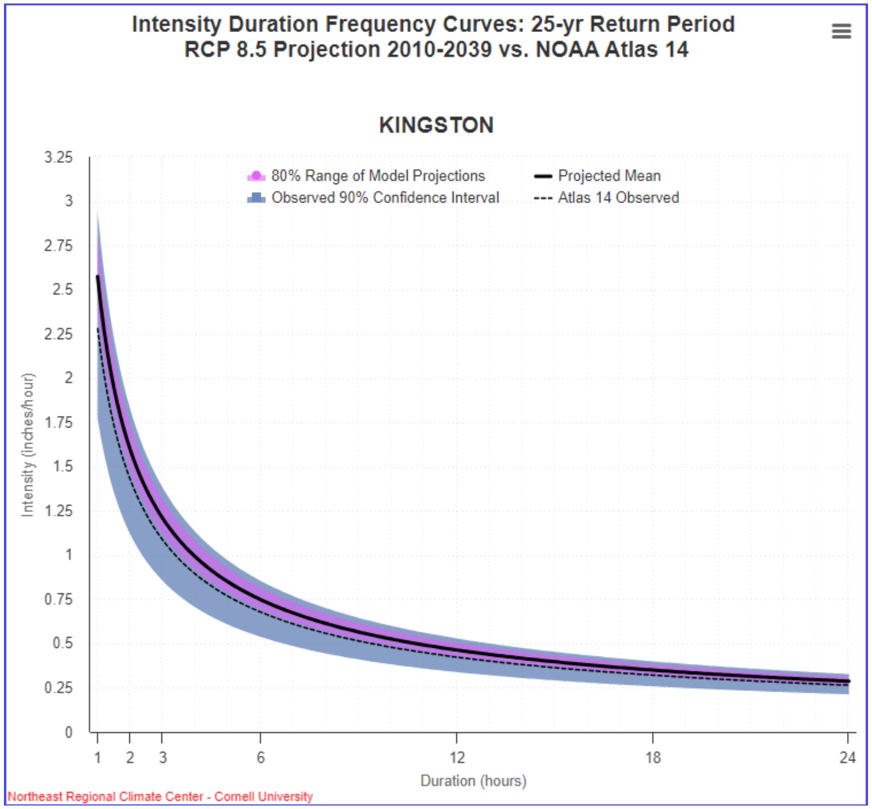
Attachment 2 - Figure 11: Lightning Fatalities by State, 2008-2017 (Source: Vaisala)



Attachment 2 - Figure 12: Lightning Fatality Rate by State, 2008-2017 (Source: Vaisala)

INTENSE RAINFALL

Intense, heavy rainfall can result in localized flooding including flash flood events. Several factors contribute to intense precipitation flooding including rainfall intensity and duration. Other factors include the presence of streams and rivers, soil type, ground cover, drainage, and the capacity of stormwater infrastructure. **Attachment 2 - Table 12** presents precipitation projections for North Kingstown developed by NOAA Atlas 14 Precipitation Frequency Data Server.



Attachment 2 - Figure 13: Rhode Island Rainfall Intensity-Duration for the 25-year Recurrence Interval Rainfall

(Source: https://ny-idf-projections.nrcc.cornell.edu/)

While there is no specific, single set of criteria that defines "intense rainfall", the rainfall intensities associated with a 25-year recurrence interval are a reasonable benchmark (a 1 in 4 chance of being met or exceeded in any given year). These are presented for Rhode Island including Washington County in **Attachment 2 - Figure 13**. This figure indicates short duration intensities on the order of 1.5 to 3 inches per hour and longer duration intensities on the order of an average 0.25 inch per hour over 24 hours (one-day total rainfall amounts of about 6 inches).

Historical Occurrence at North Kingstown and Vicinity

During the period between 1996 and 2023, Washington County experienced 22 days with Heavy Rain events, with no documented property damages, injuries, or death. Ref. NOAA Storm Events Database.

Estimated Probability of Occurrence at and near North Kingstown

The results indicate the following intense rainfall probability at or near North Kingstown (within Washington County):

- Intense Rainfall within Washington County: 21% AEP or about 5-year recurrence interval (6 years with 1 or more events over 28 years)

PDS-based precipitation frequency estimates with 90% confidence intervals (in inches)[1]										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.317** (0.258-0.390)	**0.388** (0.315-0.478)	**0.504** (0.408-0.623)	**0.600** (0.482-0.746)	**0.732** (0.566-0.954)	**0.831** (0.628-1.11)	**0.936** (0.683-1.30)	**1.06** (0.721-1.49)	**1.24** (0.807-1.81)	**1.39** (0.880-2.07)
10-min	**0.449** (0.365-0.553)	**0.549** (0.447-0.677)	**0.713** (0.577-0.882)	**0.849** (0.682-1.06)	**1.04** (0.802-1.35)	**1.18** (0.888-1.57)	**1.33** (0.968-1.84)	**1.50** (1.02-2.11)	**1.76** (1.14-2.56)	**1.97** (1.25-2.93)
15-min	**0.528** (0.430-0.651)	**0.646** (0.525-0.797)	**0.839** (0.680-1.04)	**0.999** (0.804-1.24)	**1.22** (0.944-1.59)	**1.38** (1.05-1.84)	**1.56** (1.14-2.16)	**1.76** (1.20-2.48)	**2.07** (1.34-3.01)	**2.32** (1.47-3.44)
30-min	**0.736** (0.599-0.906)	**0.902** (0.733-1.11)	**1.17** (0.950-1.45)	**1.40** (1.12-1.74)	**1.71** (1.32-2.23)	**1.94** (1.47-2.59)	**2.19** (1.60-3.03)	**2.48** (1.69-3.48)	**2.90** (1.89-4.22)	**3.25** (2.06-4.83)
60-min	**0.943** (0.768-1.16)	**1.16** (0.941-1.43)	**1.51** (1.22-1.86)	**1.80** (1.45-2.24)	**2.20** (1.70-2.87)	**2.50** (1.88-3.33)	**2.82** (2.05-3.90)	**3.19** (2.17-4.49)	**3.73** (2.43-5.44)	**4.19** (2.65-6.22)
2-hr	**1.23** (1.01-1.50)	**1.52** (1.24-1.86)	**1.99** (1.63-2.45)	**2.39** (1.93-2.95)	**2.93** (2.28-3.78)	**3.33** (2.54-4.40)	**3.76** (2.77-5.16)	**4.26** (2.93-5.94)	**5.00** (3.28-7.20)	**5.61** (3.59-8.24)
3-hr	**1.43** (1.18-1.75)	**1.77** (1.45-2.16)	**2.32** (1.90-2.84)	**2.77** (2.25-3.41)	**3.40** (2.66-4.37)	**3.87** (2.96-5.08)	**4.37** (3.23-5.96)	**4.95** (3.42-6.84)	**5.80** (3.83-8.29)	**6.51** (4.18-9.48)
6-hr	**1.86** (1.54-2.26)	**2.27** (1.88-2.75)	**2.94** (2.42-3.57)	**3.49** (2.86-4.27)	**4.25** (3.35-5.42)	**4.82** (3.71-6.28)	**5.43** (4.04-7.32)	**6.13** (4.28-8.39)	**7.17** (4.78-10.1)	**8.04** (5.22-11.6)
12-hr	**2.38** (1.98-2.86)	**2.85** (2.37-3.43)	**3.62** (3.00-4.37)	**4.25** (3.50-5.16)	**5.13** (4.08-6.48)	**5.78** (4.49-7.46)	**6.48** (4.87-8.65)	**7.29** (5.13-9.87)	**8.49** (5.72-11.9)	**9.50** (6.23-13.5)
24-hr	**2.85** (2.39-3.41)	**3.40** (2.84-4.06)	**4.28** (3.58-5.14)	**5.02** (4.16-6.05)	**6.03** (4.83-7.56)	**6.79** (5.31-8.67)	**7.60** (5.75-10.0)	**8.53** (6.06-11.4)	**9.91** (6.74-13.7)	**11.1** (7.32-15.5)
2-day	**3.21** (2.72-3.81)	**3.85** (3.25-4.57)	**4.90** (4.12-5.83)	**5.76** (4.81-6.89)	**6.96** (5.60-8.63)	**7.85** (6.18-9.92)	**8.79** (6.70-11.5)	**9.88** (7.08-13.1)	**11.4** (7.86-15.6)	**12.8** (8.53-17.6)
3-day	**3.50** (2.97-4.13)	**4.18** (3.54-4.94)	**5.29** (4.46-6.27)	**6.21** (5.21-7.39)	**7.48** (6.05-9.23)	**8.43** (6.67-10.6)	**9.43** (7.22-12.2)	**10.6** (7.62-13.9)	**12.2** (8.43-16.5)	**13.6** (9.12-18.6)
4-day	**3.76** (3.20-4.43)	**4.46** (3.79-5.26)	**5.61** (4.75-6.63)	**6.56** (5.52-7.79)	**7.87** (6.39-9.68)	**8.86** (7.03-11.1)	**9.90** (7.59-12.7)	**11.1** (8.00-14.4)	**12.7** (8.82-17.1)	**14.1** (9.51-19.2)
7-day	**4.48** (3.83-5.24)	**5.22** (4.46-6.12)	**6.44** (5.48-7.57)	**7.45** (6.30-8.80)	**8.84** (7.22-10.8)	**9.90** (7.89-12.2)	**11.0** (8.47-14.0)	**12.2** (8.89-15.8)	**13.9** (9.70-18.4)	**15.2** (10.4-20.6)
10-day	**5.17** (4.44-6.03)	**5.94** (5.09-6.94)	**7.20** (6.15-8.43)	**8.25** (7.00-9.70)	**9.69** (7.93-11.7)	**10.8** (8.62-13.2)	**11.9** (9.19-15.0)	**13.1** (9.61-16.8)	**14.8** (10.4-19.5)	**16.1** (11.0-21.5)
20-day	**7.27** (6.28-8.43)	**8.09** (6.99-9.39)	**9.44** (8.12-11.0)	**10.6** (9.02-12.3)	**12.1** (9.95-14.4)	**13.3** (10.7-16.1)	**14.4** (11.2-17.8)	**15.6** (11.6-19.8)	**17.1** (12.1-22.2)	**18.1** (12.5-24.0)
30-day	**9.00** (7.81-10.4)	**9.87** (8.56-11.4)	**11.3** (9.75-13.1)	**12.5** (10.7-14.5)	**14.1** (11.7-16.7)	**15.4** (12.4-18.4)	**16.6** (12.8-20.2)	**17.7** (13.2-22.3)	**19.0** (13.6-24.6)	**19.9** (13.9-26.1)
45-day	**11.1** (9.70-12.8)	**12.1** (10.5-13.9)	**13.6** (11.8-15.7)	**14.9** (12.8-17.2)	**16.7** (13.8-19.6)	**18.1** (14.6-21.5)	**19.4** (15.0-23.4)	**20.4** (15.4-25.6)	**21.7** (15.6-27.8)	**22.4** (15.7-29.2)
60-day	**12.9** (11.3-14.8)	**13.9** (12.1-16.0)	**15.6** (13.5-17.9)	**17.0** (14.7-19.6)	**18.9** (15.7-22.1)	**20.4** (16.5-24.2)	**21.8** (16.9-26.1)	**22.9** (17.3-28.5)	**24.1** (17.5-30.7)	**24.8** (17.6-32.0)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

Attachment 2 - Table 12 Predicted Rainfall Intensity by Duration and Recurrence Interval for North Kingstown

SEVERE WEATHER HAZARDS: HAIL

HAIL

Hailstorms are a potentially damaging outgrowth of severe thunderstorms. Hailstorms frequently accompany thunderstorms, so their locations and spatial extents overlap. Large hail (greater than 1 inch in diameter) can be destructive. Hail can cause substantial damage to vehicles, roofs, landscaping, and other areas of the built environment. U.S. agriculture is typically the resource most affected by hailstorms, which cause severe crop damage even during minor events. A recent risk, due to the widespread use of solar panels, is hail-related damage to solar panels.

Per HomeAdvisor.com, the average per building cost, nationally, to repair hail, wind or storm damage is $11,643 ranging from $225 to $58,000.

Hailstorms are fairly uncommon in Rhode Island, including North Kingstown, and have a very low risk.

The Hail Risk Score (**Attachment 2 - Table 13**) provides a short-to-medium term view of future hail risk based on the last 10 years of ultra-high resolution radar data. The score is based on a scale of 1 to 10, with the lowest score of 1 representing Very Low hail risk (damaging hail unlikely in the next 5-10 years) and the highest score of 10 representing Extreme hail risk (damaging hail very likely every year).

The Hail Risk Score for North Kingstown (reference stormersite.com) is 0.

Attachment 2 - Table 13: Hail Risk Score Classifications

Hail Risk Score	Hail Risk	Hail Risk Guidance
1	Very low	Damaging Hail unlikely in next 5-10 years
2	Very Low to Low	Damaging Hail likely every 5 years
3	Low	Damaging Hail likely every 2-4 years
4	Low to Moderate	Damaging Hail likely every 2-3 years
5	Moderate	Damaging Hail likely every other year
6	Moderate	Damaging Hail very likely every other year
7	Moderate to High	Damaging Hail likely every 1-2 years
8	High	Damaging Hail very likely every 1-2 years
9	Very High	Damaging Hail likely every year
10	Extreme	Damaging Hail very likely every year

Historical Occurrence at North Kingstown and Vicinity

For the period of 1986-2021 (34 years), hail data in Washington County indicates 36 events (an average of 1.1 events per year).

Estimated Probability of Occurrence at and near North Kingstown

The results indicate hail probability at and near North Kingstown (within Washington County) has an annualized frequency of 1.7 events per year or a 170% AEP and about 0.6-year recurrence interval.

SEVERE WEATHER HAZARDS: FLOOD

FLOODING

"Floods are among the most frequent and costly natural disasters in terms of human hardship and economic loss. Seventy five percent of federal disaster declarations are related to flooding." (www.riema.ri.gov)

A flood is the partial or complete inundation of normally dry land. The various types of flooding include riverine flooding, coastal flooding, and shallow flooding. Common impacts of flooding include damage to personal property; buildings and infrastructure; bridge and road closures; service disruptions; and injuries or even fatalities.

A flood, which can be slow or fast rising but generally develops over a period of days, is defined by the NFIP as:

- A general and temporary condition of partial or complete inundation of two or more acres of normally dry land area or of two or more properties from: overflow of inland or tidal waters; unusual and rapid accumulation or runoff of surface waters from any source; or a mudflow; or
- The collapse or subsidence of land along the shore of a lake or similar body of water as a result of erosion or undermining caused by waves or currents of water exceeding anticipated cyclical levels that result in a flood as defined above. By their very nature, floodplains are the low, flat, periodically flooded lands adjacent to rivers, lakes, and oceans and subject to geo-morphic (land-shaping) and hydrologic (water flow) processes. It is only during and after major flood events that the connections between a river and its floodplain become more apparent. These areas form a complex physical and biological system that not only supports a variety of natural resources but also provides natural flood and erosion control. In addition, the floodplain represents a natural filtering system, with water percolating back into the ground and replenishing groundwater. When a river is divorced from its floodplain with levees and other flood control structures then natural benefits are either lost, altered, or significantly reduced.

The town is vulnerable to all (4) four categories discussed in the State Hazard Mitigation Plan, 2024: Coastal, Flash, Riverine, and Urban Flooding.

- **Coastal Flooding.** North Kingstown's eastern border is Narragansett Bay, which is directly exposed to wind, waves, and storm surge from large storm events.
- **Flash Flooding.** Inland (poor drainage) flooding associated with large rainfall events occurs within areas with impervious surfaces, poor drainage, and inadequate stormwater management.
- **Riverine flooding**. There are many brooks, streams, and rivers within North Kingstown. Annaquatucket River, Chipuxet River, Mattatuxet River, Quidnessett Brook, Sand Hill Brook/ Sawmill Brook, and the Pawcatuck River and Tributaries all have a FEMA-mapped floodplain.
- **Urban Flooding**. FEMA defines urban flooding as "The inundation of property in a built environment, particularly in more densely populated areas, caused by rain falling on increased amounts of impervious surfaces and overwhelming the capacity of drainage systems."

Probability of Future Events

NOAA has determined that there are three (3) times of the year where the potential of flood activity is the greatest:

- Late winter/spring melt;
- Late summer/early fall; and
- Early winter.

Flooding in general is often a result of the occurrence of other natural hazards such as hurricanes and tropical storm systems, winter and coastal storms, ice jams, dam failures, and severe precipitation events (RIHMP 2019). For riverine flooding, severe precipitation events, ice jams and dam failures will certainly cause or certainly exacerbate the flooding event. Rhode Island has historically experienced all these other natural hazards at one time or another and can expect to experience them in the future.

Coastal Flooding

Coastal flooding includes flooding caused by rising waters in the surrounding floodplain or other low-lying areas. Flooding is often caused by storm surge resulting from, nor'easters, tropical storms, and hurricanes.

In North Kingstown, coastal flooding occurs in lowest lying areas, which includes homes and businesses along Shore Acres and Quonset Point. Flooding also occurs along Plum Beach and in nearshore buildings along Plum Point. Coastal flooding near Wickford Harbor, Wickford Cove, and Duck Cove includes the inundation of low-lying buildings and streets.

FEMA Flood Hazard Determination

Through FEMA's flood hazard mapping program, Risk Mapping, Assessment and Planning (MAP), FEMA identifies flood hazards, assesses flood risks and partners with states and communities to provide accurate flood hazard and risk data to guide them to mitigation actions. Flood hazard mapping is an important part of the National Flood Insurance Program (NFIP), as it is the basis of the NFIP regulations and flood insurance requirements. FEMA maintains and updates data through Flood Insurance Rate Maps (FIRMs) and risk assessments.

Historical Occurrence at North Kingstown and Vicinity

The Newport, RI tidal station was established on September 11, 1930, and has recorded the following as top 10 flood events with peak flood elevations listed in feet, referenced to the NAVD88 datum.

1. Great New England Hurricane of 1938 (9/21/1938) - 11.27 ft
2. Hurricane Carol - (8/31/1954) - 8.57 ft
3. Hurricane Sandy - (10/29/2012) - 6.13 ft
4. Hurricane Bob - (8/19/1991) - 5.79 ft
5. Great Atlantic Hurricane - (9/14/1944) - 5.77 ft
6. Nor'easter (1/9/1978) - 5.41 ft
7. High Tides & Coastal Low Pressure (12/23/2022) - 5.21 ft
8. January 13-14 East Coast Winter Storm (1/13/2024) - 5.15 ft
9. The Perfect Storm (10/31/1991) - 5.08 ft
10. Nor'easter (11/30/1963) - 5.07 ft

The Great New England Hurricane of 1938 was one of the most destructive and powerful storms ever to strike Southern New England. Narragansett Bay, including North Kingstown, had the most damage, where a storm surge of 12 to 15 feet destroyed most coastal homes, structures, marinas, and yacht clubs.

Hurricane Sandy's storm surge has its largest effect in southern Rhode Island, including North Kingstown, where most of the damages in these areas occurred from storm surge. This included 6+ feet of inundation in Wickford Village, where the storm surge destroyed houses, businesses, septic systems, damaged pilings and deck supports, and moved significant amounts of sand and debris into homes, businesses, streets, and adjacent coastal ponds.

Estimated Probability of Occurrence at and near North Kingstown

The results indicate the following flood probability at and near North Kingstown (within Washington County):

- about 3.7 events per year

Climate Change Effects and Coastal Flood Occurrence

Historic sea level trends (based on monthly mean sea level data from 1930 to 2023) at the Newport, RI tidal station indicate that the relative sea level is rising approximately 0.115 inches per year, equivalent to a change of 0.96 feet in 100 years.

According to the NOAA 2022 Sea Level Rise Technical Report, this trend is expected to increase in the coming decades with sea levels along the U.S. coastline projected to rise, on average, 10 - 12 inches (0.25 - 0.30 meters) in the next 30 years (2020 - 2050).

Flash Flooding

Intense, heavy rainfall can result in localized flooding including flash flood events. Risks due to intense rainfall are predominantly associated with flash flooding and are typically related to the capacity of the existing stormwater infrastructure to manage stormwater run-off. High velocity stormwater flow can also occur during these events. Damages can include localized flooding, damage to property and vehicles and potentially safety risk to the public. In addition, the spring rainy season is a particularly hazardous time, as runoff from heavy rains or winter snowfalls can saturate wetlands and fill the rivers, streams, and brooks. A heavy or severe rain event at this time of year can often overwhelm natural flood storage areas and create flood hazards on streets and around residential areas.

Most flash flooding in Rhode Island is caused by hurricanes, Nor'easters, or stationary thunderstorms. Inland areas of town are most at risk from flash flooding caused by intense rainfall over short periods of time.

Historical Occurrence at North Kingstown and Vicinity

On September 2, 2021, Hurricane Ida caused 5.4 inches of rain in the town, flooding apartments and many other areas in North Kingstown.

On February 18, 1998, there was a storm event that brought heavy rainfall, isolated flash floods, and thunderstorms to Rhode Island. North Kingstown received 2.7 inches of rainfall during this event.

During the period between March 24th, 2016, and August 2024, there have been 36 days with rainfall totals over 2 inches. (CoCoRaHS Data Explorer)

During the period of 1950 through 2023, the National Centers for Environmental Information (NCEI) recorded six (6) Flash Flood Events in Washington County.

During the period between 1996 and 2018, Washington County experienced 6 days with Flash Flood events, an average of about 1 event day every third year. Five event days included property damage at a total cost of nearly $0.5M. There were no injuries or death. Ref. NOAA Storm Events Database

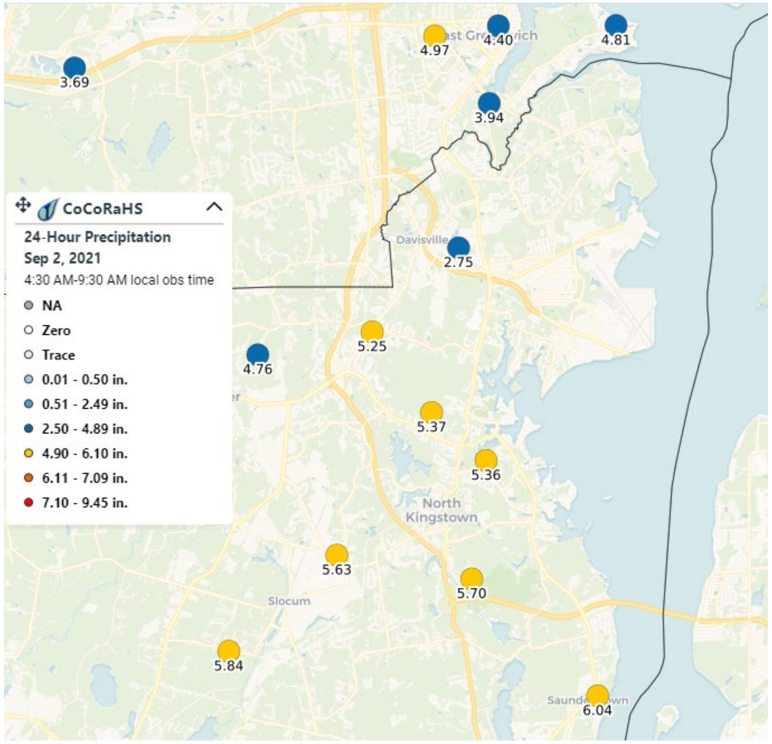
Estimated Probability of Occurrence at and near North Kingstown

The results indicate the following flash flooding probability at and near North Kingstown (within Washington County):

- Flash Flooding due to Intense Rainfall within Washington County: 27% AEP or 3.7-year recurrence interval

Effects of Climate Change

The attribution of rainfall intensity and frequency has high confidence. Average annual precipitation in the Northeast increased 10 percent from 1895 to 2011, and precipitation from extremely heavy storms has increased 70 percent since 1958. During this century, average annual precipitation and the frequency of heavy downpours are likely to keep rising. Average precipitation is likely to increase during winter and spring, but not change significantly during summer and fall.



Attachment 2 - Figure 14: September 2, 2021 (Hurricane Ida) 1-Day Total Rainfall (https://maps.cocorahs.org/)

Riverine Flooding

Riverine flooding includes flooding caused by river flows which overtop the riverbanks and spread into the surrounding floodplain or other low-lying areas. Flooding is often caused by heavy rains resulting from thunderstorms, nor'easters, tropical storms, and hurricanes. In addition, the spring rainy season is a particularly hazardous time, as runoff from winter snowfalls can saturate wetlands and fill the streams and brooks. A heavy or severe rain event at this time of year can often overwhelm natural flood storage areas and create flood hazards on streets and around residential areas.

The recurrence interval of a flood is defined as the average time interval, in years, expected to take place between the occurrence of a flood of a particular magnitude to an equal or larger flood. Flood magnitude increases with increasing recurrence interval. When land next to or within the floodplain is developed, these cyclical floods can become costly and dangerous events.

The Pawcatuck River and tributaries run west to east through the southern reaches of the State including portions North Kingstown. While there is limited development in these areas, during significant flood events flooding damages do occur. The Pawcatuck River experienced the most significant flooding in recorded history during the March 2010 floods (RIHMP 2024).

During the March of 2010 flood event, five to ten inches of rain fell across Washington County resulting in rises in rivers and streams in North Kingstown. Numerous roads were flooded disrupting transportation for residents, employees, and emergency response personnel in town. A mudslide washed onto two rail tracks near Routes 403 and 4, disrupting rail service throughout Rhode Island. Some town roads, such as Featherbed Lane were washed out from the flooding and were closed for a considerable duration for repairs. Additionally, the flooding rendered a town well pump station out of service for several months following the event.

People and property are extremely vulnerable to all types of flooding, causing damage to their homes and businesses. In addition, floodwaters can carry chemicals, sewage, and toxins from roads, factories, and farms and as such contaminate properties with these hazardous materials. The floodwaters can also carry debris from vegetation and man-made structures and create a hazard both during and after a flood. Floods may also threaten water supplies and water quality and lead to power outages. Regarding riverine flooding, the areas largely affected are those bordering rivers and are impacted by large discharges caused by heavy rainfall over upstream areas.

FEMA Flood Hazard Determination

Through FEMA's flood hazard mapping program, Risk Mapping, Assessment and Planning (MAP), FEMA identifies flood hazards, assesses flood risks and partners with states and communities to provide accurate flood hazard and risk data to guide them to mitigation actions. Flood hazard mapping is an important part of the National Flood Insurance Program (NFIP), as it is the basis of the NFIP regulations and flood insurance requirements. FEMA maintains and updates data through Flood Insurance Rate Maps (FIRMs) and risk assessments. In North Kingstown, the effective FIRM was revised in 2023, with panels in North Kingstown dated 2010, 2013, and 2020. The Special Flood Hazard Areas (shaded areas) shown on the FIRM have designated flood zones and all other (unshaded) areas are designated Zone C. Zone C are areas of minimal to no flood hazard. The Zone A and AE areas in North Kingstown have determined Base Flood Elevations (BFEs) in the effective FIRM.

Historical Occurrence at North Kingstown and Vicinity

During September 15-19, 2023, Rhode Island experienced catastrophic flooding, triggered by a 200-year rainfall event. The financial impact of the flooding caused property damage estimates of billions of dollars within the State.

The largest recent flood event in Rhode Island was a storm event during March 29-31, 2010, where parts of Rhode Island ended up receiving almost ten inches of rain. The widespread riverine and inland flooding was the result of weeks of series of moderate to heavy rainfall events during February and March. Nearly 26,000 residents of Rhode Island applied for assistance, with $79,000,000 approved for individuals and business owners (State of Rhode Island Hazard Mitigation Plan - February 2024).

For the period of 1996-2019 (24 years), there have been 21 flood events in Washington County, including 8 events with property damage (resulting in $25.150M of damage), no injuries and no deaths (NOAA Storm Events Database).

Estimated Probability of Occurrence at and near North Kingstown

The results indicate the following flood probability at and near North Kingstown (within Washington County):

- 84% AEP or about 1.2-year recurrence interval

Climate Change Effects and Riverine Flood Occurrence

There is high confidence, within the scientific community, that the frequency and severity of riverine flooding will increase within southern New England due primarily to the increase in precipitation frequency and intensity.

Urban Flooding

From the Town of North Kingstown 2019 Multi-Hazard Mitigation Plan:

"Urban flooding occurs where there has been development within stream floodplains. This is partly a result of the use of waterways for transportation purposes in earlier times. Sites adjacent to rivers and coastal inlets provided convenient places to ship and receive commodities. Floodways and wetlands which are the natural storage basins for flood waters were filled to accommodate development. The price of this accessibility to the rivers was increased flooding of the ensuing urban areas. Urbanization increases the magnitude and frequency of floods by increasing impermeable surfaces, increasing the speed of drainage collection, reducing the carrying capacity of the land and, occasionally, overwhelming sewer systems. The large amounts of impervious surfaces in urban areas can increase runoff amounts and decrease the time between when the rain event occurs and when the streams start to flood.

Rhode Island's stormwater infrastructure is undersized for today's storms by 25% to 30% (UNH Stormwater Center). The most common cause of urban flooding is due to poor or insufficient storm water drainage, high groundwater levels, and high percentage of impervious surfaces which prevent groundwater recharge. More often than not, when heavy rains occur, Rhode Island's aging sewer systems (or combined sewer overflows –CSOs) are overrun and this results in raw sewage flowing into Narragansett Bay, often creating Bay closures to shell fishing and swimming."

As part of the CRS program, the Town of North Kingstown has identified several town roads susceptible to urban/ stormwater flooding:

Street Name	Description
Fletcher at Signal Rock	Catch basin at intersection
Pine River Drive	Outfall behind #135
Edmond Drive	NA
Austin Road	By the bridge
Austin Road	At Austing Meadows
Forge Road	By the bridge
Forge at N. Quidnessett	Intersection
640 N. Quidnessett	Rt-hand side of driveway
Old Baptist Road	Basin by Blais Farm
Old Baptist Road	Basin at midway
Evergreen Road	4 basins
Chaucer Drive	NA
Dana Drive	#137
School Street	Opposite Hancock "west"
Potowomut	By the bridge
Potowomut	On the bridge
Highbank	Opposite Allen
Lake Drive	At end by school
Old Mill Lane	DBL basins on rt-hand side off road
Sachem Road	2 at dead end
Yorktown Park	Basin across the street
Stillman Road	Roadway
Plum Point Road	Roadway
Walmsley Lane	Roadway
River Rd	Roadway
Tomahawk Circle	Roadway
Oak Hill Road	Roadway and culvert
Village Hill	Roadway
Terre Mar Drive	Roadway
Duck Cove Road	Swale at #106
Laurel Ridge Lane	Roadway

• Kings Grant	West side of curve, road south end
• Earle Drive	Roadway
• Elgin and Concord	Corner of road should be kept clear (tidal influence)
• West Main Street	140-154 catch basin system both sides of street
• West Main Street	Outfall behind #180
• West Main Street	Outfall behind funeral home
• West Allenton Road	#79/ #86 flooding both sides (monitor conditions)

"Areas with higher amounts of impervious surface and poor drainage are more vulnerable to urban/stormwater flooding. Such areas in North Kingstown include Post Road/Route 1 and Quaker Lane/Route 2. In addition, as part of the CRS program, the town has identified problematic drainage areas that may also be more susceptible to urban/stormwater flooding." (North Kingstown 2019 Multi-Hazard Mitigation Plan)

Historical Occurrence at North Kingstown and Vicinity

There have been many localized and wide-spread urban flooding events within North Kingstown. Low-lying areas, heavy rain, and inadequate/ malfunction draining systems are typically the culprit. The following paragraphs describe a few of these past town events.

On October 28, 2006, significant urban flooding was reported in North Kingstown. The storm brought damaging winds to much of central and southern Rhode Island and included downed trees and power lines.

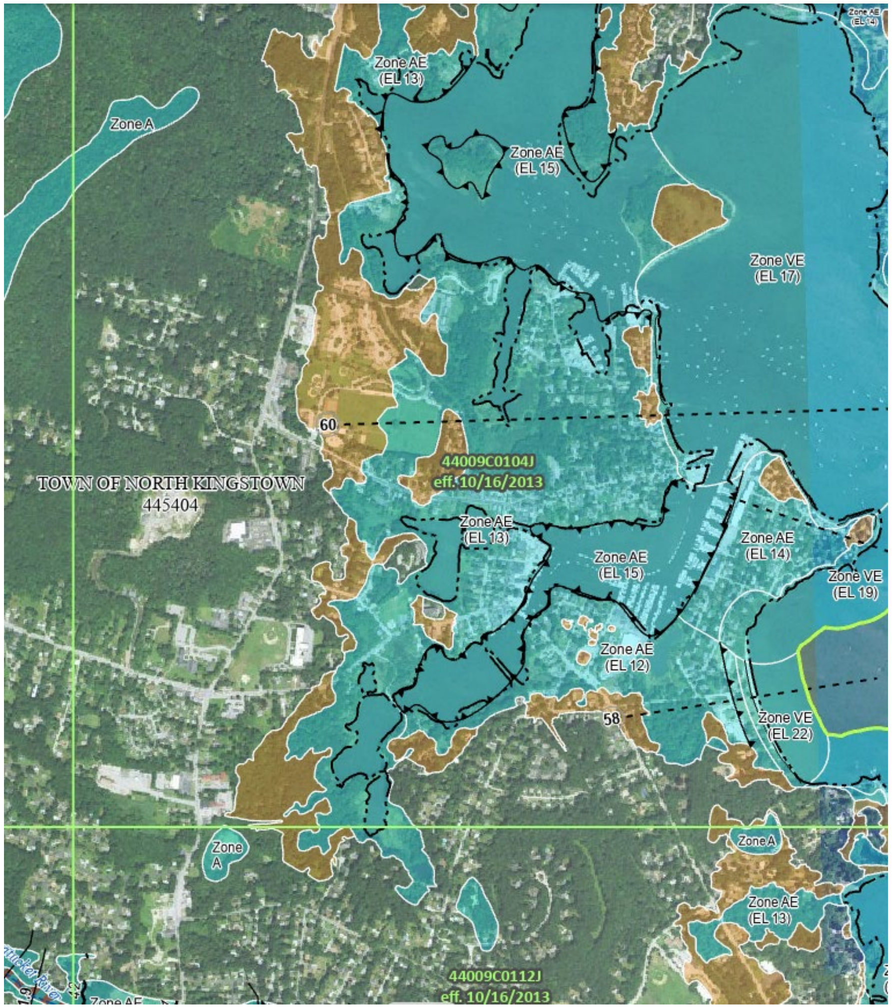
On March 2, 2007, low pressure over the mid-Atlantic states strengthened as it tracked over southeast New England. Snow quickly changed to heavy rain as the storm reached Rhode Island, when milder air was drawn into the region. Rainfall totals of 2 to 3 inches caused widespread urban and small stream flooding. Route 2 in North Kingstown was closed due to flooding, as well as West Allenton Road.

March 30, 2014, the area was hit with high rainfall over a short period of time which caused flooding and a roadway shutdown around the 600 block of Oak Hill Road due to a clogged culvert and residents to need emergency pump-outs from the Fire Department.

On September 2, 2021, remnants of Hurricane Ida brough heavy rains caused flooding which prompted the evacuation of Kingstown Crossing Apartments. Multiple units were impacted by the flooding and some first story apartments had over a foot of water.

Estimated Probability of Occurrence at and near North Kingstown

It is expected that urban flooding will continue to persist in North Kingstown, where large amounts of impervious surfaces increase runoff amounts and manmade channels may also constrict stream flow and increase flow velocities.



Attachment 2 - Figure 15: Portion of FEMA's National Flood Hazard Layer (NFHL) Viewer

(https://www.arcgis.com/apps/webappviewer/index.html?id=8b0adb5

SEVERE WEATHER HAZARDS: WINTER WEATHER

SEVERE WINTER WEATHER: SNOWFALL

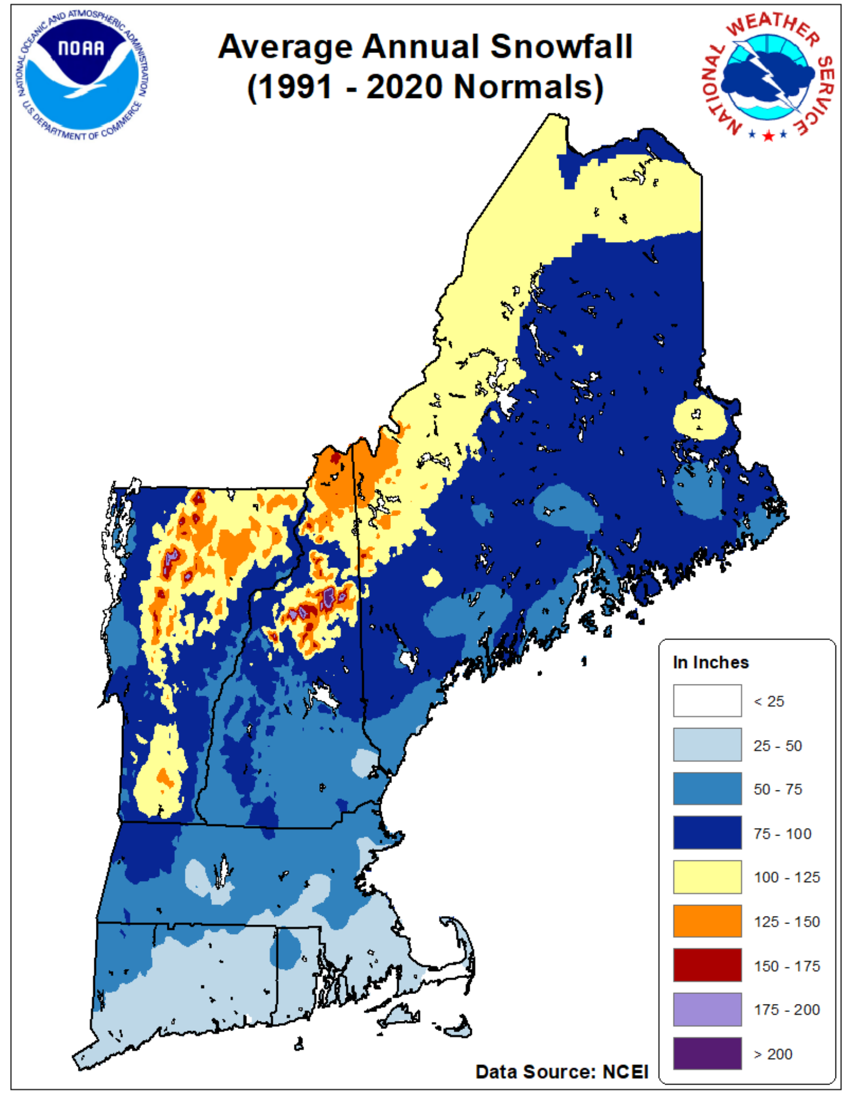
Severe winter weather includes large snow events, blizzards, and ice storms. As defined by the National Weather Service, a blizzard is a snowstorm with sustained winds or frequent gusts of 35 miles an hour or greater and considerable falling and/or blowing snow (i.e., reducing visibility frequently to less than a quarter of a mile) for a period of 3 hours or longer. NOAA's National Centers for Environmental Information produces the Regional Snowfall Index (RSI) for significant snowstorms that impact the eastern two thirds of the U.S. The RSI ranks snowstorm impacts on a scale from 1 to 5, as shown in **Attachment 2 - Table 14**. RSI is based on the spatial extent of the storm, the amount of snowfall, and the juxtaposition of these elements with population density and societal impacts. Currently, the index uses population data based on the 2000 Census. A similar storm index is the Northeast Snowfall Impact Scale (NESIS), also shown below. Reference NOAA; https://www.ncdc.noaa.gov/snow-and-ice/rsi/

Severe winter weather in Rhode Island is almost always associated with nor'easters. **Attachment 2 - Table 15** summarizes the major nor'easters that occurred between the 1880's and now in the Northeast U.S. and includes RIS and NESI values (if available). Ref. https://gis.ncdc.noaa.gov/maps/ncei/rsi

Attachment 2 - Table 14: Regional Snowfall Index (RSI) and Northeast Snowfall Impact Scale

Category	RSI Value	Description	NESIS Value	Description
1	1-3	Notable	1-2.5	Notable
2	3-6	Significant	2.5-4	Significant
3	6-10	Major	4-6	Major
4	10-18	Crippling	6-10	Crippling
5	18+	Extreme	10+	Extreme

Attachment 2 - Figure 16 indicates the average annual snowfall amounts for the Northeast U.S. The average snowfall per year near North Kingstown is 25 to 50 inches per year.



Attachment 2 - Figure 16: Average Annual Snowfall
(Source: http://www.weather.gov/btv/winter)

Attachment 2 - Table 15: Major Historical Nor'easters in the New England Region

Event	Northeast Category/RSI Value	Date	Description
Great Blizzard of 1888	NA	March 11-14, 1888	One of the worst blizzards in U.S. history. Dropped 40–50 inches (100–130 cm) of snow, killed 400 people, mostly in New York.
Great Appalachian Storm of November 1950	4/14.5	November 24-30, 1950	A very severe storm that dumped more than 30 inches (76 cm) of snow in many major metropolitan areas along the eastern United States, record breaking temperatures, and hurricane-force winds. The storm killed 353 people.
The Blizzard of'58	3/7.9	February 16-17, 1958	This coastal storm brought heavy snow and strong winds to the Northeast and resulted in 19.4 inches of snow in Boston.
	NA	March 3-5, 1960	This wind-driven snowstorm brought whirling snow from Virginia to New York, before blowing into New England. Left 19.8 inches of snow in Boston.
Ash Wednesday Storm of 1962	1/1.8	March 5-9, 1962	Caused severe tidal flooding and blizzard conditions from the Mid-Atlantic to New England, killed 40 people.
February Blizzard	5/34.0	February 24-27, 1969	This storm lasted several days and left 26.3 inches of snow in Boston.
Eastern Canadian Blizzard of March 1971	4/10.8	March 3-5, 1971	Dropped over 32 inches (81 cm) of snow over areas of eastern Canada, killed at least 30 people.
Groundhog Day Gale of 1976	NA	February 1-5, 1976	Caused blizzard conditions for much of New England and eastern Canada, dropping a maximum of 56 inches (140 cm) of snow.
January Blizzard	2/5.4	January 20-21, 1978	The January blizzard occurred just a couple of weeks before the infamous Blizzard of '78 and left 21.4 inches of snow in Boston.
Northeastern United States blizzard of 1978	5/18.4	February 5-7, 1978	A catastrophic storm, which dropped over 27 inches (69 cm) of snow in areas of New England, killed a total of 100 people, mainly people trapped in their cars on metropolitan Boston's inner beltway and in Rhode Island. $500M property damage in Massachusetts.
1991 Storm (the "Perfect Storm," combined Nor'easter/hurricane)	NA	October 28-November 2, 1991	Very unusual storm which evolved into a hurricane, tidal surge caused severe damage to coastal areas, especially Massachusetts, killed 13 people.
December 1992 nor'easter	2/4.7	December 10-12, 1992	A powerful storm which caused severe coastal flooding throughout much of the northeastern United States.

Event	Northeast Category/RSI Value	Date	Description
1993 Storm of the Century	5/22.1	March 12-15, 1993	The Superstorm of 1993 which affected the entire eastern U.S., parts of eastern Canada and Cuba. It caused 6.65 billion (2008 USD) in damage and killed 310 people.
Christmas 1994 nor'easter	NA	December 22-26, 1994	An intense storm which affected the east coast of the U.S. and exhibited traits of a tropical cyclone.
North American Blizzard of 1996	5/21.8	January 6-10, 1996	Severe snowstorm which brought up to 4 feet (120 cm) of snow to areas of the mid-Atlantic and northeastern U.S.
April Fools Storm	2/4.7	March 31-April 1, 1997	This April Fools storm dropped more than 2 feet of snow in Boston.
North American Blizzard of 2003	4/14.7	February 14-22, 2003	Dropped over 2 feet (61 cm) of snow in several major cities, including Boston, and New York City, affected large areas of the Northeastern and Mid-Atlantic U.S., and killed a total of 27 people.
North American Blizzard of 2005	NA	January 20-23, 2005	Brought blizzard conditions to southern New England and dropped over 40 inches (100 cm) of snow in areas of Massachusetts.
North American Blizzard of 2006	2/5.0	February 11-13, 2006	A powerful storm that developed a hurricane-like eye when off the coast of New Jersey. It brought over 30 inches (76 cm) of snow in some areas and killed 3 people.
April 2007 nor'easter	0/1.0	April 13-17, 2007	An unusually late storm that dumped heavy snow in parts of Northern New England and Canada and heavy rains elsewhere. The storm caused a total of 18 fatalities.
November 2009 nor'easter	NA	November 11-17, 2009	Formed from the remnants of Hurricane Ida, produced moderate storm surge, strong winds and very heavy rainfall throughout the mid-Atlantic region. It caused US$300 million (2009) in damage and killed six people.
December 2009 North American blizzard	1/2.8	December 16-20, 2009	A major blizzard which affected large metropolitan areas, including New York City, Philadelphia, Providence, and Boston. In some of these areas, the storm brought up to 2 feet (61 cm) of snow.
March 2010 nor'easter	0/0.3	March 12-16, 2010	A slow-moving nor'easter that devastated the Northeastern United States. Winds of up to 70 miles per hour (110 km/h) snapped trees and power lines, resulting in over 1 million homes and businesses left without electricity. The storm produced over 10 inches (25 cm) of rain in New England, causing widespread flooding of urban and low-lying areas. The storm also caused extensive coastal flooding

Event	Northeast Category/RSI Value	Date	Description
			and beach erosion.
December 2010 North American blizzard	2/3.4	December 5, 2010-January 15, 2011	A severe and long-lasting blizzard which dropped up to 36 inches (91 cm) of snow throughout much of the eastern United States.
January 8–13, 2011 North American blizzard and January 25–27, 2011 North American blizzard	2/3.4	January 8-13 and January 25-27, 2011	In January 2011, two nor'easters struck the East Coast of the United States just two weeks apart and severely crippled New England and the Mid-Atlantic. During the first of the two storms, a record of 40 inches (100 cm) was recorded in Savoy, Massachusetts. Two people were killed.
2011 Halloween nor'easter	1/2.6	October 28-November 1, 2011	A rare, historic nor'easter, which produced record breaking snowfall for October in many areas of the Northeastern U.S., especially New England. The storm produced a maximum of 32 inches (81 cm) of snow in Peru, Massachusetts, and killed 39 people. After the storm, the rest of the winter for New England remained very quiet, with much less than average snowfall and no other significant storms to strike the region for the rest of the season.
November 2012 nor'easter	0/0.3	November 7-10, 2012	A moderately strong nor'easter that struck the same regions that were impacted by Hurricane Sandy a week earlier. The storm exacerbated the problems left behind by Sandy, knocking down trees that were weakened by Sandy. It also left several residents in the Northeast without power again after their power was restored following Hurricane Sandy. Highest snowfall total from the storm was 13 inches (33 cm), recorded in Clintonville, Connecticut.
Late December 2012 North American storm complex	3/9.2	December 17-31, 2012	A major nor'easter that was known for its tornado outbreak across the Gulf Coast states on Christmas day as well as giving areas such as northeastern Texas a white Christmas. The low underwent secondary cyclogenesis near the coast of North Carolina and dumped a swath of heavy snow across northern New England and New York, caused blizzard conditions across the Ohio Valley, as well as an ice storm in the mountains of the Virginia and West Virginia.

Event	Northeast Category/RSI Value	Date	Description
Early February 2013 North American blizzard	3/NA	February 7-18, 2013	An extremely powerful and historic nor'easter that dumped heavy snow and unleashed hurricane-force wind gusts across New England. Many areas received well over 2 feet (61 cm) of snow, especially Connecticut, Rhode Island, and eastern Massachusetts. The highest amount recorded was 40 inches (100 cm) in Hamden, Connecticut, and Gorham, Maine, received a record 35.5 inches (90 cm). Over 700,000 people were left without power and travel in the region came to a complete standstill. The storm killed 18 people. Left 24.9 inches of snow in Boston and 22.8 inches in Providence.
March 2013 nor'easter	1/1.6	March 1-21, 2013	A large and powerful nor'easter that ended up stalling along the eastern seaboard due to a blocking ridge of high pressure in Newfoundland and pivoted back heavy snow and strong winds into the Northeast United States for a period of 2 to 3 days. Many officials and residents were caught off guard as local weather stations predicted only a few inches (several centimeters) of snow with a change to mostly rain. Contrary to local forecasts, many areas received over one foot (30 cm) of snow, with the highest amount being 29 inches (74 cm) in Milton, Massachusetts. Several schools across the region, particularly in the Boston, Massachusetts, metropolitan area, remained in session during the height of the storm, not knowing the severity of the situation. Rough surf and rip currents were felt all the way southwards towards Florida's east coast.
January 2015 North American Blizzard	3/6.2	January 23-31, 2015	Unlike recent historical winter storms, there was no indication that a storm of this magnitude was coming until about 3 days in advance. The Blizzard began as an Alberta Clipper in the Midwestern States, which was forecast to transfer its energy to a new, secondary Low Pressure off the coast of the Mid Atlantic and move northeastward and pass to the south and east of New England. Several reports of over 30 inches (76 cm) across the State of Massachusetts, breaking many records. A maximum of 36 inches (91 cm) was recorded in at least four towns across Worcester County in Massachusetts and the city of Worcester itself received 34.5 inches (88 cm), marking the city's largest storm snowfall accumulation on record. The city of Boston recorded 24.6 inches (62 cm), making it the largest storm

Event	Northeast Category/RSI Value	Date	Description
			snowfall accumulation during the month of January and the city's sixth largest storm snowfall accumulation on record. On the coast of Massachusetts, Hurricane Force gusts up to around 80 mph (130 km/h) along with sustained winds between 50 and 55 mph (80 and 89 km/h) at times, were reported. The storm also caused severe coastal flooding and storm surge. The storm bottomed out to a central pressure of 970 mb (970 hPa). By January 28, the storm began to pull away from the area.
Winter Storm Neptune	NA	February 14-15, 2015	This storm event had significant impact on the Northeast, including Rhode Island and brought heavy snowfall and cold temperatures to the region. TF Green Airport recorded 8.2 inches of snow during the storm with wind gusts over 40 mph.
January 2016 United States blizzard (also known as Winter Storm Jonas, Snowzilla, or The Blizzard of 2016 by media outlets)	4	January 19-29, 2016	This system dumped 2 to 3 feet (61 to 91 cm) of snow in the East Coast of the United States. States of Emergencies were declared in 12 States in advance of the storm as well as by the Mayor of Washington D.C. The blizzard also caused significant storm surge in New Jersey and Delaware that was equal to or worse than Hurricane Sandy. Sustained damaging winds over 50 mph (80 km/h) were recorded in many coastal communities, with a maximum gust to 85 mph (137 km/h) on Assateague Island, Virginia. A total of 55 people died due to the storm.
February 2017 United States blizzard (also known as Winter Storm Niko and The Blizzard of 2017 by media outlets)	4.17.8	February 6-11, 2017	Forming as an Alberta clipper in the northern United States on February 6, the system initially produced light snowfall from the Midwest to the Ohio Valley as it tracked southeastwards. It eventually reached the East Coast of the United States on February 9 and began to rapidly grow into a powerful nor'easter, dumping 1 to 2 feet (30 to 61 cm) across the Northeast Megapolis. The storm also produced prolific thunder and lightning across Southern New England. Prior to the blizzard, unprecedented and record-breaking warmth had enveloped the region, with record highs of above 60 °F (16 °C) recorded in several areas, including Central Park in New York City. Some were caught off guard by the warmth and had little time to prepare for the snowstorm.

Event	Northeast Category/RSI Value	Date	Description
October 2017 nor'easter	NA	October 28-31, 2017	An extratropical storm absorbed the remnants of Tropical Storm Philippe. The combined systems became an extremely powerful nor'easter that wreaked havoc across the Northeastern United States and Eastern Canada. The storm produced sustained tropical storm force winds along with hurricane force wind gusts. The highest wind gust recorded was 93 mph (150 km/h) in Popponesset, Massachusetts. The storm caused over 1,400,000 power outages. Damage across New England, especially in Connecticut, Massachusetts, and Rhode Island, was extreme. This was due to the combination of the high winds, heavy rainfall, saturated ground, and most trees still being fully leaved. Some residents in Connecticut were without power for nearly a week following the storm. Heavy rain in Quebec and Eastern Ontario, with up to 98 mm (3.9 in) in the Canadian capital region of Ottawa, greatly interfered with transportation.
January 2018 North American blizzard	4/17.8	January 2-6, 2018	A powerful blizzard that caused severe disruption along the East Coast of the United States and Canada. It dumped snow and ice in places that rarely receive wintry precipitation, even in the winter, such as Florida and Georgia, and produced snowfall accumulations of over 2 feet (61 cm) in the Mid-Atlantic states, New England, and Atlantic Canada. The storm originated on January 3 as an area of low pressure off the coast of the Southeast. Moving swiftly to the northeast, the storm explosively deepened while moving parallel to the Eastern Seaboard, causing significant snowfall accumulations. The storm received various unofficial names, such as Winter Storm Grayson, Blizzard of 2018 and Storm Brody. The storm was also dubbed a "historic bomb cyclone".

Event	Northeast Category/RSI Value	Date	Description
March 1-3, 2018 nor'easter (also known as Winter Storm Riley or False Tropical Storm Riley by media outlets)	2/4.4	March 1-5, 2018	A very powerful nor'easter that caused major impacts in the Northeastern, Mid-Atlantic and Southeastern United States. It originated as the northernmost low of a stationary front over the Midwest on March 1, which moved eastward into the Northeast later that night. A new low-pressure system rapidly formed off the coast on March 2 as it slowly meandered near the coastline. It peaked later that day and began to gradually move out to sea by March 3. Producing over 2 feet (24 in) of snow in some areas, it was one of the most significant March snowstorms in many areas, particularly in Upstate New York. In other areas, it challenged storm surge records set by other significant storms, such as Hurricane Sandy. It also produced widespread damaging winds, with gusts well over Hurricane force strength in some areas across Eastern New England as well as on the back side in the Mid-Atlantic via a sting jet. Over 2.2 million customers were left without power.
March 6-8, 2018 nor'easter (also known as Winter Storm Quinn by media outlets)	1/2.2	March 2-9, 2018	A powerful nor'easter that affected the Northeast United States. It came just days after another nor'easter devastated much of the Northeast. Frequent cloud to ground Thundersnow as well as snowfall rates of up to 3 inches (7.6 cm) an hour were reported in areas around the Tri-State Area, signaling the rapid intensification of the storm. Late in the afternoon, an eye-like feature was spotted near the center of the storm. It dumped over 2 feet of snow in many areas across the Northeast, including many areas in New England where the predominant precipitation type was rain for the previous storm. Over 1 million power outages were reported at the height of the storm due to the weight of the heavy, wet snow on trees and power lines. Many people who lost power in the previous storm found themselves in the dark again.
March 12-14, 2018 nor'easter (also known as Winter Storm Skylar by media outlets)	1/2.2	March 11-14, 2018	A powerful nor'easter that affected portions of the Northeast United States. The storm underwent rapid intensification with a central millibar pressure dropping down from 1001 mb to 974 mb in just 24 hours. This was the third major storm to strike the area within a period of 11 days. The storm dumped over up 2 feet of snow and brought Hurricane force wind gusts to portions of Eastern New

Event	Northeast Category/RSI Value	Date	Description
			England. Hundreds of public-school districts including Boston, Hartford, and Providence were closed on Tuesday, March 13.
March 20–22, 2018 nor'easter (also known as Winter Storm Toby by media outlets)	1/1.6	March 20-22, 2018	A powerful nor'easter that became the fourth major nor'easter to affect the Northeast United States in a period of less than three weeks. It caused a severe weather outbreak over the Southern United States on March 19th before moving off of the North Carolina coast on March 20th and spreading freezing rain and snow into the Mid-Atlantic States after shortly dissipating later that night. A new low-pressure center then formed off of Chesapeake Bay on March 21st and then became the primary nor'easter. Dry air prevented most of the precipitation from reaching the ground in areas in New England such as Boston, Hartford, and Providence, all of which received little to no accumulation, in contrast with what local forecasts had originally predicted. In Islip, New York at the height of the storm, snowfall rates of up to 5 inches per hour were reported. 8 inches was reported at Central Park and over 12 inches was reported in many locations on Long Island as well in and around New York City and in parts of New Jersey.
Nor'easter	3.2	December 14-18, 2020	T.F. Green Airport measured at least 7.3 inches of snow, and a wind gust of 49 mph was recorded at Quonset, RI.
2021 Groundhog Day Nor'easter	4.9/3	January 30-February 3, 2021	Snowfall rates of 2-3" per hour occurred for many hours across New England with high winds that led to blizzard conditions in some areas.
Nor'easter	NA	January 29, 2022	The most amount of snow to land in one day at T.F. Green Airport since 1948 with 18.8 inches. Snowfall totals exceeded 24 inches in areas of eastern Massachusetts, Rhode Island, and Long Island, NY.
Nor'easter – Blizzard Event	8.52	December 13-20, 2022	Major snowstorm event for northern New England. Coastal Rhode Island, Connecticut, and Massachusetts didn't have high snowfall totals; however, winds, waves, and coastal erosion were high.

Event	Northeast Category/RSI Value	Date	Description
Nor'easter - December 2022 North American winter storm	2.66	December 21-26, 2022	An extratropical cyclone created winter storm conditions, including blizzards, high winds, snowfall, and record cold temperatures across the Northeast.
Nor'easter	NA	December 18, 2023	Power was knocked out for hundreds of thousands of customers in an area stretching north from Virginia through New England, including nearly 423,000 in Maine and about 200,000 in Massachusetts as of Monday night, according to poweroutage.us.
Nor'easter	NA	January 6-7, 2024	Heavy snow fell in the region, with up to 5.6 inches recorded at TF Green Airport and 3-6 inches in North Kingstown. This event marked the first snowfall event with over 6 inches of snow recorded in the area in well over a year. This event resulted in a Presidential declaration of a major disaster for the State of Rhode Island.

Historical Occurrence at North Kingstown and Vicinity

Between 1996 and 2024, there were a total of 37 Heavy Snow event days in Washington County, with 3 days with property damage of $141,000 reported and no injuries or fatalities. Heavy Snow in the NOAA database is defined as snow accumulation meeting or exceeding locally/regionally 12 and/or 24-hour warning criteria: typically 4, 6, or 8 inches or more within 12 hours or 6, 8, or 10 inches or more in 24 hours. Storms including strong winds or other types of precipitation are classified as Winter Storms instead of Heavy Snow events. Ref. NOAA Storm Events Database.

Estimated Probability of Occurrence at and near North Kingstown

The results indicate the following Heavy Snowfall probability at and near North Kingstown:

- Average annual snowfall of 25 to 50 inches
- 127% AEP or about 0.8- year recurrence interval Heavy Snowfall

Effects of Climate Change

The attribution of Heavy Snowfall events to climate change and understanding is moderate. High sea surface temperatures, increased atmospheric moisture, and polar vortex conditions may result in an increased frequency of Heavy Snowfall.

SEVERE WINTER WEATHER: ICE STORMS

Ice storms are an occasional component of severe winter weather. Rain that falls and freezes on contact with cold surfaces is called freezing rain, while sleet is precipitation that freezes in the air before hitting the ground in the form of ice pellets. Heavy accumulations of ice can bring down trees or tree branches that may damage utility wires, causing power and communications outages, which may take days to repair. Ice can increase the weight of branches by 30 times. A 1/2-inch accumulation on power lines can add 500 lbs. of weight. Even slight accumulations of ice result in slippery conditions for motorists and pedestrians.

The National Weather Service issues:

- an Ice Storm Warning for a quarter inch or more of ice accumulation
- a Freezing Rain Advisory for ice accumulation of less than one-quarter inch

Ice storms are relatively rare events in Rhode Island, including North Kingstown.

Historical Occurrence at North Kingstown and Vicinity

There were no (0) Ice Storm event days recorded in the NOAA Storm Events Database for Washington County or the State of Rhode Island between 1950 and 2024.

Estimated Probability of Occurrence at and near North Kingstown

The results indicate the Ice Storm probability at and near North Kingstown is rare:

- greater than a 1.3% AEP or greater than a 74-year recurrence interval Ice Storms (no events detected in 74 years)

Effects of Climate Change

The attribution of Ice Storm events to climate change and understanding is low to moderate. High sea surface temperatures, increased atmospheric moisture, and polar vortex conditions may result in an increased frequency of Ice Storms.

EXTREME TEMPERATURES

EXTREME TEMPERATURE: HEAT

The National Weather Service issues the following general criteria, which vary across the country, especially for areas that are not used to dangerous heat conditions:

- Excessive Heat Warnings are issued "when the maximum heat index temperature is expected to be 105° or higher for at least 2 days and nighttime air temperatures will not drop below 75°"
- A Heat Advisory is issued "when the maximum heat index temperature is expected to be 100° or higher for at least 2 days, and nighttime air temperatures will not drop below 75°"
- A Heat Wave is defined as 3 or more days of temperatures of 90° F or above.

Heat Index

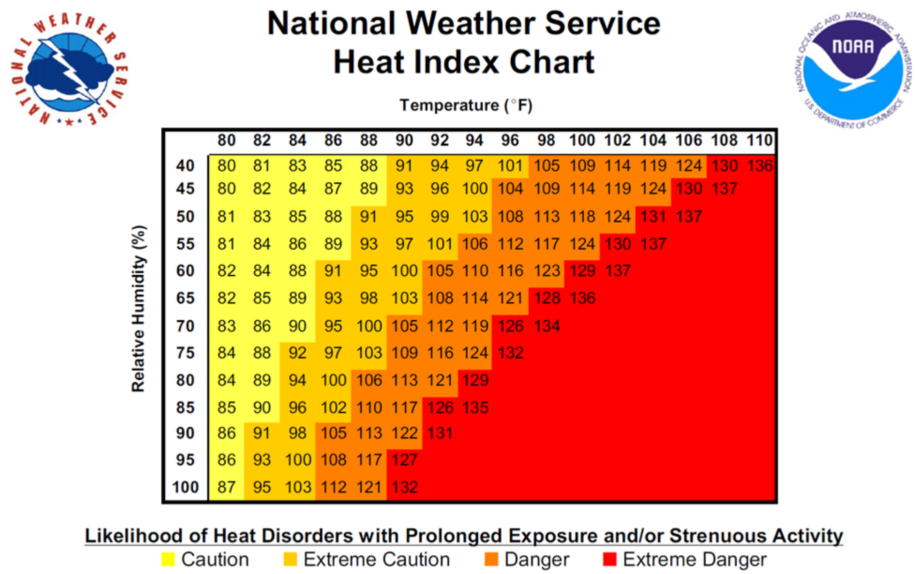
The Heat Index, also known as the Apparent Temperature, is a subjective measure of what it feels like to the human body when relative humidity is factored into the actual air temperature. Relative humidity is a measure of the amount of water in the air compared with the amount of water that air can hold at the current temperature. The body cools itself through the evaporation of perspiration or sweat. However, when the relative humidity is high, the increased moisture content in the air decreases the evaporation of perspiration or sweat. For example, a hot and very humid air mass with a temperature of 94 degrees and a relative humidity of 45 percent yields an apparent temperature of 100 degrees. Holding the temperature constant and increasing the relative humidity to 60 percent yields an apparent temperature of 110° F.

The National Weather Service will initiate alert procedures when the Heat Index is expected to exceed 100° F to 104° F (depending on local climate). Under these conditions, sunstroke and heat exhaustion are likely, and physical activity or being outside for long periods is risky, potentially leading to heat stroke.

These dangerous heat days pose the greatest threat to children and the elderly, and to people who don't have easy access to air conditioning. The Heat Index values were derived for shady, light wind conditions, and exposure to full sunshine can increase heat index values by up to 15°F. (http://www.nws.noaa.gov/om/heat/heat_index.shtml).

From 1979-2022, more than 14,000 Americans have died in the United States from heat related ailments (CDC, 2024). During this period, more people in this country died from extreme heat than from hurricanes, lightning, tornadoes, floods, and earthquakes combined.

"Metropolitan areas and portions of Northern Rhode Island can expect eight to 10 days of temperatures of 90° F or higher. Coastal areas can expect fewer hot days, with an average of one 90° F. Temperatures of 100° F or higher have been recorded in the northern interior occasionally. The highest recorded temperature in Rhode Island was 104° F in 1975" (2024 RI Hazard Mitigation Plan).



Relative Humidity (%)	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
55	81	84	86	89	93	97	101	106	112	117	124	130	137			
60	82	84	88	91	95	100	105	110	116	123	129	137				
65	82	85	89	93	98	103	108	114	121	128	136					
70	83	86	90	95	100	105	112	119	126	134						
75	84	88	92	97	103	109	116	124	132							
80	84	89	94	100	106	113	121	129								
85	85	90	96	102	110	117	126	135								
90	86	91	98	105	113	122	131									
95	86	93	100	108	117	127										
100	87	95	103	112	121	132										

Attachment 2 - Figure 17: Heat Index Chart

Historical Occurrence at North Kingstown and Vicinity

Between 1996 and 2024, there was a total of 1 event with Excessive Heat in Washington County and no fatalities or injuries. Ref. NOAA Storm Events Database.

Estimated Probability of Occurrence at and near North Kingstown

The results indicate that the probability of Excessive Heat near North Kingstown (Washington County) is:

- 3.5% AEP or 22-year recurrence interval (1 years with 1 or more events over 28 years)

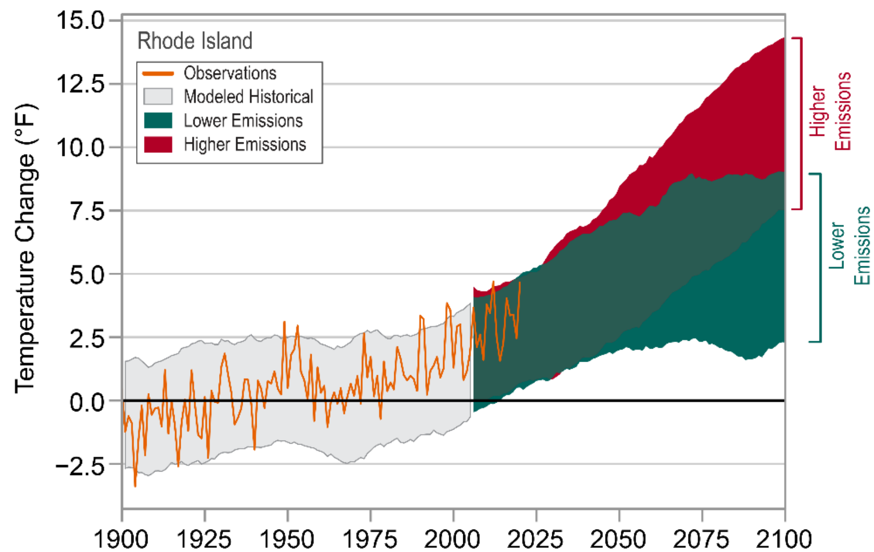
Additional Heat Effects

In addition to the Heat Index, air quality is a significant issue related to extreme temperature. Summers in the U.S. bring more than just searing, dangerously hot days. When the air is stagnant and there is little air circulation, hot weather can trigger high levels of air pollution that can have health consequences. High temperatures on sunny days make ground-level ozone (a major component of smog) form much more readily. An EPA study looking at more than 20 years of measurements across most of the rural areas in the eastern U.S. found that harmful ozone concentrations increased nearly linearly as temperatures increased and named the effect the "climate penalty on ozone."

Effects of Climate Change

The confidence of attribution of Excessive Heat to climate change, and understanding, is high. High global temperatures are affecting temperatures at the local level, including North Kingstown.

"Temperatures in Rhode Island have risen by 4° F since the early 1900s, with the number of hot days above the long-term average since the 1990s. Additionally, the greatest number of warm nights has been recorded over the 2015–2020 period. Very cold days have been mostly below average since the 1980s." "Recent climate modeling results indicate that extreme temperature events may become more common for Rhode Island, especially heat. The following chart indicates the projected temperature change for Rhode Island utilizing two global climate models. One model utilizes information in which greenhouse gas emissions continue to increase (higher emissions), with the other model utilizing information in which greenhouse gas emissions increase at a slower rate (lower emissions). Temperatures in Rhode Island, detailed by the orange line, have risen 4° F since the beginning of the early 1900s. Based on both the higher emission and lower emission models, continued warming is projected throughout this century." (2024 RI Hazard Mitigation Plan).



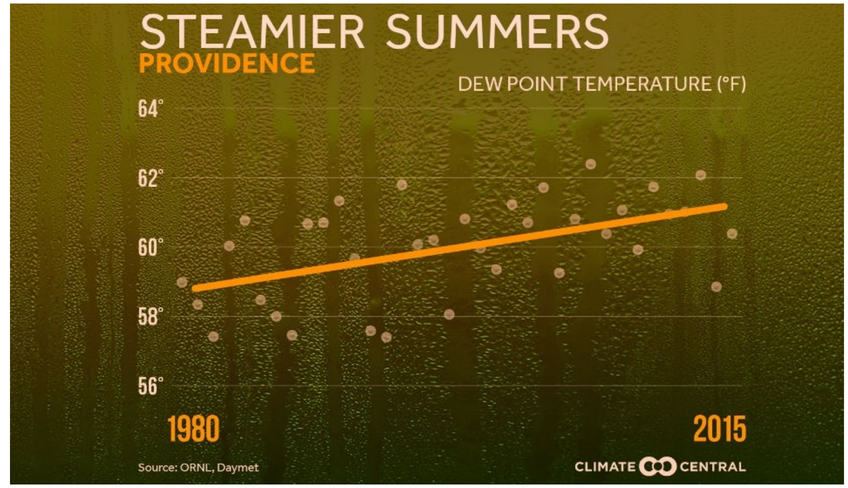
Attachment 2 - Figure 18: Observed and Projected Temperature Change for Rhode Island compared to the 1901–1960 average. (NOAA NCEI State Climate Summaries 2022)

Historically, there have been nine (9) days per year on average with a heat index above 90 degrees Fahrenheit and zero (0) days per year on average with a heat index above 105 degrees Fahrenheit. Heat Index above 90° F would increase to 36 days per year on average by midcentury and 65 by the century's end. A heat index above 105° F would increase to 5 days per year on average by midcentury and 17 by the century's end (Union of Concerned Scientists - Killer Heat in the United States 2019 report).

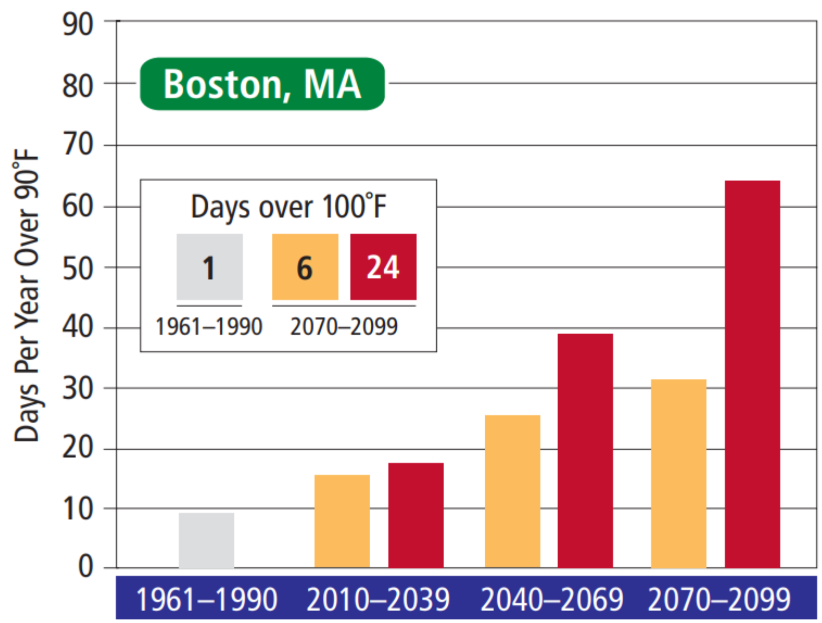
As summers get hotter from the increase in greenhouse gases, they are also getting stickier. More evaporation occurs in a warming atmosphere, and on a world where water covers nearly three-quarters of the surface, it means an increase in water vapor in the air. During the period of 1980 to 2015, the dew point temperature increased from about 59 °F to 61 °F. as presented on **Attachment 2 - Figure 20.**

In addition to the effect of climate change on extreme heat events, the overall increase in global and local temperature averages will significantly change climate patterns within the Northeast U.S., including North Kingstown. Spring will arrive sooner, summers are growing hotter, and the weather is becoming more extreme with swings between above-average winter temperatures to extreme cold with large snowfall events. Per the Union of Concerned Scientists summary reports, if global greenhouse gas emissions continue, the Northeast can expect dramatic temperature increases and other climate changes within the next several decades. Recent observations indicate that these effects are already underway, including within Rhode Island.

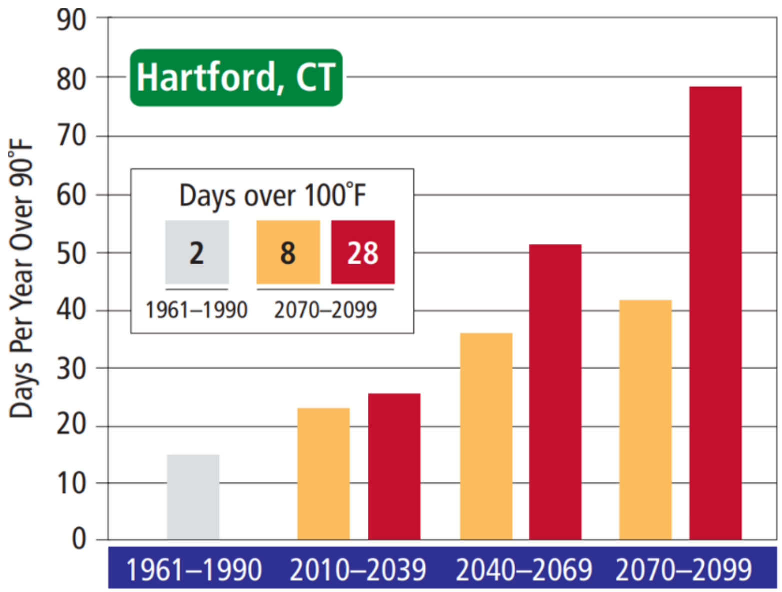
Attachment 2 - Figure 19: Predicted Days above 90° F and 100° F (source Union of Concerned Scientists)



Attachment 2 - Figure 21: Dew point during the period of 1980 to 2015 in Providence, RI (Climate Central Report)



Attachment 2 - Figure 20: Predicted Days above 90° F and 100° F (source Union of Concerned Scientists 2019 Report)



Attachment 2 - Figure 22: Predicted Days above 90° F and 100° F (source Union of Concerned Scientists 2019 Report)

EXTREME TEMPERATURE: COLD

Extreme cold events are generally defined as a prolonged period of excessively cold weather. Extreme cold conditions are often, but not always, part of winter storms. Winter in Rhode Island almost always includes periods of extreme cold weather. Exposure to cold can cause frostbite or hypothermia and has the potential to become life-threatening. Although anyone can suffer from cold-related health issues, some people are at greater risk than others, such as:

- Older adults
- Young children
- Those who are sick; and
- Those without adequate shelter.

Heating sources can be impacted by power failures due to winter storms. Infants and the elderly are more at risk of serious or life-threatening health problems from extreme cold. Secondary hazards may include risk of fires or carbon monoxide poisoning from space heaters, generators, inadequately cleaned or vented fireplaces, or use of candles.

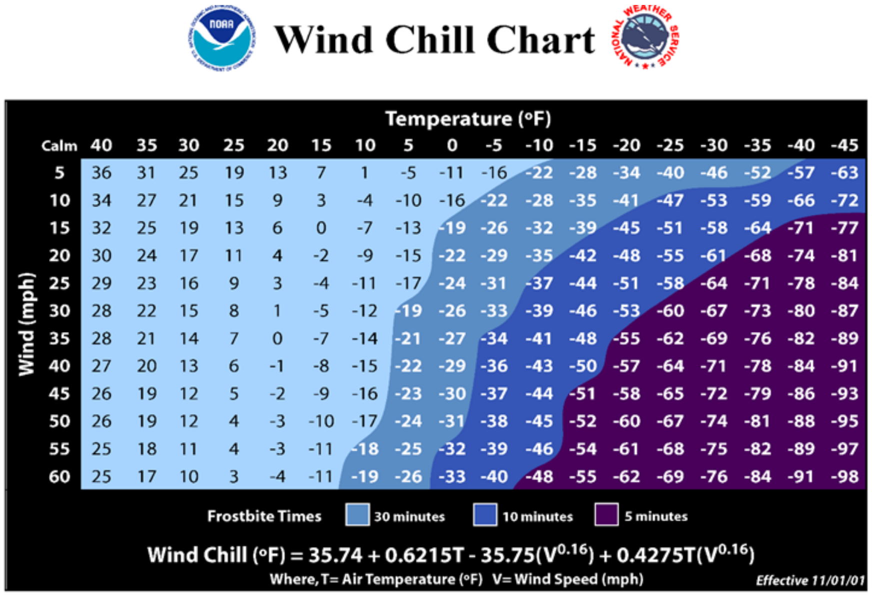
The following extreme cold warnings and advisories are issued by the National Weather Service (NWS):

- Freezing Warning – When minimum shelter temperature drops to 32° F or lower during the growing season.
- Frost Advisory – Issued under clear, light wind conditions with forecast minimum shelter temperature at 33-36° F during the growing season.
- Wind Chill Warning – Wind chill index is -25° F or lower for at least three hours using only sustained wind.
- Wind Chill Advisory - Wind chill index is between -15° F and -24° F for at least three hours using only sustained wind.

The National Weather Service Wind Chill Chart indicates the amount of time in which frostbite may occur on exposed skin based on temperature and wind speed. The National Weather Service maintains a Wind Chill Calculator, which calculated wind chill based on temperature and wind speed, as a period of extremely low temperatures or wind chill temperatures reaching or exceeding locally/regionally defined warning criteria (typical value around -35° F or colder). Ref. http://www.wpc.ncep.noaa.gov/html/windchill.shtml.

The lowest temperature recorded in Rhode Island was -28° F on January 11, 1942, at the Wood River Junction, according to NOAA (https://www.ncdc.noaa.gov/extremes/scec/records).

Nationally, there have been 972 recorded cold fatalities since 1988, with a 10-year average of 30 fatalities/year (80years_2020.pdf weather.gov)



Wind Chill Chart

Wind (mph)	Calm 40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Temperature (°F)

Frostbite Times: 30 minutes, 10 minutes, 5 minutes

Wind Chill (°F) = $35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$

Where, T= Air Temperature (°F) V= Wind Speed (mph)

Effective 11/01/01

Attachment 2 - Figure 23: Wind Chill Chart

Historical Occurrence at North Kingstown and Vicinity

Between 1950 and 2023, Washington County has experienced 2 event days with an Extreme Cold/Wind Chill event. Ref. National Centers for Environmental Information.

Estimated Probability of Occurrence at and near North Kingstown

The results indicate the following Extreme Cold/Wind Chill probability at and near North Kingstown:

- 3% AEP or 37-year recurrence interval
- The average daily minimum temperature in January and February is 19 to 20 over about two- thirds of the State, increasing to near 25° F in immediate coastal sections (RI DEM).

Effects of Climate Change

The confidence of attribution of Extreme Cold to climate change, and understanding, is moderate. It appears that warming trends have weakened polar vortex winds resulted in meandering of these winds. This condition allows cold Arctic air to dip further south, resulting in a variable New England winter with temperatures varying from above-average warm to periods of extreme cold.

Available data suggests that both the average high temperatures and the record high temperature will likely increase over the coming years (NOAA).

DROUGHT

Droughts occur when there has not been enough rainfall and water levels get low, in particular when precipitation and other water resources fall below expectations but the demand for water remains. They can happen anywhere in the United States, and droughts increase the risk of other hazards like wildfires, flash floods, and possible landslides or debris flows. Drought is a slow-onset hazard that can last for months or years. Droughts are generally classified into different types including:

- meteorological drought - lack of precipitation
- agricultural drought - lack of soil moisture
- hydrologic drought - reduced streamflow or groundwater levels.

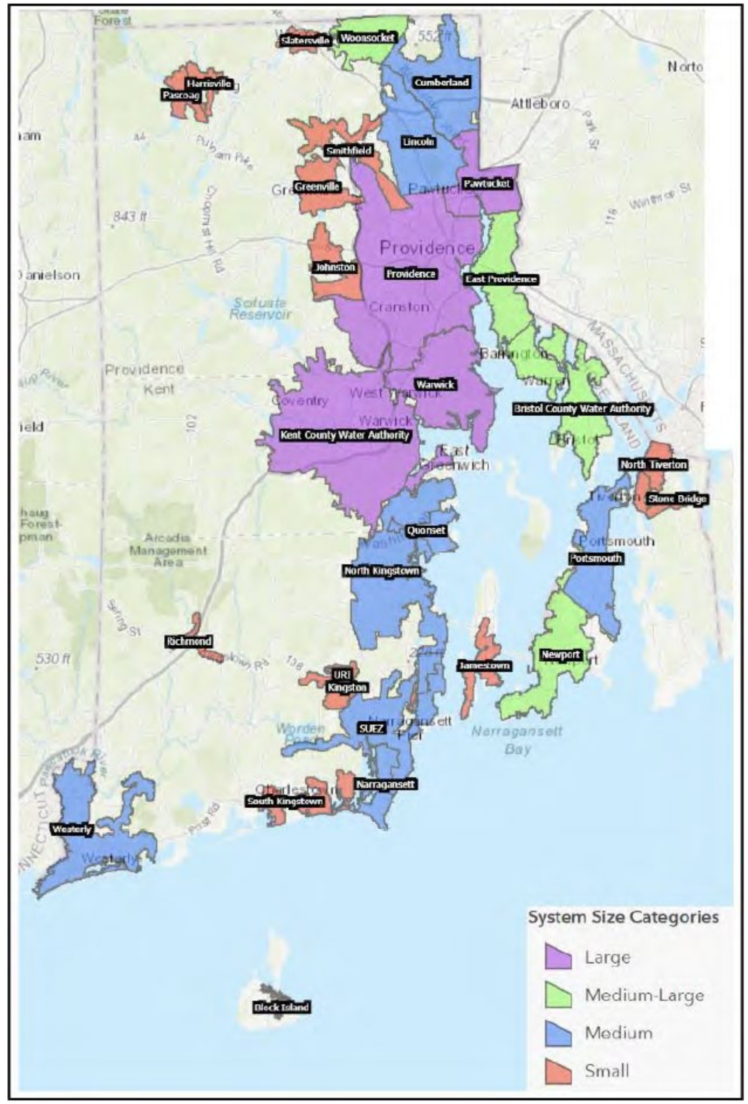
As a hazard, it has the potential to impact many aspects of life, including two of our most important needs: drinking water and food. Because of the long duration of droughts, the impacts can last for years and can ripple through a community over time.

The RI Drought Steering Committee assigns drought levels, for the seven (7) designated drought regions in the state, based on hydrological indices such as precipitation, groundwater, stream flow, and the PDI as well as local supply indices such as static groundwater levels and reservoir levels. North Kingstown is in the Southern Region. The Normal, Advisory, and Watch levels are issued statewide.

A drought in North Kingstown would primarily be felt in the form of lost income to agricultural and tourist industries, damage to wildlife habitat, increased risk of wildfires, and well salinization and residents would also be affected by water use restrictions. Demand Management, System management, Integration of water and wastewater planner and policy, legislative and regulatory considerations are important to the future prevention of droughts.

During the summer of 2002, one-third of the U.S., including Rhode Island, experienced drought conditions. The most severe drought on record in the northeastern United States was during 1961-69. Although it is challenging to compare the intensity and duration of droughts that can last from a couple of months to most of a decade, notable droughts in New England in the past 60 years include 1961–69, 1991, 1995, 1998–2002, 2016, 2020, and 2022 (USGS, Drought 2024).

The following map, from the Rhode Island Water Resources Board, shows water utility coverage for the state.



Attachment 2 - Figure 24: Rhode Island Drought Regions

Historical Occurrence at North Kingstown and Vicinity

Previous drought events in RI have affected the entire state. As is the case in North Kingstown, most of Southern Rhode Island relies on extensive groundwater aquifers for water supply. Precipitation levels vary widely from region to region and from year to year. In Rhode Island, the average yearly precipitation is 42 to 46 inches (RI 2024 HMP).

From 2012 to 2023, the Secretary of Agriculture designated Washington county as a drought disaster area 3 times, in 2016, 2020, and 2022. This declaration makes emergency loans available to producers and designations must be requested by a governor or the governor's authorized representative.

Rhode Island is considered at risk to short-term droughts, which often occur in the summer months and long-term droughts, which on average appear once every eleven years.

Estimated Probability of Occurrence at and near North Kingstown

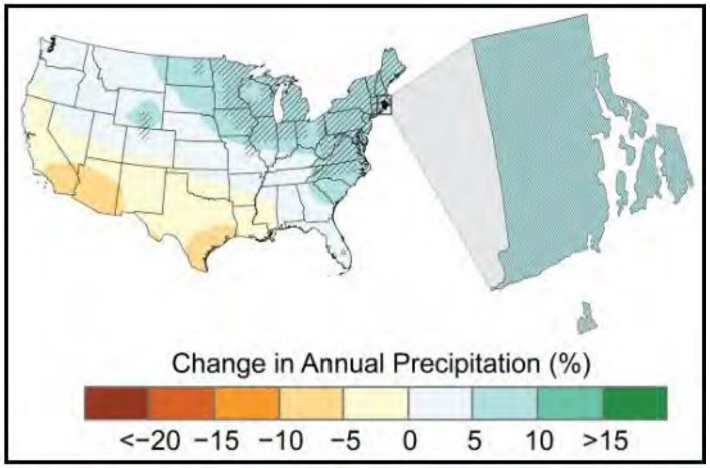
Based on recent drought history (1996 to 2023), Washington County has been impacted by drought during 2 of 28 years. Based on this limited data:

- The probability of Drought near North Kingstown (Washington County) is 7% AEP or 1 event every 14 years.

Effects of Climate Change

The confidence of attribution of Drought to climate change is moderate. Increased air temperatures and evapotranspiration can increase drought potential. In the Northeast U.S, the relationship between increased rainfall intensity and drought is uncertain.

The NOAA State Climate Summary 2022 for Rhode Island suggests that annual average precipitation, as well as extreme precipitation events, are projected to increase for Rhode Island. However, naturally occurring droughts are projected to be more intense because higher temperatures will increase evaporation rates (RI 2024 HMP).



Attachment 2 - Figure 25: Rhode Island Change in Annual Precipitation. Source: NOAA State Climate Summary 2022 for Rhode Island

WILDFIRE

A wildfire is a non-structure/vehicle fire that occurs in undeveloped, wildland vegetated areas, including grass, brush/shrub, and forested areas. Wildfires occur when natural vegetation is ignited naturally, such as by lightning, or by human activity. Sometimes, wildfires are set intentionally for management of vegetation or to limit accidental fire risk. Wildfires may be unnoticed at first. Unnoticed fires often can spread to the urban-wildland interface and threaten developed areas.

Rhode Island's forests are owned and managed by a combination of federal agencies and programs, state agencies and programs, national and local land trusts and other conservation organizations, and private landowners. The 2020 State and Private Forestry Fact Sheet for Rhode Island estimates that approximately 68% of forest land is privately owned and managed by an estimated 38,000 landowners, including conservation organizations and nonprofits. RIDEM permanently protects 73,324 acres of forest land, owning 47,384 acres of forest land in fee, and holding additional interests on 25,940 acres through conservation easements, deeds to development rights, and recreation easements. (RI 2024 HMP)

Historical Occurrence at North Kingstown and Vicinity

Wildfires are a frequent occurrence in Rhode Island but are generally small and quickly contained. The worst year for wildfires was 1930, when 37,400 acres burned. Recent fire occurrences have burned a much smaller acreage due to quicker response times, better spotting practices, and stronger forest management policies.

In April 2023, almost 300 acres were burned in Exeter at the Queen's River Preserve, less than 2 miles away from North Kingstown. This necessitated mutual aid from 54 fire departments, as far away as Connecticut and North Kingstown responded significantly. More details can be found online from the Rhode Island Emergency Management Agency.

As of 2005, almost 50 percent of North Kingstown's total acreage was forested. While this percentage has fluctuated over time, there have been very few wildfire occurrences in the town and none of these have caused great amounts of damage or burned on a large, uncontrolled scale. The two largest fires in North Kingstown's recent history occurred in 1968 and 1974 in the Slocum area. Sparks from the adjacent railroad tracks lit both of these fires, which burned in an area exceeding 500 and 300 acres respectively.

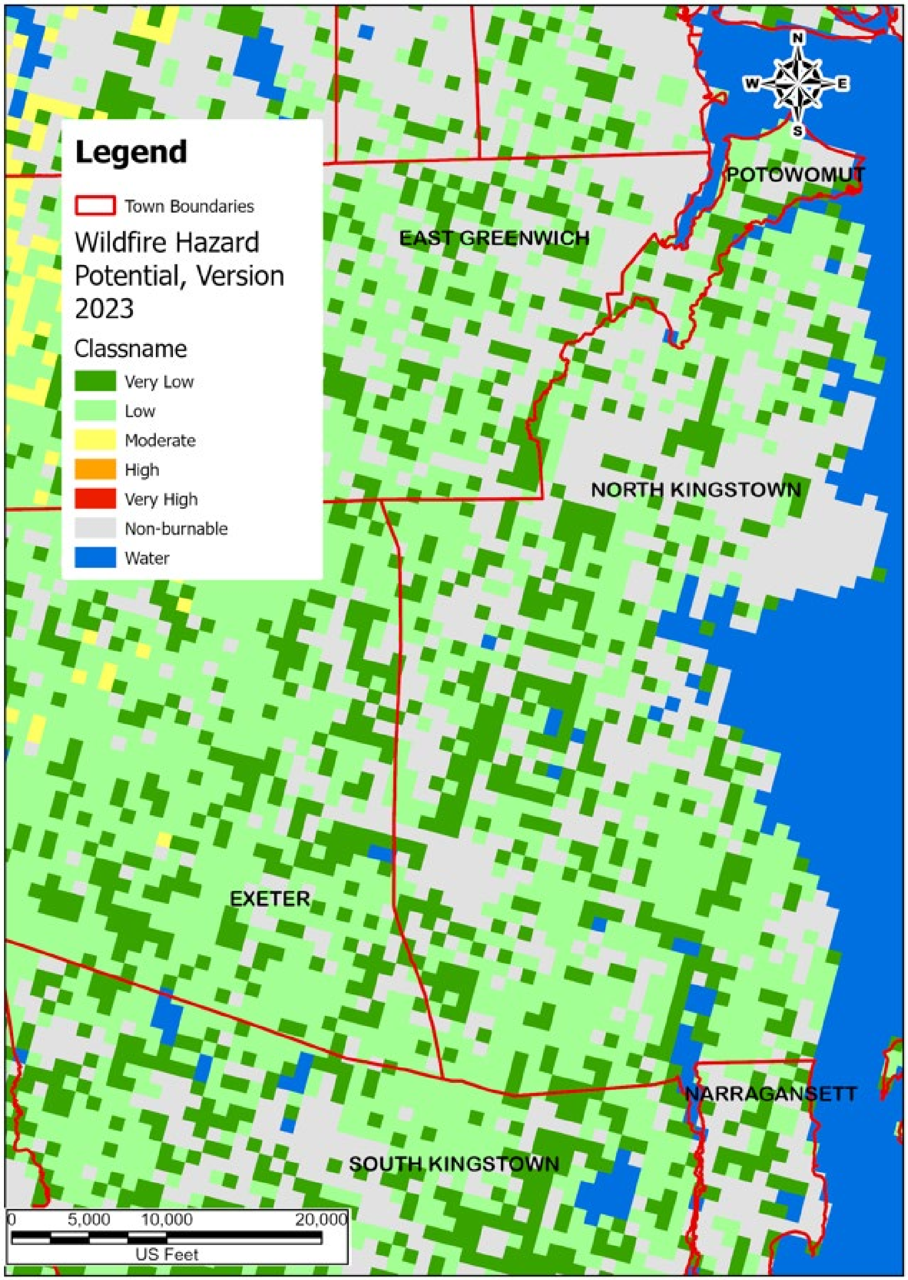
The 2024 RI Hazard Mitigation Plan lists many wildfire events each year occurring throughout the state, with 118 events occurring within Washington County from 2019 to 2023.

Estimated Probability of Occurrence at and near North Kingstown

The historical data indicates that the probability of a large wildfire within North Kingstown is low. The Wildfire Hazard Potential Index, developed by the U.S. Forest Service (**Attachment 2 - Figure 26**) indicates that there is very low wildfire hazard potential in North Kingstown.

Effects of Climate Change

The confidence of attribution of Wildfire to climate change is low. Increased air temperatures and evapotranspiration, as well as increases in drought, can increase Wildfire potential. However, because North Kingstown's land cover type, it is unlikely that a fire would burn out of control and cause significant damage.



Attachment 2 - Figure 26: This map layer portrays the Wildfire Hazard Potential (WHP), developed by the U.S. Forest Service's (USFS) Fire Modeling Institute to help inform assessments of wildfire risk or prioritization of fuels management needs across large landscapes. (arcgis.com)

EARTHQUAKE

Earthquakes occur as the result tectonic activity. An earthquake is sudden ground motion or trembling caused by an abrupt release of accumulated strain acting on the tectonic plates that comprise the Earth's crust along faults. Although earthquakes have caused much less economic loss annually in the United States than other hazards such as floods, they have the potential for causing great and sudden loss. Within 1 to 2 minutes, an earthquake can devastate part of an area through ground-shaking, surface fault ruptures, and ground failures. The location of an earthquake is commonly described by the geographic position of its epicenter and by its focal depth. The focal depth of an earthquake is the depth from the surface to the region where the earthquake's energy originates (the focus). The epicenter of an earthquake is the point on the Earth's surface directly above the focus. The effects of earthquakes are: 1) ground shaking; 2) ground displacement; and 3) loss of soil strength (liquefaction). Ground shaking is represented by the Peak Ground Acceleration (PGA) and spectral acceleration (SA) response. The PGA reflects the ground acceleration at the top of bedrock. Thick deposits of soil over bedrock will modify (typically increase) the acceleration, resulting in ground surface accelerations that are greater than the PGA. Liquefaction is a function of soil type and density. Earthquake intensity is characterized by: 1) the Richter Scale; and 2) the Modified Mercalli Scale. Seismic hazards include damage to structures and infrastructure, landslides, and tsunamis.

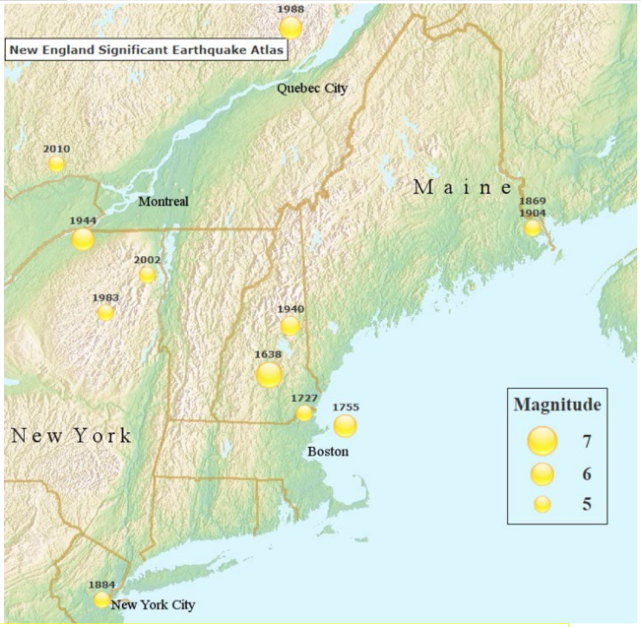
The National Seismic Hazard Maps (NSHM) (and the hazard model from which they are derived) are used by engineers who construct buildings to determine how strongly a particular site might be shaken by earthquakes. The NSHMs compile known earthquake sources, their distance from the site in question, and other seismological and geological information to project potential maximum expected ground motions at a site over a particular period of time (50 years).

Soil deposits above bedrock are classified based on shear wave velocity according to Site Class. Site Class Definitions are presented in **Attachment 2 - Table 17**. The geologic data indicates that the majority of North Kingstown consists of outwash, glacial till or a mix (**Attachment 2 - Figure 31**).

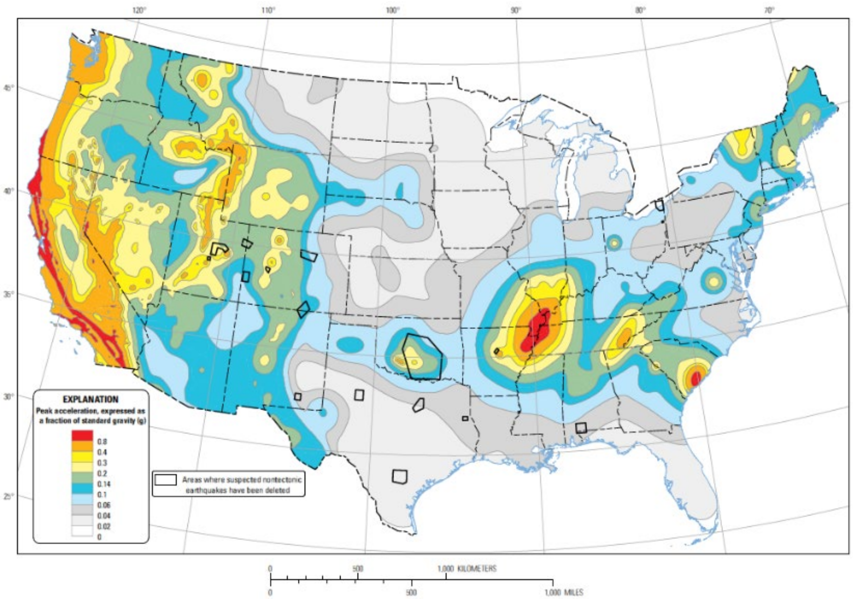
Attachment 2 - Figure 27 presents the significant earthquakes in New England. **Attachment 2 - Figure 28** presents the 2% probability of exceedance in 50 years PGA. The 2% in 50 years PGA in the vicinity of North Kingstown is 0.14g, where g is the acceleration of gravity (32.2 ft/sec^2).

Attachment 2 - Table 16: Richter Scale

Richter Scale	Earthquake Effects
2.5 or less	Not felt or felt mildly near the epicenter, but can be recorded by seismographs
2.5 to 5.4	Often felt, but only causes minor damage
5.5 to 6.0	Slight damage to buildings and other structures
6.1 to 6.9	May cause a lot of damage in very populated areas
7.0 to 7.9	Major earthquake; serious damage
8.0 or greater	Great earthquake; can totally destroy communities near the epicenter



Attachment 2 - Figure 27: Significant Earthquakes in New England http://aki.bc.edu/quakes_historical.htm



Attachment 2 - Figure 28: 2% Probability of Exceedance in 50 years Map of Peak Ground Acceleration

Attachment 2 - Table 17: Site Class Definitions

2010 ASCE-7 Standard – Table 20.3-1
SITE CLASS DEFINITIONS

Site Class	$\bar{v}_s$	$\bar{N}$ or $\bar{N}_{ch}$	$\bar{s}_u$
A. Hard Rock	>5,000 ft/s	N/A	N/A
B. Rock	2,500 to 5,000 ft/s	N/A	N/A
C. Very dense soil and soft rock	1,200 to 2,500 ft/s	>50	>2,000 psf
D. Stiff Soil	600 to 1,200 ft/s	15 to 50	1,000 to 2,000 psf
E. Soft clay soil	<600 ft/s	<15	<1,000 psf
	Any profile with more than 10 ft of soil having the characteristics: • Plasticity index PI > 20, • Moisture content $w \geq 40\%$, and • Undrained shear strength $\bar{s}_u$ < 500 psf		
F. Soils requiring site response	See Section 20.3.1		

North Kingstown, RI, USA
Latitude, Longitude: 41.5568315, -71.4536835

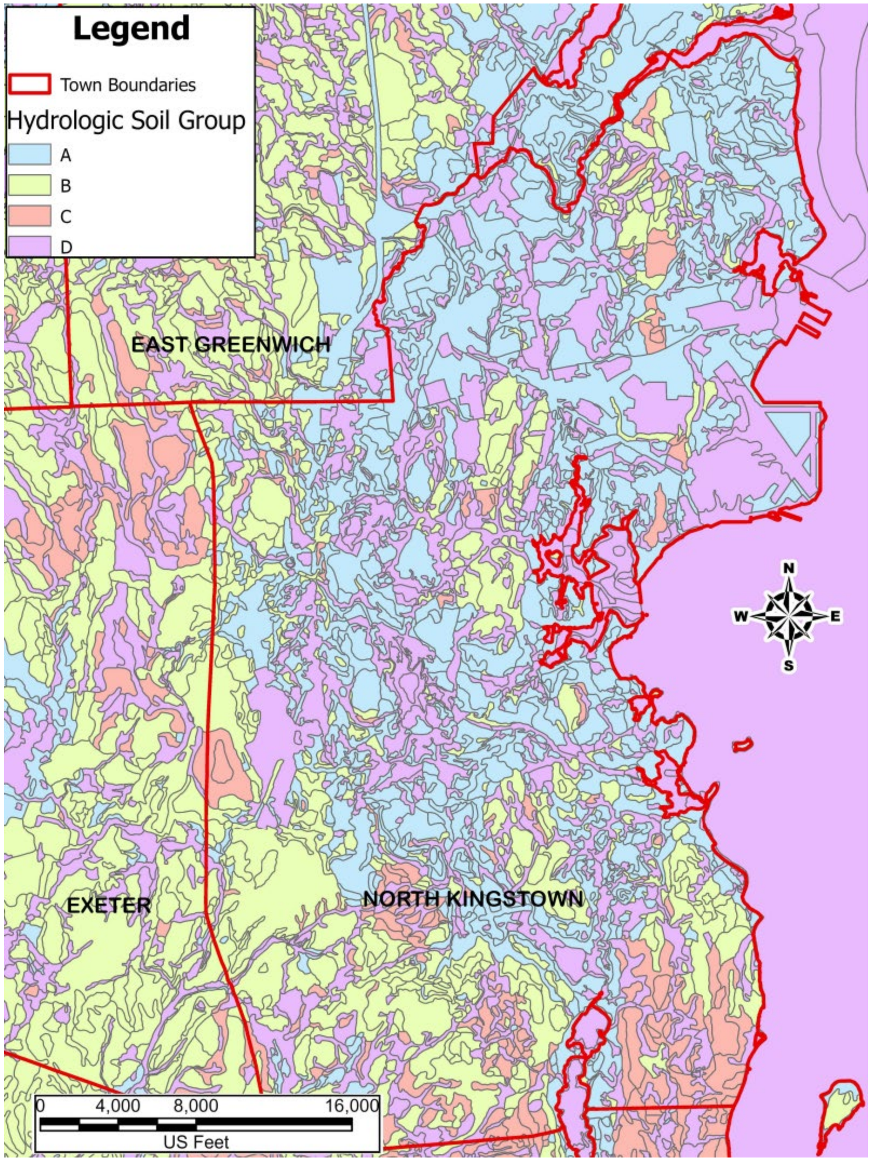
Print

Date	8/23/2024, 8:24:21 AM
Design Code Reference Document	ASCE7-16
Risk Category	II
Site Class	D - Default (See Section 11.4.3)

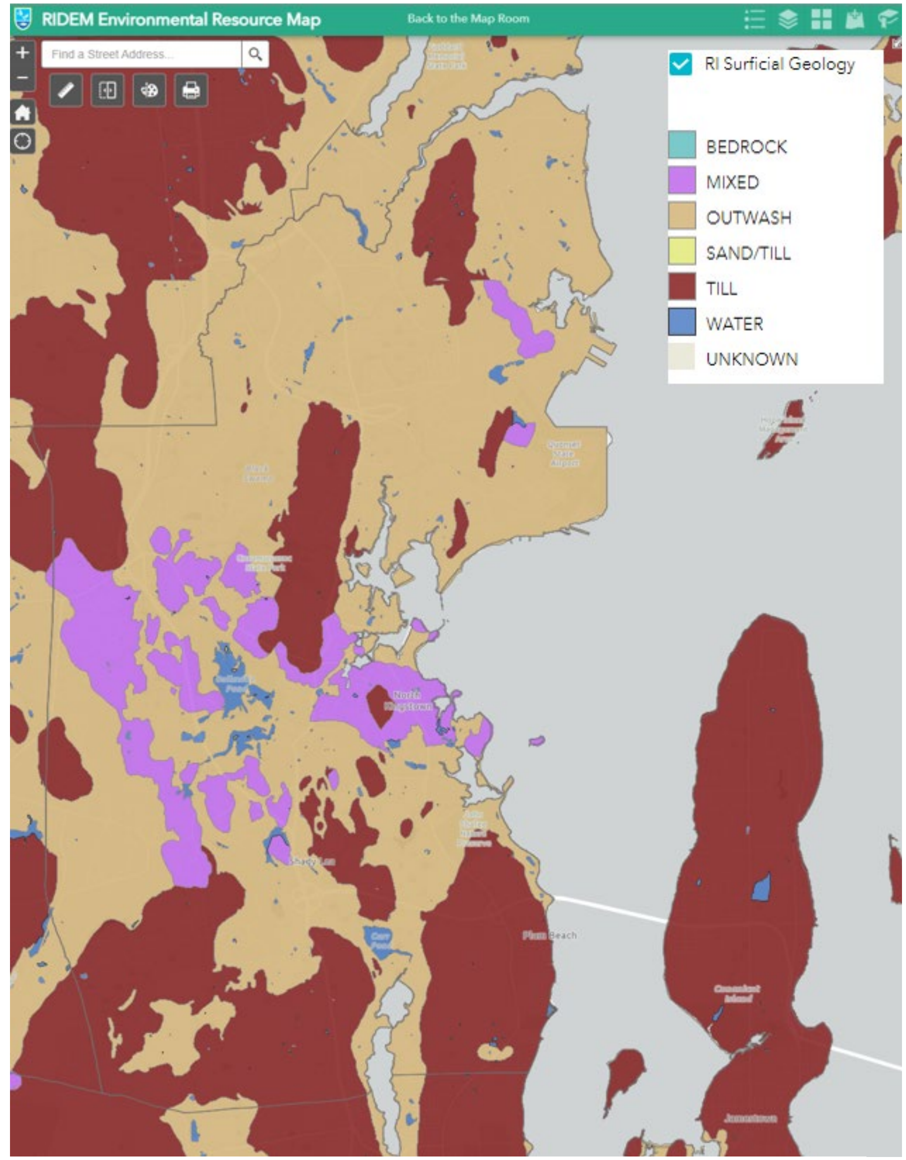
Type	**Value**	**Description**
S_S	0.192	MCE_R ground motion. (for 0.2 second period)
S_1	0.053	MCE_R ground motion. (for 1.0s period)
S_{MS}	0.307	Site-modified spectral acceleration value
S_{M1}	0.127	Site-modified spectral acceleration value
S_{DS}	0.205	Numeric seismic design value at 0.2 second SA
S_{D1}	0.085	Numeric seismic design value at 1.0 second SA

Type	**Value**	**Description**
SDC	B	Seismic design category
F_a	1.6	Site amplification factor at 0.2 second
F_v	2.4	Site amplification factor at 1.0 second
PGA	0.105	MCE_G peak ground acceleration
F_{PGA}	1.589	Site amplification factor at PGA
PGA_M	0.167	Site modified peak ground acceleration
T_L	6	Long-period transition period in seconds
SsRT	0.192	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	0.202	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	1.5	Factored deterministic acceleration value. (0.2 second)
S1RT	0.053	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.057	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	0.6	Factored deterministic acceleration value. (1.0 second)
PGAd	0.5	Factored deterministic acceleration value. (Peak Ground Acceleration)
PGA_{UH}	0.105	Uniform-hazard (2% probability of exceedance in 50 years) Peak Ground Acceleration
C_{RS}	0.949	Mapped value of the risk coefficient at short periods
C_{R1}	0.925	Mapped value of the risk coefficient at a period of 1 s
C_V	0.7	Vertical coefficient

Attachment 2 - Figure 29: USGS Seismic Hazard Report for North Kingstown (https://seismicmaps.org/)



Attachment 2 - Figure 30: NRCS Soil Site Classes at North Kingstown



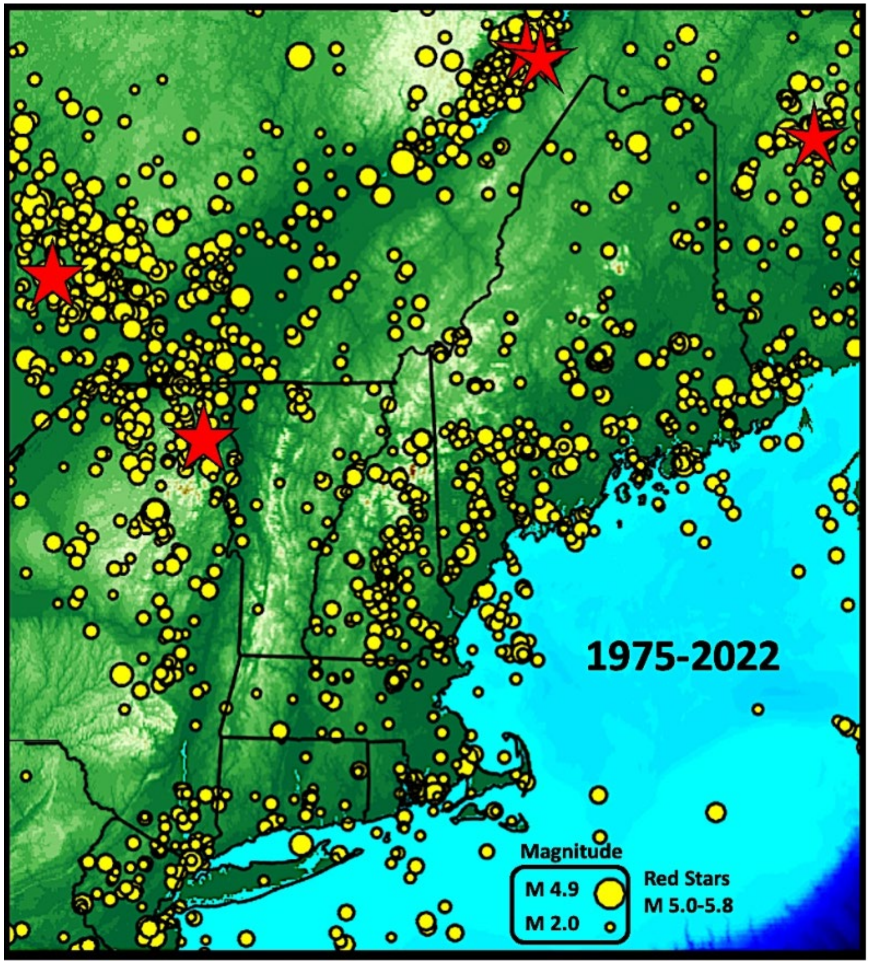
Attachment 2 - Figure 31: Surficial Geology of North Kingstown

Historical Occurrence at North Kingstown and Vicinity

According to the USGS Earthquake Catalog data search, there have been 5 earthquakes of magnitude 2.5 or greater which have occurred in Rhode Island or off the coast since 1974. The largest was a magnitude 3.5 which occurred near Fogland Point in Tiverton in 1976 (https://earthquake.usgs.gov/earthquakes/search/). As show in **Attachment 2 - Figure 32**, there have historically been more significant earthquakes in the vicinity of Rhode Island.

Estimated Probability of Occurrence at and near North Kingstown

- The occurrence of historic earthquakes, PGA, and Site Class indicate that the seismic risk at North Kingstown is low. Amplified ground motion may occur within localized areas within North Kingstown classified as Site Classes D and E. These areas may also be susceptible to liquefaction.



Attachment 2 - Figure 32: Area Earthquakes during 1975 through 2022
Source: Weston Observatory website

ATTACHMENT 3: NATURAL HAZARD RISK

Overview

A Natural Hazard Risk Assessment was conducted by GZA to evaluate the potential consequences of natural hazards to the people, economy, and built and natural environments of the Town of North Kingstown. The risk assessment was performed based on guidance provided by the FEMA Local Mitigation Planning Handbook and included the Local Planning Team (LPT). Two local planning meetings were held on May 14, 2024 and July 23, 2024.

The Natural Hazard Risk Assessment evaluates the effects of the relevant natural hazards (described in **Attachment 2**) on the community assets (identified in **Attachment 1**). The methodology assesses risk in terms of 1) the likelihood (i.e., frequency) of the natural hazard occurring; 2) the predicted effects (damages, losses, etc.); and 3) the consequences (e.g., costs) associated with those effects.

A vulnerability analysis was performed based on historical data and by spatially comparing the hazard data to the community assets. In particular, the vulnerability of the town to flooding was assessed by identifying which assets are located within the FEMA flood zones (Special Flood Hazard Areas).

The FEMA Multi-Hazard MH-HAZUS program was used to evaluate losses due to seismic, flood, and hurricane hazards. The hazards were ranked using a scoring system. The scoring system is based on the likelihood/frequency, severity/magnitude, and potential impact area. The scoring process and results were reviewed by the LPT to assess the town's current "perceived" risk.

Historical Hazard Events

Previous federal Presidential Major Disaster Declarations in Rhode Island were reviewed. FEMA Repetitive Loss Property data within the town was also evaluated.

Presidential Disaster Declarations:

Under the Robert T. Stafford Disaster Relief and Emergency Assistance Act, 42 U.S.C. §§ 5121-5207 (the Stafford Act), a Governor of a State affected by an emergency, or a disaster can submit a request for a declaration by the President of the United States that a major disaster exists. The President can declare a major disaster for any natural event, including any hurricane, tornado, storm, high water, wind-driven water, tidal wave, tsunami, earthquake, volcanic eruption, landslide, mudslide, snowstorm, or drought, or, regardless of cause, fire, flood, or explosion, that the President determines has caused damage of such severity that it is beyond the combined capabilities of state and local governments to respond.

A major disaster declaration provides a wide range of federal assistance programs for individuals and public infrastructure, including funds for both emergency and permanent work (FEMA, "The Disaster Declaration Process", https://www.fema.gov/disaster-declaration-process).

Attachment 3 -Table 1 presents major disaster declarations which have been made since 1954 in Rhode Island (current through August 2024). These disaster declarations included Washington County. Based on the occurrence rate, the expected frequency of major disaster declarations is about 1 every 4 years. Based on past declarations, the most common natural disasters were Severe Weather Hazards, including flooding, winter storms, snowstorms; and hurricanes and tropical storms.

Attachment 3 -Table 1: Major Disaster Declarations in Rhode Island 1954 to 2024

Disaster	Declaration Date
Rhode Island Severe Storms and Flooding (DR-4766-RI) January 9, 2024 - January 13, 2024	March 20, 2024
Rhode Island Severe Storm and Flooding (DR-4765-RI) December 17, 2023 - December 19, 2023	March 20, 2024
Rhode Island Severe Storms, Flooding, and Tornadoes (DR-4753-RI) September 10, 2023 - September 13, 2023	January 7, 2024

Rhode Island Severe Winter Storm and Snowstorm (DR-4653-RI) January 28, 2022 - January 29, 2022	May 12, 2022
Rhode Island Hurricane Henri (EM-3563-RI) August 20, 2021 - August 24, 2021	August 21, 2021
Rhode Island Covid-19 Pandemic (DR-4505-RI) January 20, 2020 - May 11, 2023	March 30, 2020
Rhode Island Severe Winter Storm and Snowstorm (DR-4212-RI) January 26, 2015 - January 28, 2015	April 3, 2015
Rhode Island Severe Winter Storm and Snowstorm (DR-4107-RI) February 8, 2013 - February 9, 2013	March 22, 2013
Rhode Island Hurricane Sandy (DR-4089-RI) October 26, 2012 - October 31, 2012	November 3, 2012
Rhode Island Tropical Storm Irene (DR-4027-RI) August 27, 2011 - August 29, 2011	September 3, 2011
Rhode Island Severe Storms and Flooding (DR-1894-RI) March 12, 2010 - April 12, 2010	March 29, 2010
Rhode Island Severe Storms and Inland and Coastal Flooding (DR-1704-RI) April 15, 2007 - April 16, 2007	May 25, 2007
Rhode Island Blizzard (DR-1091-RI) January 7, 1996 - January 13, 1996	January 24, 1996
Rhode Island Hurricane Bob (DR-913-RI) Aug 19, 1991	August 26, 1991
Rhode Island Hurricane Gloria (DR-748-RI) Sep 27, 1985	October 15, 1985
Rhode Island Snow, Ice (DR-548-RI) Feb 16, 1978	February 16, 1978
Rhode Island Hurricane, Flood (DR-39-RI) Aug 20, 1955	August 20, 1955
Rhode Island Hurricanes (DR-23-RI) Sep 2, 1954	September 2, 1954

Ranking Hazards

The natural hazards were ranked according to the FEMA National Risk Index (FEMA, 2021). The National Risk index is a dataset and online tool that utilizes available natural hazard and community risk factors data to develop a relative risk measurement for counties and census tracts. Its intended use is to help planners and emergency managers at the local, regional, state, and federal level better understand the natural hazard risk of their communities.

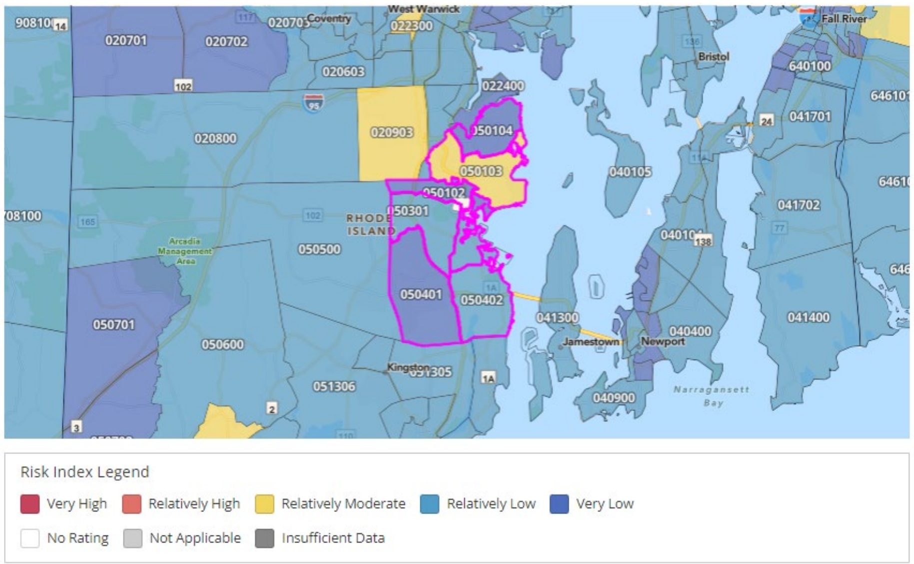
Risk is driven by loss due to natural hazard, social vulnerability, and community resilience. Risk is calculated using the following equation:

$$\text{Risk} = \frac{\text{Expected Annual Loss} \times \text{Social Vulnerability}}{\text{Community Resilience}}$$

The risk index scores are calculated for each natural hazard. The social vulnerability and community resilience scores remain the same for each hazard, while the expected annual loss (EAL) varies by hazard. Social vulnerability is the susceptibility of social groups to the adverse impacts of natural hazards. The score is a relative score and indicates the relative level of a community’s social vulnerability compared to other communities at the same level. Community resilience is the ability of a community to prepare for a natural disaster, adapt to changing conditions, and withstand and recover rapidly from disruptions. Similar to social vulnerability, it is a relative score and represents the community’s relative level compared to other communities at the same level.

The EAL represents the average economic loss in dollars resulting from a certain natural hazard each year. The EAL for each hazard is calculated as the product of exposure, annualized frequency, and historic loss ratio. Exposure represents the value of buildings, population, or agriculture potentially exposed to a natural hazard occurrence. Annualized frequency represents the expected frequency or probability of a natural hazard occurrence per year. Historic loss ratio represents the estimated percentage of the exposed building value, population, or agriculture value expected to be lost due to a natural hazard occurrence.

The FEMA National Risk Index provides risk index scores at county and census tract levels. The report for census tracts included within the town is included in **Attachment 10.** As shown in **Attachment 3 - Figure 1**, the Washington County tract that includes North Kingstown is mostly ranked as “Relatively Low” for the overall risk index. Further breakdown of the risk index for each hazard for the town’s combined census tracts is presented in **Attachment 3 - Table 2**. The details of each natural hazard are presented in **Attachment 2**, including the expected probability of occurrence (i.e., Likelihood/Frequency). A Hazard Vulnerability Assessment was performed to evaluate the expected consequences (i.e., the Severity/Magnitude and Impact Area) of the top ranked hazards. The results of the vulnerability assessment are presented in this Attachment, in order of the hazard rank. There are qualitative ratings associated with each numerical score, ranging from “Very Low” to “Very High”. There are no specific numeric values that determine the rating since the scores are relative to other communities at the same level.



Attachment 3 - Figure 1: FEMA National Risk Index Score for North Kingstown

Attachment 3 -Table 2: Natural Hazard Ranking Results for North Kingstown

Severe Weather Hazards:	**Hazard Index**	**Hazard Rating**
Strong Wind	24.5	Very Low
Tornadoes	27.3	Relatively Low
Hurricanes/Tropical Storms	74.7	Relatively Moderate
Lightning	44.6	Relatively Low
Hail	24.8	Very Low
Coastal Flooding	87.4	Relatively Moderate
Riverine Flooding	71.4	Relatively Moderate
Severe Winter Weather	32.9	Very Low
Ice Storms	64.6	Relatively Moderate
Climate-Related Hazards:		
Heat Wave/ Extreme Heat	18.3	Relatively Low
Cold Wave/ Extreme Cold	44.6	Relatively Low
Drought	35.1	Relatively Low
Wildfire	59.6	Very Low
Geologic Hazards:		
Earthquake	29.5	Very Low
Landslides	37.7	Relatively Moderate

Attachment 3 -Table 2 presents the results of the hazard ranking for the town (FEMA, 2022).

The top ranked hazards include: 1) Coastal Flooding, 2) Hurricanes/ Tropical Storms/ Nor’easters; and 3) Riverine Flooding.

Coastal storm events can cause residential, business and roadway flooding within North Kingstown, with larger events having the potential to greatly effect infrastructure.

Hurricanes, Tropical Storms, and Nor'easters bring coastal flooding from storm surge and waves, as well as inland flooding from rainfall. Strong winds and related damages can also be significant during these events.

Riverine/overbank flooding is a highly ranked hazard due to: 1) flood inundation impacts to buildings; and 2) impacts to transportation infrastructure, especially along the Hunt, Annaquatucket, and Pawcatuck Rivers and tributaries.

Severe winter weather (including greater than 10-inches snowfall) most frequently occur during Nor'easters, coincident with high winds, cold temperatures, and blizzard conditions. They present risks due to transportation impacts (limited use of roadways), cold temperatures (including wind chill) and the potential for structure damage (roof failures). Winter weather has a high annualized frequency.

Failure of the high-hazard dams due to a dam breach is a medium ranked hazard due to the unlikelihood of occurrence, but potential of property damage and loss of life if failure occurs.

Other hazards currently rank medium to low but are expected to become more impactful in the future due to climate change. In particular, these include:

- Extreme temperatures. The frequency and intensity of heat waves is expected to increase in the future. Overall warming will also increase the northern migration of disease vectors such as West Nile Virus and increase the duration and intensity of tick-borne diseases such as Lyme Disease.
- Drought. Droughts are expected to increase in the future with potential impacts to the town's water supply and residential private wells.

For comparison Washington County's hazard risk index ranking within Rhode Island is only the second highest, next to Providence County and the Quonset census tract within North Kingstown has the highest risk index within the State.

Hazard Vulnerability Assessment

As indicated by the past Presidential Major Disaster Declarations (**Attachment 3 -Table 1**), North Kingstown (like most of Washington County and much of Rhode Island) is principally vulnerable to the following frequent severe weather hazards: 1) flooding that occurs during hurricanes, tropical storms and nor'easters; 2) severe winds due primarily to hurricanes and nor-easters, which can occur coincident with flooding; and 3) heavy snowfall during winter nor'easters. Climate change has the potential to amplify the intensity and frequency of each of these hazards.

Although less frequent (or affecting less area), North Kingstown is also vulnerable to: 1) ice storms; 2) wildfire; and 3) lightning. The attribution of climate change to these hazards is not completely understood, however the frequency and magnitude of these events are expected to increase into the future.

Flood Vulnerability

The Town is vulnerable to both coastal and riverine flood events. There are many coastal and inland surface waters throughout the town that present flooding potential. **Attachment 2** presents details about North Kingstown's flood hazards. **Attachment 3 - Figure 2** presents the FEMA special flood hazard areas within North Kingstown.

Municipal Buildings in the Special Flood Hazard Area

Some of the property owned by the Town of North Kingstown is located in the special flood hazard area (SFHA). The North Kingstown Senior Services building and Cold Spring community center are entirely located in the SFHA. The North Kingstown Free Library property is in the SFHA although the library building itself is not. The property home to the public safety building on Post Road is located in the SFHA however the building is not. Only the property surrounding the North Kingstown Town Hall is in the SFHA. The town hall building is in the 0.2% annual chance for flooding, not considered the SFHA. In terms of school properties, while the school buildings themselves are not located in the SFHA, portions of some of the lots on which the schools are located are in the flood zone. The lands surrounding Davisville Middle, Forest Park Elementary, Davisville Academy, Fishing Cove, and the former Wickford Elementary schools contain some portion of the SFHA.

A screening level assessment of flood vulnerability relative to the FEMA 100-year (1% AEP) special flood areas indicates:

Essential Facilities:

- NK Highway Garage: Vulnerable
- NK Town Hall at 80 Boston Neck Road: Vulnerable
- North Kingstown Fire Department Station 3: Vulnerable
- Quonset Fire Department: Vulnerable

Lifeline Systems:

- Water Pollution Control Facility: Not applicable (individual private septic systems may be vulnerable to flooding)
- Power Generation and Transmission: 1 electric substation is vulnerable
- Potable water: 1 groundwater well is vulnerable
- Communications: Not vulnerable

Support, High Occupancy and Vulnerable Population Facilities:

- North Kingstown Senior Center
- North Kingstown Free Library
- First Baptist Church - Wickford
- Old Narragansett Church
- St Paul's Episcopal Church

Transportation Infrastructure:

- Airports: Quonset State Airport
- Public Transit Stations: 8 bus stops vulnerable
- Roads and Bridges: Vulnerable (Certain structures. See below)

Based on the effective FEMA Flood Insurance Rate Map (FIRM), certain state roads in town are vulnerable to flooding, including:

- U.S. Route 1 (Post Road)
- State Route 1A – Especially West Main Street
- State Route 102
- State Route 138
- Hamilton Allenton Road
- Potter Road
- Stony Lane
- Phillips Street
- Many Local Coastal Roadways

A complete discussion of town and state roads that are vulnerable to flooding and sea level rise are outlined in "Adaptation to Natural Hazards & Climate Change in North Kingstown, Rhode Island, 2015." and "Mapping Assets Vulnerable to Sea Level Rise North Kingstown, RI, 2011."

In addition, there are cross-culvert locations that drain surface runoff beneath roadways, which are susceptible to clogging by leaves and debris and which may overtop during heavy rain events and lead to erosion and failure of roadways. Proactive inspection and cleaning of vulnerable infrastructure, especially prior to a potential flood event, can increase flood mitigation measures and reduce flooding.

High Potential Loss Facilities:

- Failure of the high-hazard dams due to a dam breach is a medium ranked hazard due to the unlikelihood of occurrence, and potential loss of life. The high hazard dams in North Kingstown are:
    - Silver Spring Lake Dam

- Carr Pond Dam
- Rodman Mill Dam
- Slocum Woods Dam
- Slocum Road Upper Dam
- Shady Lea Mill Dam

National Flood Insurance Program (NFIP) Repetitive Losses

According to the FEMA Flood Insurance Manual, Effective April 2024, a Repetitive Loss Structure is defined as a "NFIP-insured building that has incurred flood-related damages on two occasions during a 10-year period ending on the date of the event for which the insured makes a second claim. The cost of repairing the flood damage, on average, must equal or exceed 25 percent of the market value of the building at the time of each flood", and a Severe Repetitive Loss Building is any building that:

1. Is covered under a Standard Flood Insurance Policy made available under this title;
2. Has incurred flood damage for which:

- 4 or more separate claim payments have been made under a Standard Flood Insurance Policy issued pursuant to this title, with the amount of each such claim exceeding $5,000, and with the cumulative amount of such claims payments exceeding $20,000; or
- At least 2 separate claims payments have been made under a Standard section 7Flood Insurance Policy, with the cumulative amount of such claim payments exceed the market value of the insured building on the day before each loss.

As of April 2025, there are 16 Repetitive Loss Properties (RLP) within the Town of North Kingstown, 12 of which are Residential and 4 are Non-Residential, per OpenFEMA Dataset: NFIP Multiple Loss Properties.

Attachment 3 -Table 3 provides an overview of NFIP information for the Town of North Kingstown as provided by the Rhode Island NFIP Coordinator. FEMA maintains a database on these flood insurance policies and claims.

Attachment 3 -Table 3: North Kingstown Flood Insurance Policies and Claims

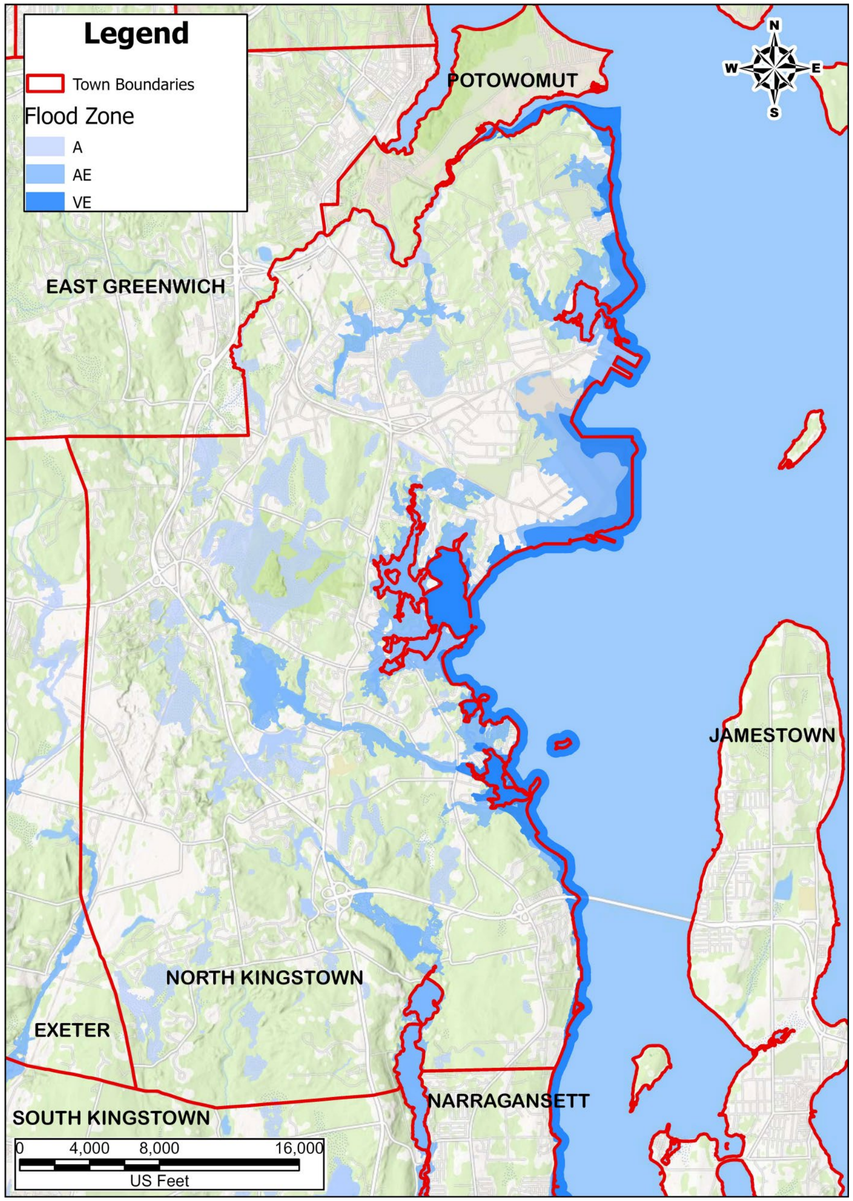
Item	(as of 9/10/2024)
Flood insurance policies in force	652
Coverage amount of flood insurance policies	$196,968,000
Premiums paid	$735,196

Flood Risk Summary

As presented on the previous pages, some town offices, and portions State Route 1A, and the Quonset Fire Department which provide essential services are located within the FEMA 100-year flood zone, mostly associated with Narragansett Bay and the Atlantic Ocean.

Likelihood/Frequency

While flooding can occur more frequently at North Kingstown, significant flood events are associated with the 1% AEP.



Attachment 3 - Figure 2: FEMA Special Flood Hazard Areas (SFHAs)

Legend: Blue shaded area indicates FEMA Base Flood inundation area (100-year recurrence interval)

Severity/Magnitude

As part of the Plan preparation, GZA completed a Level 1 HAZUS-MH damage analysis for flood scenario (based on FEMA flood hazard delineation). The results are presented at the end of this Attachment. The results predict about $454M to $1,794M building and content damage for the 1% AEP (100-year recurrence interval) and the 0.2% (500-year recurrence interval flood, respectively.

Flooding is a top-ranked hazard due to: 1) potential flood inundation impacts to buildings within the town and high associated economic losses; and 2) impacts to transportation infrastructure.

As noted in **Attachment 3 -Table 3**, there are currently 652 NFIP-subsidized flood insurance policies in place. The Level 1 HAZUS scenario analyses identified 194 and 562 buildings vulnerable to flood damage (ranging from slight to substantial) for the 1% AEP and 0.2% AEP floods, respectively. Substantial damage will trigger specific flood regulations within the State Building Code, requiring that building repair or replacement be in compliance with current flood regulations.

Impact Area:

- 1,130 buildings are predicted to be impacted during the 1% AEP flood. This number represents 10.1% of the total number of buildings in the town.
- 2,020 buildings are predicted to be impacted during the 0.2% AEP flood. This number represents 18% of the total number of buildings in the town.

Strong Winds/ Tornadoes

North Kingstown is vulnerable to severe wind events due to hurricanes and tropical storms, nor'easters, thunderstorms and tornadoes. **Attachment 2** presents details about North Kingstown's wind hazards. Severe winds at North Kingstown occur most frequently due to hurricanes and tropical storms which can occur coincident with heavy precipitation and flooding. Severe winds can also occur at North Kingstown, although rarely, during tornadoes and more frequently during severe thunderstorms. High winds can also occur, frequently, during nor'easters (along with heavy rain and snow).

Likelihood/Frequency

The annual exceedance probability of experiencing High Winds within Washington County is near 100% AEP or 1-year recurrence interval.

A total of 2 days with tornadoes were reported in Washington County for the period of record between 1950 and 2024, according to the NOAA Storm Events Database

Severity/Magnitude

Damages due to severe winds include: 1) damage to trees, often resulting in power outages and also potentially fatal accidents related to treefalls; 2) structure damage. **Attachment 3 -Table 4** presents the typical physical effects associated with different wind speeds. As shown on **Attachment 3 -Table 4**, significant, widespread damage can be expected due to sustained wind speeds of about 74 mph or greater.

As part of the Plan preparation, GZA completed a Level 1 HAZUS-MH damage analysis for hurricane scenario. The results are presented at the end of this Attachment. The results predict about $92.7M to $490.7M building and content damage for the 1% AEP (100-year recurrence interval) and the 0.2% (500-year recurrence interval flood, respectively, for the town.

Impact Area

The Level 1 HAZUS scenario analyses identified 1,899 buildings (17% of total buildings) and 4,844 buildings (43% of total buildings) vulnerable to wind damage (ranging from minor to destroyed) for the 1% AEP and 0.2% AEP, respectively, for the town.

Attachment 3 -Table 4: Physical Effects associated with different wind speeds

Sustained Wind Speed	Annual Recurrence Interval (years)	Physical Effects
6-38 kts (30-44 mph)	<1	Trees in motion. Light-weight loose objects (e.g., lawn furniture) tossed or toppled.
39-49 kts (45-57 mph)	2 to 10	Large trees bend; twigs, small limbs break, and a few larger dead or weak branches may break. Old/weak structures (e.g., sheds, barns) may sustain minor damage (roof, doors). Building partially under construction may be damaged. A few loose shingles removed from houses. Carports may be uplifted; minor cosmetic damage to mobile homes and pool lanai cages.
50-64 kts (58-74 mph)	10 to 70	Large limbs break; shallow rooted trees pushed over. Semi-trucks overturned. More significant damage to old/weak structures. Shingles, awnings removed from houses; damage to chimneys and antennas; mobile homes, carports incur minor structural damage; large billboard signs may be toppled

65-77 kts (75-89 mph)	70 to 300	Widespread damage to trees with trees broken/uprooted. Mobile homes may incur more significant structural damage; be pushed off foundations or overturned. Roof may be partially peeled off industrial/commercial/warehouse buildings. Some minor roof damage to homes. Weak structures (e.g., farm buildings, airplane hangars) may be severely damaged.
78+ kts (90+ mph)	>300	Many large trees broken and uprooted. Mobile homes severely damaged; moderate roof damage to homes. Roofs partially peeled off homes and buildings. Moving automobiles pushed off dry roads. Barns, sheds demolished.

Dam Failure

There are six high hazard potential dams within North Kingstown, including Silver Spring Lake Dam, Carr Pond Dam, Rodman Mill Dam, Slocum Woods Dam, Slocum Road Upper Dam, and Shady Lea Mill Dam. There are three significant hazard potential dams within North Kingstown, including Hamilton Reservoir Dam, Belleville Pond Dam, and Secret Lake Dam.

High and Significant hazard dams are required by the Rhode Island Department of Environmental Management (RIDEM) to have Emergency Action Plans (EAPs) to assist public safety personnel before, during, and after an uncontrolled release of water at the dams. The Town of North Kingstown Emergency Management should have copies of each EAP, if available.

The EAP establishes the guidelines and procedures for addressing emergency conditions identified at the dam in time to take mitigative action such as notifying the appropriate emergency management officials of potential, impending, or active failing of the dam. Emergency conditions are generally identified by dam inspections (formal or casual) or triggered by unusual rainfall events or an earthquake. Identification of hazardous condition should be reported to the dam owner or to public safety personnel via 911 to initiate the notification process based on the Notification Flowchart (NFC) listing the personnel to be called and their phone numbers in case of emergency. The reader is referred to each dam's EAP for detailed information regarding these procedures.

Each EAP contains a Notification Flowchart (NFC) and Emergency Level Determination: The NFC indicates the chain of communication to be followed in the event of an emergency. There are different NFCs based on three emergency levels as determined necessary based on the judgement of the personnel monitoring the emergency condition at the dam. The three emergency conditions outlined in the EAP are as follows:

- Emergency Level 1: "Non-Emergency, Unusual Event, Slowly Developing": This situation is not normal but has not yet threatened the operation or structural integrity of the dam, but possibly could if it continues to develop. The condition of the dam should be closely monitored, especially during storm events, to detect any development of a potential or imminent dam failure situation.
- Emergency Level 2: "Potential Dam Failure Situation, Rapidly Developing": This situation may eventually lead to dam failure and flash flooding downstream, but there is not an immediate threat of dam failure. The dam owner/operator should closely monitor the condition of the dam and periodically report the status of the situation through Level 2 of the Notification Flowchart.
- Emergency Level 3: "Urgent; Dam Failure is in Progress or Appears to be Imminent": This is an extremely urgent situation when a dam failure is occurring or obviously about to occur and cannot be prevented. Flash flooding will occur downstream of the dam. This situation is also applicable when flow through the earth spillway is causing downstream flooding of people and roads.

General Responsibilities: The EAP includes specific emergency response actions for each emergency Condition to be carried out by the responsible local and state authorities. Decisions that are made should be made in accordance with the Incident Command Structure outlined in the EAP. Notification of local authorities is primarily the responsibility of the dam owner, depending on the identified emergency Condition as outlined in Section 5 of the EAP.

Evacuation Lists: The EAP includes a list of property lots and coordinates that would be notified in the event of an emergency.

Preparedness: The most important part of the EAP is the identification of a problem at the dam. The EAP notes that problem identification will be much easier if the dam is monitored closely by knowledgeable personnel. Maintenance District personnel must continue to monitor the dam on a regular basis. This is especially important during high rainfall events and during spring conditions when a large amount of snow melting occurs.

Each EAP also contains inundation mapping displaying the anticipated area subject to flooding in the event of dam failure. The inundation maps may consist of an overall index map and finer-scale resolution maps.

The dam failure inundation areas often include separate areas for failure during a flood and failure during a sunny day. Generally, the inundation areas close to the dam are larger than FEMA's Base Flood. Dam failure is often considered a potential low probability, high consequence type event. The reader is referred to the dam's EAP for more information.

Risks and Vulnerabilities from High Hazard Potential Dams (HHPDs)

Cascading impacts to the Town's High Hazard Potential Dams (HHPDs) can be attributable to hydraulic loading and over-topping, aging, deterioration, and inadequate maintenance. The Town of North Kingstown does not own any High Hazard Dams but has worked with the owners of all the HHPDs in town through the development and management of their associated Emergency Action Plans (EAPs). This includes awareness and responsible actions relative to upkeep and forecasted storm events. Dialogue and outreach with dam owners has also allowed us to address the aging, deterioration and inadequate maintenance concerns of their dams and potential downstream cascading impacts resulting from dam failure. The EAPs contain important information relative to potential downstream effects of a dam break, as well as Tables listing specific downstream developments or infrastructure. The downstream effects are summarized below and Tables attached for further detail.

Dam Name	RI Dam No.	Hazard	River
Rodman Mill	615	High	Annaquatucket
Bellville Pond	553	Significant	Annaquatucket
Secret Lake	704	Significant	Annaquatucket
Hamilton Reservoir	550	Significant	Annaquatucket
Silver Spring Lake	444	High	Mattatuxet
Carr Pond	513	High	Mattatuxet
Slocum Woods	693	High	Chipuxet
Slocum Road Upper	710	High	Chipuxet

All the dams studied as part of the EAP program are associated with riverine areas that have also been studied and mapped by FEMA, through their National Flood Insurance Program (NFIP). Flood designated areas developed from these FEMA modeling studies have been codified by the Town of North Kingstown through local Ordinances and Building Codes. Resulting flood hazard limitation districts impose minimum development restrictions in areas of flooding, ensuring suitable building sites and buildings constructed above regulated flood elevations. This has allowed the Town to regulate development in areas of riverine flooding, from either dam failure inundation or natural disasters, as FEMA flood zones coincide and overlay dam inundation flood zones, in all but two areas. The two exceptions, which are small upstream tributaries to a river modeled in the NFIP program (Chipuxet), are addressed below. EAP Inundation maps and FEMA NFIP Flood Maps have been included for clarity. An assessment of risks and vulnerabilities primarily focuses on HHPDs but include reference to Significant Hazard Dams because of their relative location to HHPDs, potential cascading impacts and adjacent riverine benefits.

The HHPDs in the Town of North Kingstown are essentially located along the reach of three rivers, the Annaquatucket, Mattatuxet and tributaries to the Chipuxet. All three rivers have been mapped through FEMA's National Flood Insurance Program. As mentioned, all but two of the HHPDs fall within flood study areas of the National Flood Insurance Program. These three rivers and associated impacts from flooding are discussed below. Mapping is provided that locates the dams, associated riverine features, infrastructure, inundation and storm event hydraulic flooding limits, and environmental areas of impact.

The Annaquatucket River in the Town of North Kingstown contains one high hazard and three significant hazard dams along its reach to Narragansett Bay. The four structures include Rodman Mill Dam, Bellville Pond Dam, Secret Lake Dam and Hamilton Reservoir Dam. Secret Lake Dam is located on a minor tributary to the Annaquatucket, with its confluence with the Annaquatucket just downstream from the Bellville Pond Dam and is mentioned only in context of potential cascading impacts. EAP information documents moderate to high population density downstream from these structures.

The Rodman Mill Dam is the only HHPD on this river and is at the highest hydraulic point of the stream reach in question. The Rodman Mill Dam EAP states that a flood wave generated from failure of this structure would most likely dissipate quickly and generally remain within the stream banks. With Bellville Pond located about 1,500 feet downstream from the Rodman Mill Dam, and the recent rehabilitation of the Bellville Pond Dam, the inundation surcharge created from a breach of the Rodman Mill Dam would be managed by the Bellville Pond. Rodman Mill Dam has only one area of concern with a potential dam breach, being a day care facility immediately downstream.

Parking lot flooding and potential structural damage to an adjacent mill building are also mentioned in the EAP. The day care facility is alerted by the town's Public Safety Director whenever there are concerns with Rodman Mill Dam.

Should a cascading impact occur from hydraulic loading from a Rodman Mill Dam breach, the EAP's for the downstream structures (Significant Hazard Dams) provide information on risks and vulnerabilities. From Bellville Pond to the mouth of the Annaquatucket River, flooding and inundation would generally remain in the stream banks, create shallow flooding on the overbanks and adjacent wetlands, and fully dissipate within Bissell Cove. However, shallow flooding impacts would result to five homes and a commercial building downstream from the Bellville Pond Dam on Sweet Lane, with anticipated overtopping and damage to the Hamilton Reservoir Dam (US Route 1), as well as shallow flooding of the Hamilton Harbor residential complex and property along Bates Avenue downstream from the Hamilton Reservoir Dam. Mapping from the attached USGS and Inundation maps show relatively few structures directly adjacent to or partially within the inundation and FEMA flood zones, except for flood zones between Route 1 and Narragansett Bay. It is important to note that the most significant flooding impact to this residential and commercial area is from FEMA coastal flooding and impacts from its VE Flood Zone and not dam failure. Throughout its reach in North Kingstown, the inundation flood zone is within the FEMA flood zone area.

The upper reaches of the Mattatuxet River are in the Town of North Kingstown, where there are two HHPDs, Silver Spring Lake Dam on Silver Spring Lake and Carr Pond Dam on Carr Pond. The Mattatuxet empties into the Pettaquamscutt River, just to the south of Carr Pond Dam (Carr Pond), and at a location of tidal flooding. Silver Spring Lake Dam is owned by the State of Rhode Island.

With Carr Pond Dam's proximity to the tidally influenced Pettaquamscutt River (appr. 1000 ft. apart), inundation from a dam breach would attenuate quickly. A dam breach would most likely overtop Gilbert Stuart Road and significantly damage the Gilbert Stuart Museum building. Damage to Gilbert Stuart Road would be less than documented in the EAP because of recent improvements made to the road and culvert just downstream of Carr Pond Dam. Adjacent population density is low with significant wetlands adjacent to this final reach of the Mattatuxet River. Any residential structures located adjacent to inundation waters would also fall within tidal flood zones and regulated by Town Flood Ordinances.

Silver Spring Lake Dam is adjacent to a moderate population density along Shady Lea Road. A mill complex and a few older residential homes along Shady Lea Road are adjacent to and partially within the inundation and FEMA flood zones. These structures are vulnerable to damage from a dam breach, and their residents are alerted by the Town's Public Safety Director when there are concerns with the Silver Spring Lake Dam. The remainder of the homes in this area of concern were built following the approval of Town flood ordinances and are outside of the inundation and flood zones. The remainder of the reach of the Mattatuxet River between the two dams in question is located within an expanse of wetlands. The Mattatuxet River crosses two State limited access highways downstream of the Silver Spring Lake Dam, both of which are expected to be overtopped from inundation flooding.

The Slocum Woods Dam and Slocum Road Upper Dam are located on tributaries to the Chipuxet River, less than one mile from their confluence with the Chipuxet River. Both dams are HHPDs and discharge into a section of the Chipuxet River that is located in South Kingstown and regulated by NFIP local flood ordinances. Both dams are also located in agricultural areas with low density residential. Immediate downstream areas from these dams consist of uninhabited woods, wetlands, and agricultural turf farms. There are several residential structures downstream, adjacent to the confluence of the Chipuxet River and located in South Kingstown, that are vulnerable to serious flooding. It is also expected that a dam break inundation wave could overtop Slocum Road. Cascading impacts further downstream and outside the Town of North Kingstown's jurisdiction are not addressed but fall within a FEMA study area and zones of local building and development oversight.

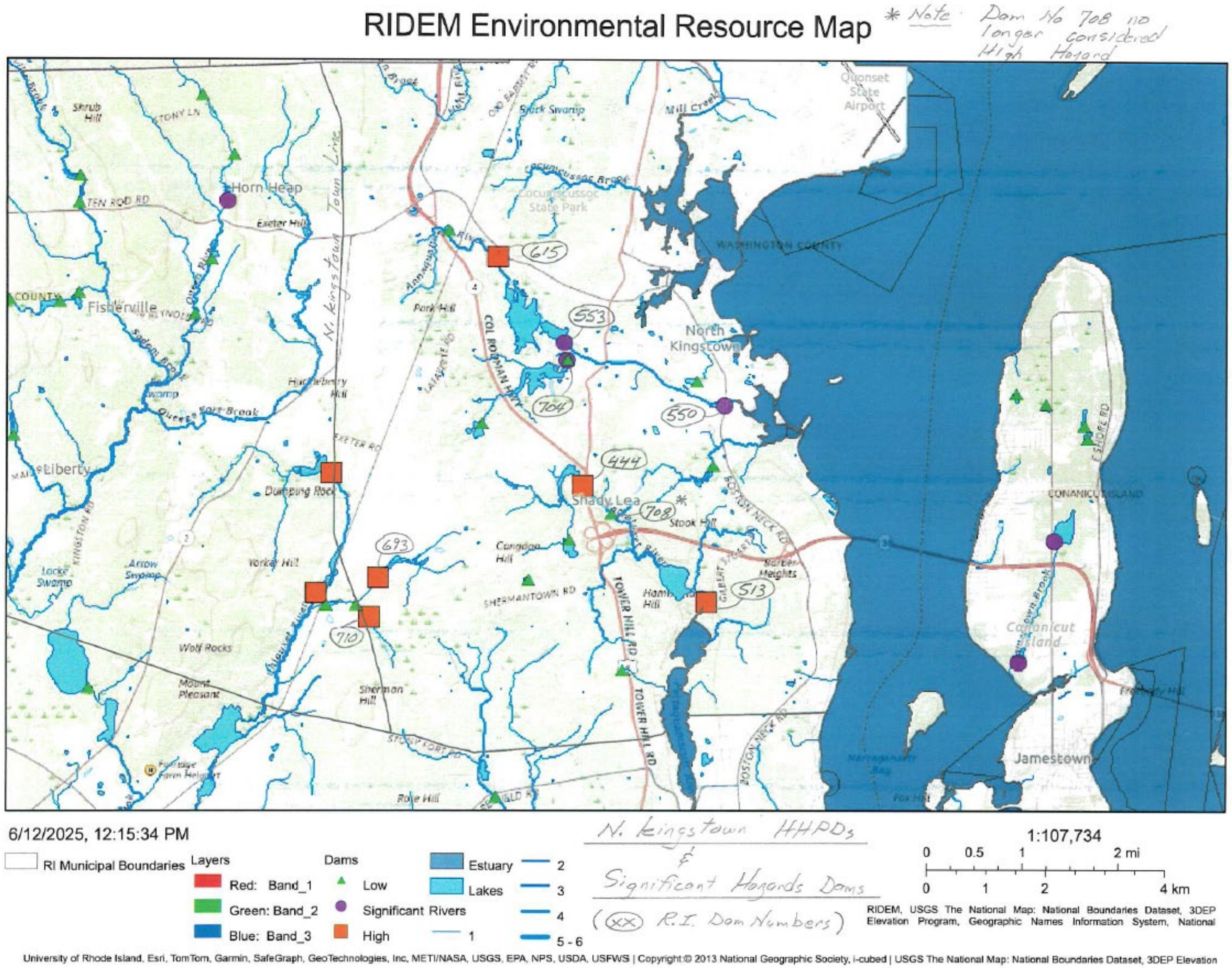


Figure 3-3: North Kingstown HHPDs and Significant Hazard Dams

Ice Storms/ Severe Winter Weather

North Kingstown is vulnerable to ice storms. An Ice Storm is a freezing rain situation (rain that freezes on surface contact) with significant ice accumulations of 0.25 inches or greater.

North Kingstown is also vulnerable to snowstorms, usually associated with nor'easters. The U.S. Northeast annually experiences about 20 to 40 nor'easters. Beginning in October and ending in April, the nor'easter season runs for seven months. Out of the 20 to 40 annual storms, at least two are severe. **Attachment 2** presents details about North Kingstown's severe winter weather hazards.

Heavy accumulations of ice can bring down trees and topple utility poles and communication towers. Ice can disrupt communications and power for days while utility companies repair extensive damage. Even small accumulations of ice can be extremely dangerous to motorists and pedestrians. Bridges and overpasses are particularly dangerous because they freeze before other surfaces (National Weather Service).

Damages due to severe winter weather include: damage to trees, often resulting in power outages and also potentially fatal accidents related to treefalls; structure damage, including roof collapse; and roadway issues including access limitations and vehicular accidents.

Likelihood/Frequency

Between 1996 and 2024, there were a total of 37 Heavy Snow event days in Washington County, with 3 days with property damage of $141,000 reported and no injuries or fatalities.

There were no (0) Ice Storm event days recorded in the NOAA Storm Events Database for Washington County or the State of Rhode Island between 1950 and 2024.

Severity/Magnitude

The severity/magnitude of severe winter weather is a function of the type of vulnerability. Winter weather vulnerabilities generally include: 1) building damage (e.g., roof collapse) due to snow weight; 2) branch fall and power line failure due to snow and ice weight and wind; and 3) roadway conditions due to ice and snowfall.

Building Damage: The Rhode Island State Building Code requires that structures be constructed, at a minimum, to flat roof snow loads of 30 pounds per square foot (PSF). The relationship of snow load to snow depth is a function of the water content of the snow (i.e., wet snow is heavier) and can be variable. In general, 30 PSF snow loads correlates to about 24 inches of snow. For wet snow events (saturated snow = +/- 2 PSF), 30 PSF correlates to about 15 inches of snow. During periods of cold, snow will not melt on roofs and will accumulate due to multiple snowfall events. Ref. https://www.mutualbenefitgroup.com/insurance-101/storm-center/prevent-roof-collapse-on-your-home/

Tree and Powerline Damage: 1/2" of ice can add 500 pounds load on power lines and trees, resulting in extensive damage. Similarly, greater than 6 to 8 inches of heavy snow accumulation on tree branches can result in significant tree damage.

Roadway Conditions: Black ice is a deadly driving hazard defined as patchy ice on roadways or other transportation surfaces that cannot easily be seen. It is often clear (not white) with the black road surface visible underneath. It is most prevalent during the early morning hours, especially after snow melt on the roadways has a chance to refreeze over night when the temperature drops below freezing. Black ice can also form when roadways are slick from rain and temperatures drop below freezing overnight.

Impact Area: Town wide

Town Participants Ability to Expanded and Improve Capabilities

The Town of North Kingstown has a variety of current mitigation capabilities and, in its pursuit of future goals, will collaborate across departments to drive expansion and improvements. The following list outlines how these departments and individuals can contribute to achieving these objectives.

- **Town Manager** - Can work to improve hazard mitigation by fostering cross-departmental collaboration, assisting in securing funding for mitigation projects, and reviewing the latest hazards and risk assessments. Coordinate with the North Kingstown Town Council on mitigation projects and funding.
- **Planning Department** - Oversees and coordinates efforts, ensuring that all departments work together to implement mitigation strategies. Current and anticipated future lead for updating the Hazard Mitigation and Floodplain Management Plan. Coordinates activities related to the town's participation in the CRS program. Capabilities to obtain grant funding.
- **Building Department/ Official** - Trained on Hazards and Mitigation strategies and ensures that town projects comply with safety standards, zoning, and building codes. Has effective coordination between departments and with the Planning Department. Ensures compliance with the NFIP.
- **Emergency Services** - Prepare for and respond to disasters, improve community safety by implementing response plans and coordinating resources during emergencies. Able to coordinate with Planning and other Departments to complete mitigation actions and develop new goals and actions.
- **Public Works** - Enhance mitigation capabilities by upgrading infrastructure to be more resilient to flooding, severe weather, and other hazards, as well as implementing proactive maintenance and inspections to prevent potential system issues.
- **Harbormaster** - Can expand hazard mitigation by assisting in and identifying implementing needs of coastal protection measures and improving waterway management to reduce storm surge impacts. Helps to administer and enforce the Storm Preparedness Plan.
- **Town Engineer** – Able to enhance hazard mitigation by incorporating climate and hazard-resilient designs into designs such as infrastructure projects, including flood-resistant roads and bridges, to better withstand future hazard events.

ATTACHMENT 4: FEMA HAZUS-MH SIMULATION RESULTS

FEMA HAZUS-MH HAZARD SCENARIO ANALYSES

Scenario analyses predict the impacts of an event or particular type of an event. This level of analysis considers potential impacts to infrastructure, people, and cost, as well as likelihood or frequency of the event. Scenario analyses were performed using the FEMA Multi-Hazard HAZUS-MH software.

Level 1 HAZUS analyses were performed using the HAZUS Flood, Hurricane and Earthquake modules. A Level 1 HAZUS analysis calculates basic estimates of earthquake, flood and hurricane wind losses based on national databases and expert-based analysis parameters included in the HAZUS software. The data used for this analysis included the HAZUS "default" data included in the HAZUS software and 2020 US Census Data. Level 1 analyses are appropriate for initial loss estimation at the planning level, and is not intended for establishing the flood, earthquake, or hurricane related risk of any specific parcel or property. The HAZUS analysis was completed for the census tracts that make up the North Kingstown study area.

Potential losses estimated by HAZUS include:

- **Physical damage,** to residential and commercial buildings, schools, critical facilities, and infrastructure;
- **Economic loss**, including lost jobs, business interruptions, repair, and reconstruction costs;
- **Social impacts**, including estimates of shelter requirements, displaced households, and population exposed to scenario floods, earthquakes, and hurricanes

https://www.fema.gov/HAZUS

There are 11,000 buildings in North Kingstown, with a total building replacement value (excluding contents) of $6,403 million (2020 dollars; HAZUS). **Attachment 4 - Table 1** presents the total building value in North Kingstown. Approximately 86% of the buildings (representing about 61% of the total value) are residential. **Attachment 4 - Table 2** provides an overview of the expected damage and loss categories that will be the focus of this scenario analysis based on the results generated from the Earthquake, Flood and Hurricane HAZUS module runs.

Attachment 4 - Table 1: North Kingstown Building Exposure and Occupancy Type

Occupancy	Exposure ($1000)	Percent of Total
Residential	3,891,740	60.80%
Commercial	1,632,649	25.50%
Industrial	479,800	7.50%
Agricultural	15,179	0.20%
Religion	72,894	1.10%
Government	103,071	1.60%
Education	207,249	3.20%
Total	6,402,582	100%

Attachment 4 - Table 2: Damage and Loss Categories

DIRECT DAMAGE
General Building Stock
Essential Facilities
DIRECT LOSSES
Shelter Needs
INDIRECT LOSSES
Economic Loss Property Damage Business Interruption

FLOOD SCENARIO

North Kingstown is vulnerable to coastal flood events. The flood scenario analysis used the default building stock from HAZUS as presented categorically in **Attachment 4 - Table 2** and the FEMA-defined flood hazard zones and flood depths. **Attachment 4 - Table 3** presents the estimated damages and losses for the 100-year (1%), and 500-year (0.2%) flood events for: 1) buildings; 2) essential facilities; 3) displaced people and sheltering; and 4) Economic Losses.

Building Damages

In North Kingstown, flood events are predicted to cause slight to substantial damage, with 194 buildings experiencing slight to substantial damage from a 100-year recurrence interval flood event and 562 buildings experiencing slight to substantial damage from a 500-year recurrence interval flood event.

The associated economic losses (including business interruption) range from $454.14 million (100-year event) to $1.793 billion (500-year event).

Essential Facilities

Based on the HAZUS flood analysis, one (1) essential facility is expected to be impacted or lose functionality during the 100-year recurrence interval flood event, while two (2) facilities are expected to be impacted or lose functionality during the 500-year recurrence interval flood event.

Sheltering Requirements

Based on the HAZUS flood analysis, 531 households would be displaced, and 103 people would require shelter for the 100-year flood event and 1,554 households would be displaced and 205 people would require shelter for the 500-year flood event.

Attachment 4 - Table 3: HAZUS Flood Scenario Results

	100-Yr	**500-Yr**
Building Damages (# of Buildings)		
# of Buildings with Slight Damage (1-10%)	14	26
# of Buildings with Moderate Damage (11-50%)	157	498
# of Buildings with Substantial Damage (>50%)	23	38
TOTAL	**194**	**562**
Essential Facilities Building Damages (Lose of Use > 1 Day)	100-Yr	500-Yr
Emergency Operations Center	0	0
Fire	1	1
Hospitals	N/A	N/A
Police	0	0
Schools	0	1
TOTAL	**1**	**2**
Sheltering Requirements	100-Yr	500-Yr
Displaced Households (# Households)	531	1,554
Short-Term Shelter (# People)	103	205
Economic Losses (in $millions of dollars)	100-Yr	500-Yr
Residential Property - Building Loss	$116.86M	$523.15M
Total Property - Building Loss	$239.93M	$1,195.15M
Business Interruption	$214.21M	$598.58M
Total	**$454.14M**	**$1,793.71M**

HURRICANE WIND SCENARIO

The town will likely experience increasing order of magnitude impacts from hurricane wind events with increasing intensity that have a lower probability of occurrence especially from hurricanes with storm tracks that move directly through or in close proximity to North Kingstown. **Attachment 4 - Table 4** shows the estimated damages for the 100-year (1%), and 500-year (0.2%) hurricane-wind events for: 1) buildings, 2) essential facilities, 3) displaced people and sheltering, and 4) Economic Losses from the 100-year and 500-year hurricane-wind events.

Building Damages

In North Kingstown, hurricane wind events are predicted to cause minor damage to destruction of buildings, with 1,899 building experiencing minor damage to destruction from a 100-year recurrence interval wind event, and 4,844 buildings experiencing minor damage to destruction from a 500-year recurrence interval wind event.

The estimated economic losses are about $92.7 million and $490.7 million, for the 100-year and 500-year events, respectively.

Essential Facilities

Two (2) of the essential facilities are expected to be impacted or lose functionality during the 100-year recurrence interval wind event, and ten (10) are expected to be impacted or lose functionality during the 500-year recurrence interval wind event.

Sheltering Requirements

Based on the HAZUS wind analysis 28 households would be displaced and 12 people would require shelter during the 100-year event, and 261 households would be displaced, and 108 people would require shelter during the 500-year hurricane wind event.

Attachment 4 - Table 4: HAZUS Hurricane Wind Scenario Results

	100-Yr	**500-Yr**
Building Damages (# of Buildings)		
# of Buildings with Minor Damage	1,592	3,278
# of Buildings with Moderate Damage	266	1,097
# of Buildings with Severe Damage	22	196
# of Buildings Destroyed	19	273
TOTAL	1,899	4,844
Essential Facilities Building Damages (Loss of Use < 1 Day)	100-Yr	500-Yr
Emergency Operations Center	0	0
Fire	0	0
Hospitals	N/A	N/A
Police	0	0
Schools	2	10
TOTAL	**2**	**10**
Sheltering Requirements	100-Yr	500-Yr
Displaced Households (# Households)	28	261
Short-Term Shelter (# People)	12	108
Economic Losses	100-Yr	500-Yr
Residential Property	$65.38M	$339M
Total Property	$84.98M	$442.5M
Business Interruption	$7.73M	$48.23M
Total	**$92.7M**	**$490.73M**

EARTHQUAKE SCENARIO

This earthquake analysis was conducted assuming a magnitude 5 earthquake on the Richter scale. **Attachment 4 - Table 5** summarizes the estimated damages for the 1,000-year and 2,500-year recurrence interval earthquakes for: 1) buildings, 2) essential facilities, 3) displaced people and sheltering, and 4) Economic Losses from the 1,000-year and 2,500-year earthquake events.

Building Damages

In North Kingstown, 175 buildings and 587 buildings are predicted to experience damage, ranging from slight to complete, from a 1,000-year (aka 5% in 50 years) and 2,500 -year (aka 2% in 50 years) recurrence interval earthquake, respectively. The majority of damage is predicted to be slight.

The estimated economic losses are about $9.5 million and $42.9 million, for the 1,000-year and 2,500-year events, respectively.

Essential Facilities

None of the essential facilities are expected to be impacted or lose functionality during either the 1,000-year and 2,500-year recurrence interval earthquake events.

Sheltering Requirements

Based on the HAZUS earthquake analysis, no households would be displaced for the 1,000-year event or the 2,500-year event. No people would require shelter for the 1,000-year or 2,500-year earthquake events.

Attachment 4 - Table 5: HAZUS Earthquake Scenario Results

	1,000-Yr	**2,500-Yr**
Building Damages (# of Buildings)		
# of Buildings with Slight Damage	150	489
# of Buildings with Moderate Damage	23	89
# of Buildings with Extensive Damage	2	8
# of Buildings with Complete Damage	0	1
TOTAL	**175**	**587**
Essential Facilities Building Damages (Loss of Use > 1 Day)	1,000-Yr	2,500-Yr
Emergency Operations Center	0	0
Fire	0	0
Hospitals	N/A	N/A
Police	0	0
Schools	0	0
TOTAL	**0**	**0**
Sheltering Requirements	1,000-Yr	2,500-Yr
Displaced Households (# Households)	0	0
Short-Term Shelter (# People)	0	0
Economic Losses	1,000-Yr	2,500-Yr
Residential Property	$3.24M	$15.97M
Total Property	$8.1M	$38.31M
Business Interruption	$1.4M	$4.61M
TOTAL	**$9.5M**	**$42.92M**

ATTACHMENT 5: POTENTIAL STATE AND FEDERAL FUNDING SOURCES

Several of the proposed hazard mitigation projects and actions may be eligible activities for funding under the FEMA Hazard Mitigation Assistance (HMA) Grant Programs. The FEMA HMA Grant Programs include two non-disaster mitigation grant programs that include the BRIC and Flood Mitigation Assistance grant programs, and one disaster mitigation grant program that is the Hazard Mitigation Grant Program. An overview of each program is outlined as follows:

Building Resilient Infrastructure and Communities (BRIC)

BRIC is a funding source for proactive investment in community resilience. On an annual basis FEMA will set aside up to 6% of the annual Disaster Recovery Fund for proactive natural hazard mitigation and community capacity building planning projects. For more information on the current BRIC Notification of Funding Opportunities visit FEMA.gov and search for the word BRIC as the FEMA website content is currently being updated to comply with President Trump's Executive Orders and links to current content may change. The BRIC program guiding principles are supporting communities through capability- and capacity-building; encouraging and enabling innovation; promoting partnerships; enabling large projects up to $50 million; maintaining flexibility; and providing consistency. The Mitigation Action Portfolio is an online resource that includes many project case history examples of eligible hazard mitigation activities, the community lifelines involved, and the funding partners involved around the country. BRIC grants will require a national disaster declaration within the past seven years, which, as an example, included the Whole of America COVID-19 Pandemic Emergency Declaration effective March 10, 2020.

The Pre-Disaster Mitigation grant program

Federal funds are offered in addition to funds provided through other FEMA grant programs for projects that will support growing mitigation needs nationwide. Congressionally Directed Spending funding opportunities are set annually for this program. Generally, the cost share is 75% federal and 25% non-federal cost share. Only states, territories, or federally recognized tribal governments identified by Congress in the Further Consolidated Appropriations Act, 2024 and enumerated in the accompanying Joint Explanatory Statement for Division C are identified in this Notice of Funding Opportunity (NOFO) and are eligible to apply.

Flood Mitigation Assistance (FMA)

The purpose of the FMA program is to reduce or eliminate the risk of repetitive flood damage to buildings and structures insured under the National Flood Insurance Program (NFIP). The FMA Program makes federal funds available to state, local, tribal, and territorial governments available for: 1) Project Scoping (previously Advance Assistance); 2) Community Flood Mitigation Projects; 3) Technical Assistance; 4) Flood Hazard Mitigation Planning; and 5) Individual Flood Mitigation Projects. FEMA Funding for Pre-Disaster Mitigation (PDM) Grant Program and FMA is appropriated by Congress annually and awarded on a nationally competitive basis. In FY 2023, $800 Million was available for the FMA grant program. Applications were due to FEMA on February 29, 2024. For more detailed program information on the FMA program please go to FMA Grant Program. (09/09/24)

Hazard Mitigation Grant Program (HMGP)

The HMGP provides funds to states, territories, tribal governments, and other communities after a disaster, to reduce or eliminate future risk to lives and property from natural hazards. The funding for FEMA's HMGP is 15% of the total assessed damages for a given disaster for states that meet FEMA's standard Mitigation Plan requirements, which applies to the State of Rhode Island. The HMGP application period is open for one year from the disaster declaration date.

The federal share of HMGP assistance is not less than 75 percent of the eligible cost. The HMGP requires a 25% local match for traditional Hazard Mitigation Assistance (HMA) projects. The most recent open disaster was Rhode Island Severe Storms and Flooding (DR-4766-RI) January 9, 2024 - January 13, 2024, declared on March 20, 2024. On March 13, 2020, the

United States declared a nationwide emergency from the COVID-19 global pandemic which ended on May 11, 2023. On Aug. 8, 2021, an additional 3.46 billion in mitigation funding was announced for 59 major disaster declarations for COVID-19 global pandemic. Future HMGP funding will become available during the next open disaster declaration. https://www.fema.gov/hazard-mitigation-grant-program

RIEMA manages the HMGP application process by providing a state application that eligible entities complete and submit to RIEMA electronically. Note that the application process for BRIC and FMA is conducted through FEMA's Grants Outcome (GO) online application process system (see https://www.fema.gov/grants/guidance-tools/fema-go).

All three HMA programs are managed by the RIEMA. Contact RIEMA (401) 946-9996 for more information on each of these HMA grant programs.

Public Assistance (PA)

FEMA's Public Assistance (PA) grant program provides federal assistance to governmental organizations and certain private nonprofit (PNP) organizations following a Presidential disaster declaration. Through the program, FEMA provides supplemental federal disaster grant assistance for debris removal, life-saving emergency protective measures, and the repair, replacement, or restoration of disaster-damaged publicly owned facilities, and the facilities of certain PNP organizations. The PA program also encourages protection of these damaged facilities from future events by providing assistance for hazard mitigation measures during the recovery process. The federal share of assistance is not less than 75 percent of the eligible cost. The Recipient (usually the state) determines how the non-federal share (up to 25 percent) is split with the subrecipients (eligible applicants). https://www.fema.gov/public-assistance-local-state-tribal-and-non-profit

HUD Disaster Recovery and Resiliency Grants

Community Development Block Grant – Disaster Recovery (CDBG-DR)

Similar to FEMA's HMGP, HUD provides disaster recovery grants to help municipalities like North Kingstown and the State recover from Presidentially declared disasters, especially in low-income areas. The goal of these grants is to rebuild the impacted areas and provide critical funding to start the recovery process. The CDBG-DR program allows for the funding of a wide range of recovery activities including planning activities that aide communities and neighborhoods that may otherwise not recover because of a lack of resources.

US Department of Agriculture's (USDA) and other Federal Grants

Natural Resources Conservation Services (NRCS)

The NRCS is the US Department of Agriculture's (USDA) leading agency providing voluntary technical and financial assistance to conservation districts, private landowners, tribal governments, and other organizations to help sustainably manage, conserve and improve natural resources at the local level. Two financial programs that offer funding support in response to natural hazards are outlined as follows.

Emergency Watershed Protection Program (EWP)

Congress established the EWP to assist public and private landowners in response to emergencies resulting from natural hazards including riverine flooding and storms. The mission of the EWP program is to assist people and conserve natural resources by reducing the future impacts to public safety and property caused by floods, storms and other natural hazards. The NRCS is the managing agency for the EWP program that includes two focus areas which are: EWP-Recovery and EWP-Floodplain Easement (FPE).

The EWP-Recovery provides recovery assistance to public and private landowners as a result of a natural disaster that requires a 25% local match with the NRCS providing a 75% match for the construction cost for emergency measures. The EWP-FPE provides assistance to privately-owned lands or lands owned by a local or state government that have been damaged by flooding at least once within the previous calendar year or have been subject to flood damage at least twice within the previous ten years.

Watershed & Flood Prevention Operations (WFPO) Program

The Watershed Protection and Flood Prevention Act of 1954 authorizes the NRCS to provide technical and financial assistance to states, local and tribal governments (project sponsors) for the planning and implementation of approved watershed plans. The NRCS works with local sponsors to protect and restore watersheds from damage caused by erosion, floodwater, and sediment, to conserve and develop water and land resources, and to solve natural resource and related economic problems on a watershed basis.

U.S. Department of Commerce Economic Development Administration Disaster Recovery Grants

The Economic Development Administration (EDA) often releases a Disaster Recovery Supplemental grant program to address economic development challenges caused by a disaster. For example, in, the EDA provided $500 million in 2023 Disaster Supplemental. These funds are for expenses related to flood mitigation, disaster relief, long-term recovery, and restoration of infrastructure in areas impacted by hurricanes, tornadoes, wildfires, volcanic eruptions, and earthquakes. Recent EDA recovery efforts include funding for the 2021 Kentucky tornado damage relief, 2020 Hurricane Ida relief for Louisiana, and economic harm resulting from natural disasters occurring in calendar years 2021 and 2022 such as Hurricanes Ian and Fiona, and wildfires and flooding. EAA funds can be awarded to assist a wide variety of activities related to disaster recovery focused on economic development, including economic recovery strategic planning grants and construction assistance. Through this program, EDA can support both the development of disaster recovery strategies, and the implementation of recovery projects identified with those strategies, including construction activities, capitalizing revolving loan funds (RLFs), and a variety of others. Disaster recovery project activities that can be eligible for Disaster Supplemental grants include, but are not limited to, economic recovery and resiliency projects that:

- Support the creation of new businesses and jobs in a variety of industry sectors, including, but not limited to advanced manufacturing, agriculture, energy, information technology, health care, telecommunications, tourism and recreation, transportation, and cultural and natural assets.
- Implement local and regional job creation and growth and economic diversification strategies targeted towards affected workers and businesses.
- Construction activities, including the restoration of damaged infrastructure, infrastructure enhancement, building new infrastructure including high performance and resilient infrastructure.
- Strengthening or developing existing or emerging industry clusters.
- Resiliency projects to increase the ability of a community or region to anticipate, withstand, and bounce back from future economic injuries and disasters. This may include: ensuring redundancy in telecommunications and broadband networks; promoting business continuity and preparedness; industrial diversification; employing safe development practices in business districts and surrounding communities; conducting disaster recovery planning with key stakeholders; and other methods that strengthen local and regional capacity to troubleshoot and address vulnerabilities within the regional economy.
- Developing business incubator programs.
- Enhancing access to and use of broadband services to support job growth through business creation and expansion.
- The development of economic development diversification strategies in accordance with EDA CEDS recommendations.
- Facilitating access to private capital investment and providing related capacity building and technical assistance, such as effective utilization of capital investment for business development and job creation.
- Facilitating and promoting market access for goods and services.

https://www.eda.gov/disaster-recovery/ (September 2024)

State of Rhode Island Grants

Municipal Resilience Program (MRP)

The Rhode Island Municipal Resilience Program (MRP) is funded by the RI Infrastructure Bank and provides direct support to cities and towns to complete a municipal-driven workshop process called Community Resilience Building (www.CommunityResilienceBuilding.org), which enables municipalities to apply for dedicated MRP Action Grants after successful workshop completion. The workshop helps identify top hazards, current challenges, community strengths, and identifies priority projects and strategies to improve the municipality's resilience to natural and climate-related hazards. Participating municipalities in the MRP program are eligible to apply for MRP Action Grants annually. Eligible projects are required to be identified through the MRP workshop process to improve climate resilience, and result in design, permitting, and/or construction projects.

Stormwater Project Accelerator (SPA)

This Ri Infrastructure Bank program provides upfront capital for green stormwater infrastructure projects that will eventually be funded through state and local reimbursement grants. Current program eligibility and requirements are summarized below:

- Eligible projects must secure state or local funding and provide a signed grant agreement,
- Eligible projects include green infrastructure, nature-based solutions, and stormwater best management practices which address water quality issues,
- Municipalities, non-profit organizations, and utilities are eligible to participate in the program,
- Individual agreements and financing timelines for loans made through the Stormwater Project Accelerator are made on a case-by-case basis, and
- Loans are interest free, and a 1.5% fee will be charged on the total loan amount to cover loan administration.

ATTACHMENT 6: PUBLIC REVIEW DOCUMENTATION

Natural Hazard Mitigation Plan Update
North Kingstown, Rhode Island

NORTH KINGSTOWN

Public Meeting #1

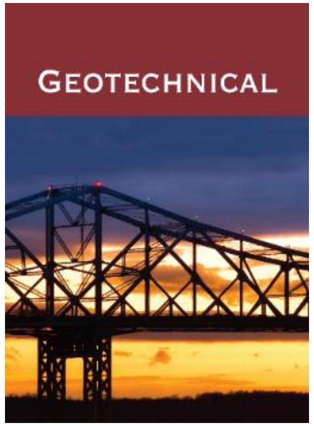
May 21st, 2024

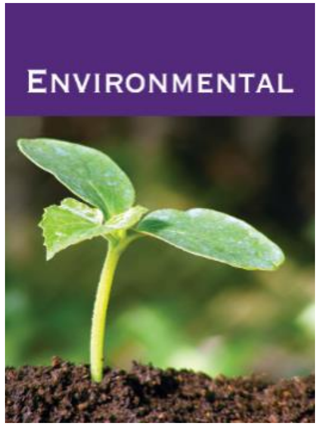
Proactive By Design.
Our Company Commitment

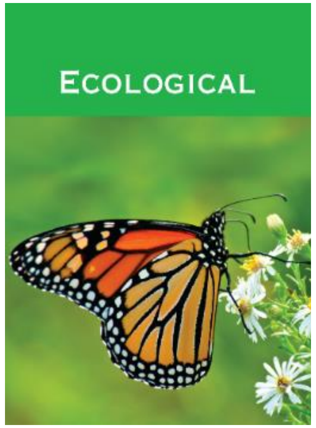
Project Hazard Mitigation Planning Consultant

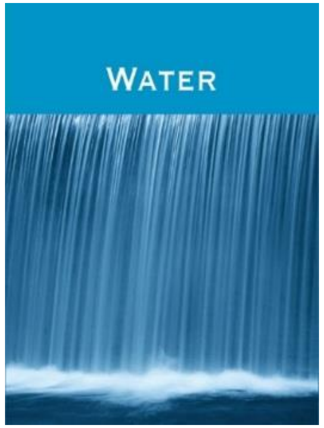
About GZA

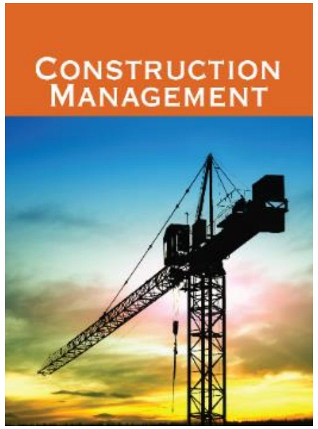
*32 offices, 7000 Engineers, Scientists, Planners, and Technical Specialists providing expert, risk-informed and pragmatic advice and solutions in the following **Core Service** areas….*











Today's Meeting

- ✓ Project Overview
  - ✓ Background on Hazard Mitigation Planning
- ✓ Describe Town Assets
- ✓ Review Hazards Characterization
- ✓ Overview of the Preliminary Risk Assessment
- ✓ Discuss Next Steps

Public Meeting #1: May 21, 2024

Flooding in Wickford during December 18, 2023 storm (image ref. RI MyCoast)

HAZARD MITIGATION PLANNING BACKGROUND

what is it?, why is it being done?

PURPOSE: Hazard Mitigation Planning is a proactive effort to identify actions that can reduce the dangers to life and property from natural hazard events, such as hurricanes, tornadoes, winter storms, and earthquakes.

REQUIREMENTS: The Federal Disaster Mitigation Act of 2000 requires all municipalities that wish to be eligible to receive FEMA funding for hazard mitigation grants, to adopt a local multi-hazard mitigation plan and update this plan in five-year intervals.

Figure credit FEMA

Wickford – Source: Town of North Kingstown

HAZARD MITIGATION PLANNING BACKGROUND

what is it?, why is it being done?

Figure credit FEMA

BENEFITS OF HAZARD MITIGATION PLANNING

- Act now, before a disaster, to reduce losses
- Increase public safety and prevent loss of life and injury
- Reduce damage to existing and future development
- Prevent harm to economic, cultural, and environmental assets
- Reduce downtime, speed up recovery, and lower response costs
- Meet other community objectives such as: capital improvements, infrastructure protection, and open space preservation

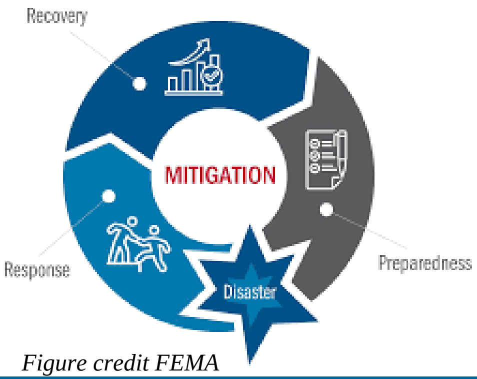


Figure credit FEMA

Natural Hazard Mitigation Plan Update

Goals:

- Update Town assets
- Document progress made per the 2019 Plan Update
- Characterize and assess natural hazard and climate-related hazard risks
- Provide public education and outreach during the planning process
- Revise and develop strategies and actions to mitigate the hazard risks
- Adopt plan update

Project Overview

Natural Hazard Mitigation Plan Update - Tasks

Draft due to FEMA

FEMA approval by August 22, 2024.

Table 1: Approximate Project Schedule

	Month – Calendar Year 2024					
Task	**March**	**April**	**May**	**June**	**July**	**August**
Task 1: Project Initiation						
Task 2: Conduct Working Group Meetings						
Task 3: Planning Process Documentation						
Task 4: Multi-Hazard Mitigation Plan Update Development						
Task 5: Plan Review, Revisions and Local Adoption						

Public Meeting 1 & 2

Planning Process

Planning Process:

2. Assess Risk:
   - Community Demographics/Social Vulnerability
   - Asset Inventory
   - Natural Hazards Characterization
   - Risk Assessment
3. Mitigation Strategy and Actions
4. Plan Adoption and Maintenance

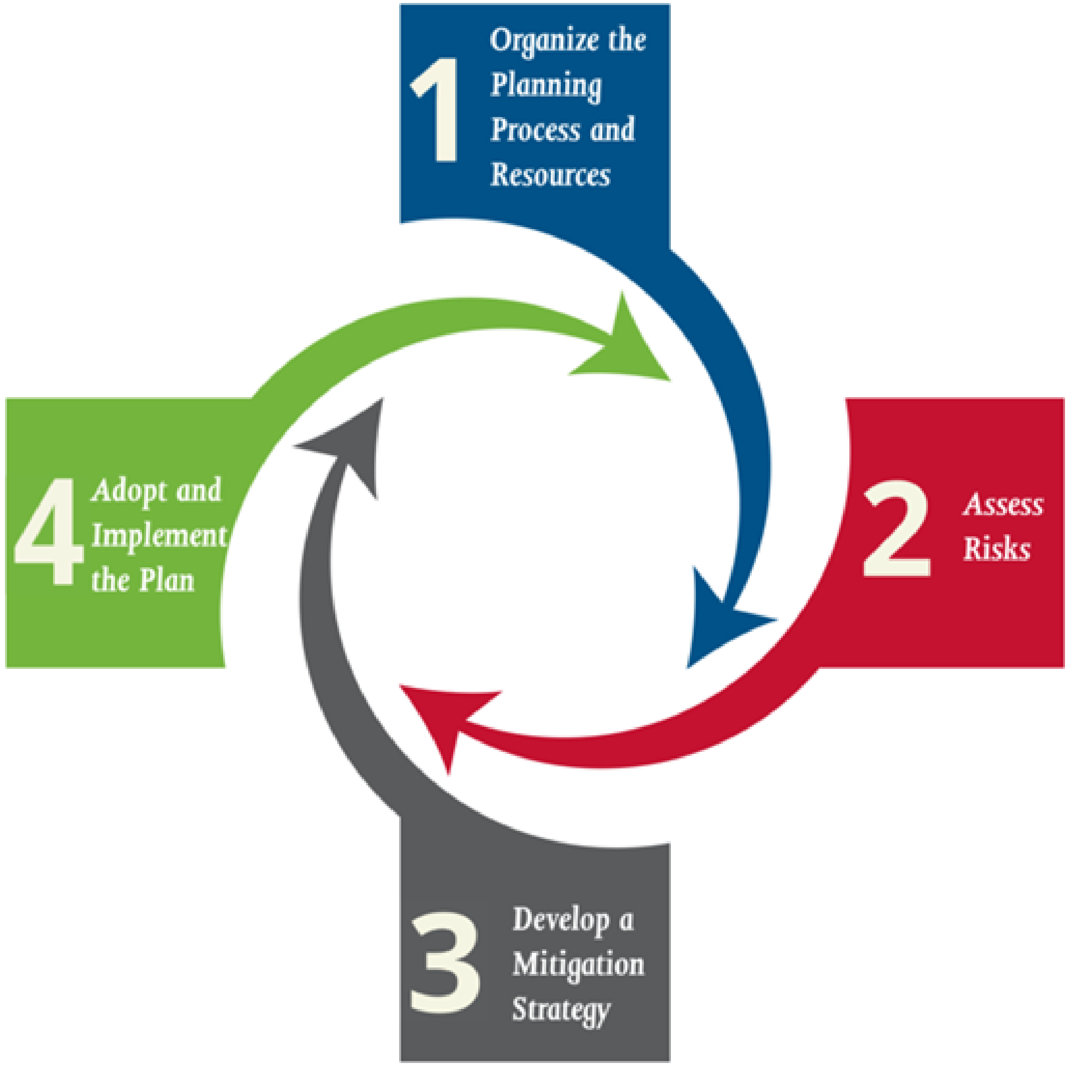


Figure credit FEMA/Jenny Burmester – Aug 21, 2017

Plan Components

Previous Plan Implementation Status (2019 – Present)

- Currently using yearly progress from 2019 as a guideline

Table of Contents

Invited Working Group Team Members

Local Planning Team
Ralph Mollis – Town Manager
Nicole LaFontaine - Director of Planning and Development
Becky Lamond - Supervising Planner
Elle Moore - Planning Technician
Donald Peck - Building Department
Scott Kettelle - Fire Department
John Urban - Police Department
Marie Marcotte - Director

Local Planning Team
Adam White - Public Works Director
Aly Sparks - Deputy Public Works
Meg Kerr - Planning Commission
Eli Mulligan - Administrative Captain
Scott Lessard - Fire Department
Rita Lavoie - Manager of Planning and GIS
John Linacre - Fire Department
Matthew Souza - Building Official
Robert Corrente – Facilities Director

Public Outreach

Public Meeting:

- 1st Public Meeting - May 21
- 2nd Public Meeting - June 24
- Public survey
  - QR Code:

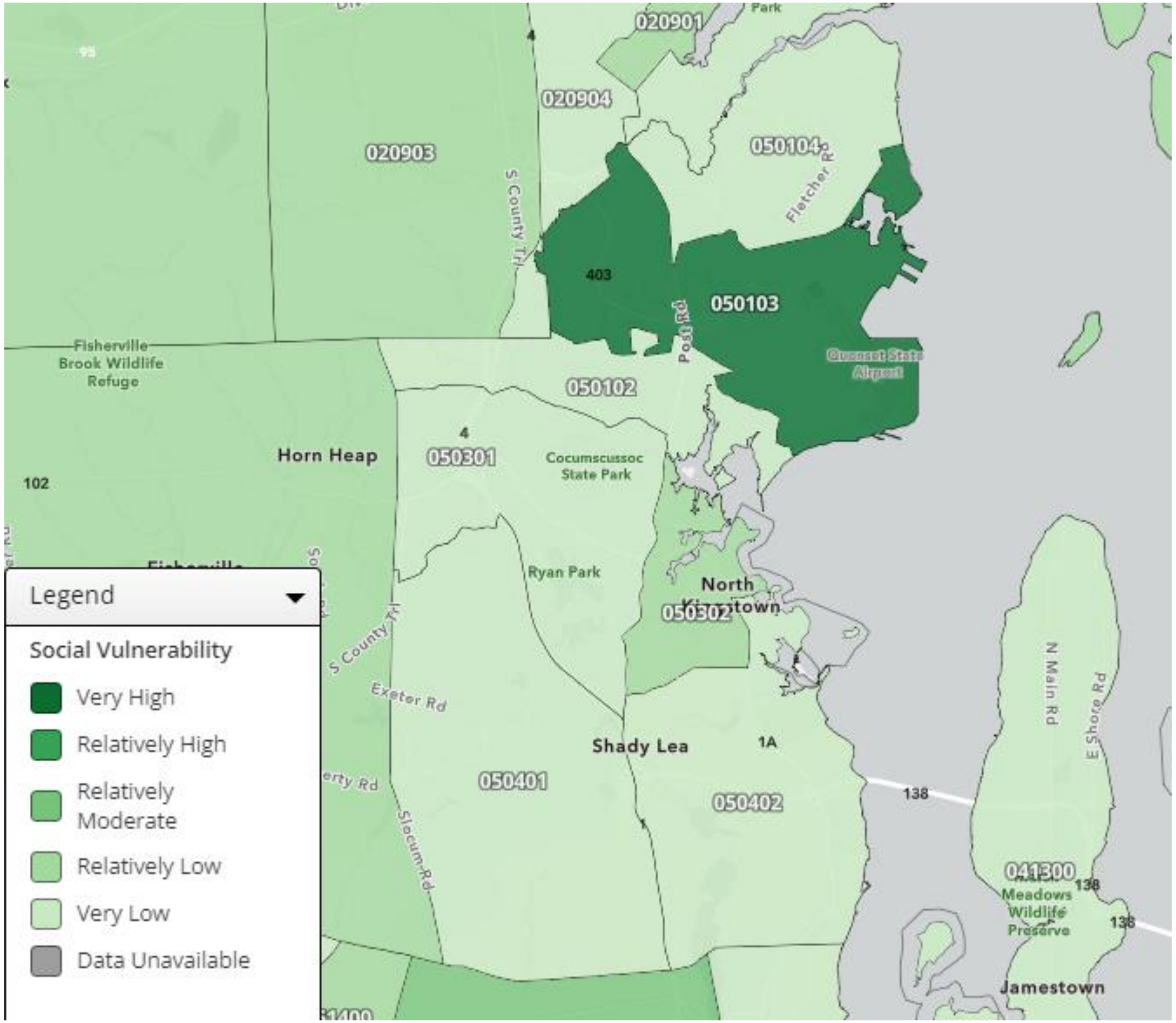
Scan Me!

Community Profile Overview

- Population: +/- 27,732 people
- Population change since 2000: 1,246 (+4.7%)
- Land Area: about 43.6 square miles
- Water Area: about 14.8 square miles
- Population Density: about 642.4 people per square mile
- Households: 11,341
- Median household income: $116,053 (compared to State average of $81,370)

Social Vulnerability Index (SVI)

- SVI Index Themes
  - Socioeconomic
  - Household Composition/Disability
  - Minority/Language
  - Housing/Transportation



2019 MRNHMP Update – Assets Inventory Overview

Critical Facility Assets:

- Key Public Buildings (e.g., Town Hall, Town Hall Annex)
- Medical Clinics
- Colleges
- Public Water Supply
- Early Education Childcare Facilities
- Elderly Housing
- Emergency Shelters
- Funeral Homes
- Emergency Operations Centers
- Fire
- HazMat Sites
- Hospice
- Hospitals
- Long Term Care Facilities
- Other Critical Facilities
- Other Government Buildings
- Police
- Pumping Stations
- Schools
- Potable Water and Wastewater

2024 Plan Update Asset Categories

1. Essential Facilities
2. Lifeline Utility Systems
3. Hazardous Material Facilities
4. High Potential Loss Facilities
5. Transportation Systems
6. Support, High Occupancy and Vulnerable Populations
7. Natural Resources

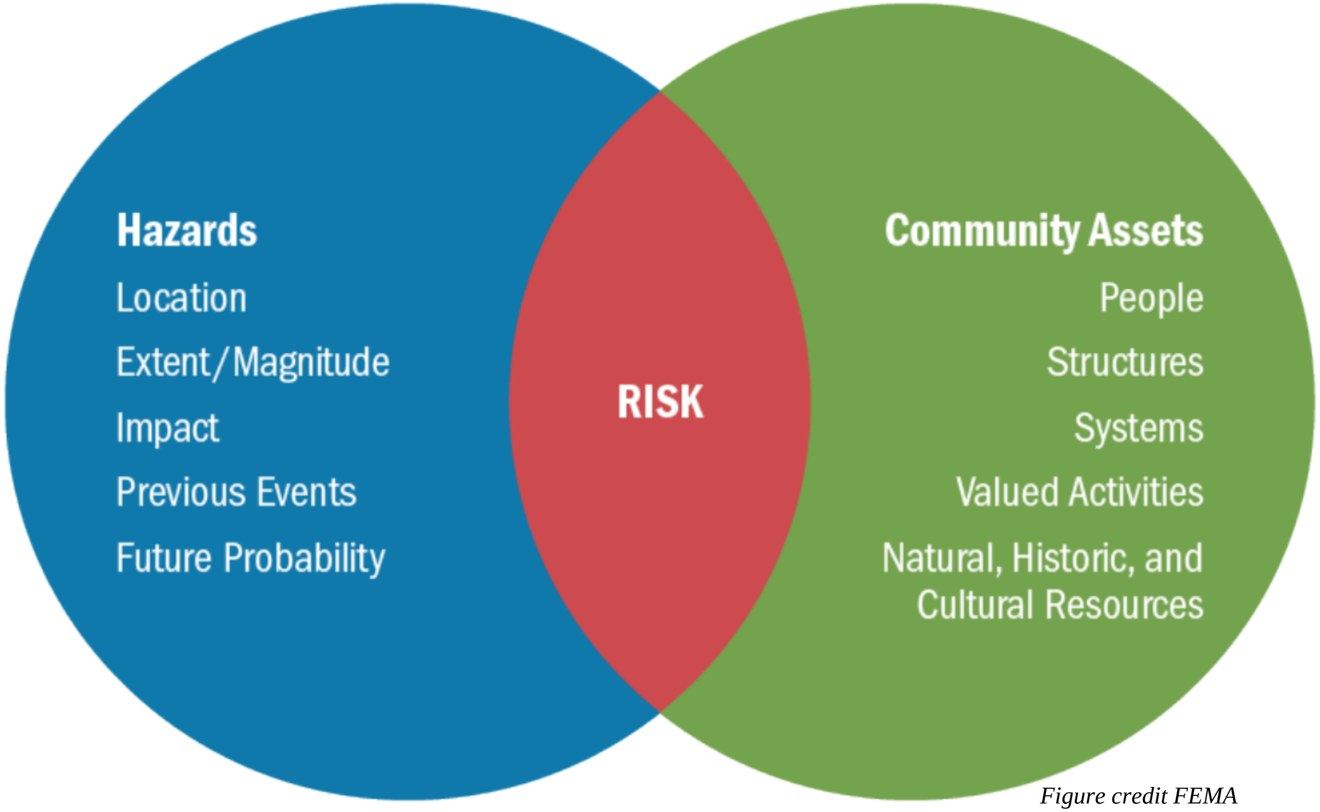


Figure credit FEMA

Town Assets

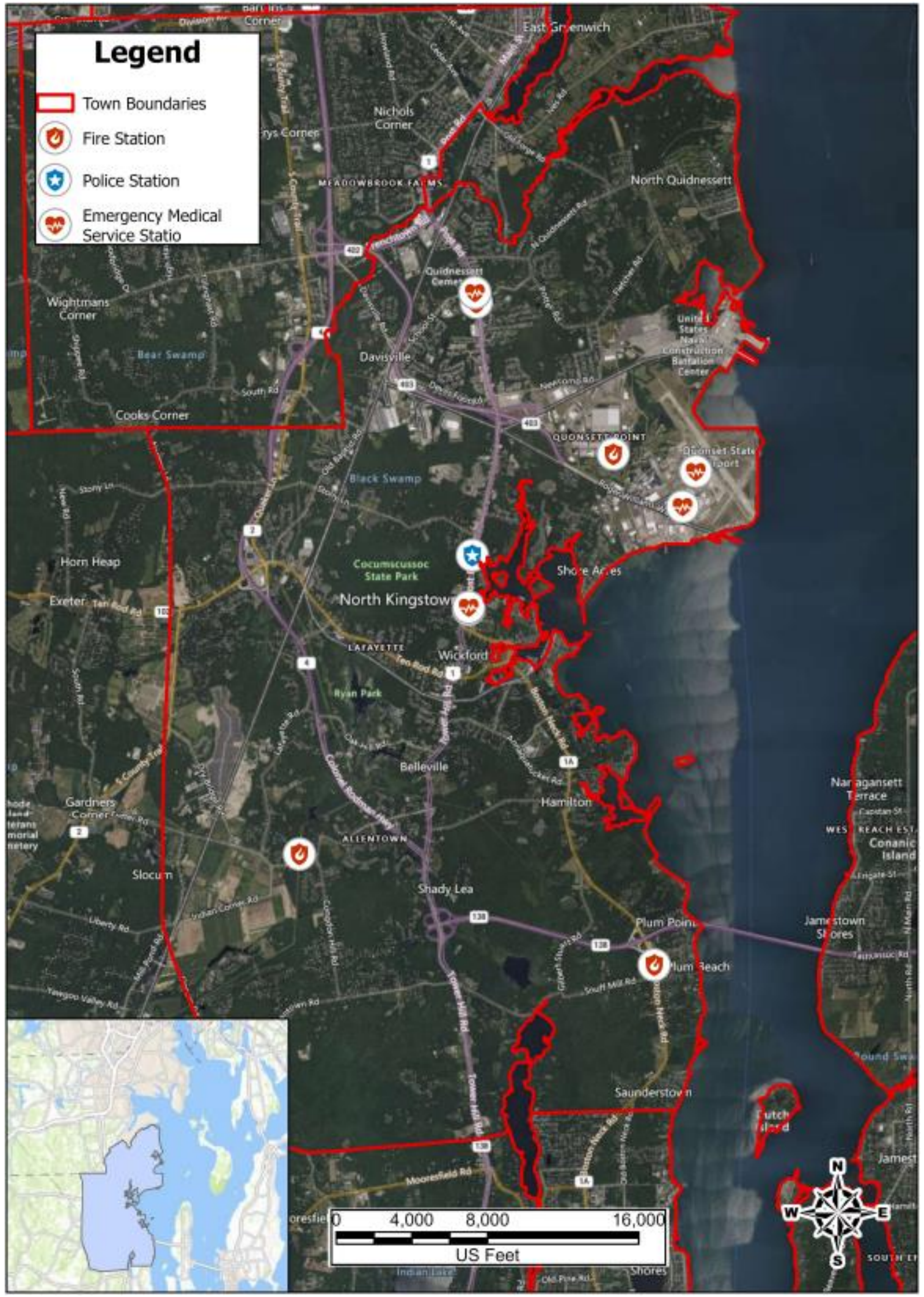
Newly identified or changes since 2019 when current plan was adopted :

- Pump stations
- Streetlights
- Post Road senior housing
- New sewer lines
- New bridge at Gilbert Stuart
- Well 6 offline
- Town beach bathroom renovation
- New housing across town
- New daycares

Figure credit FEMA

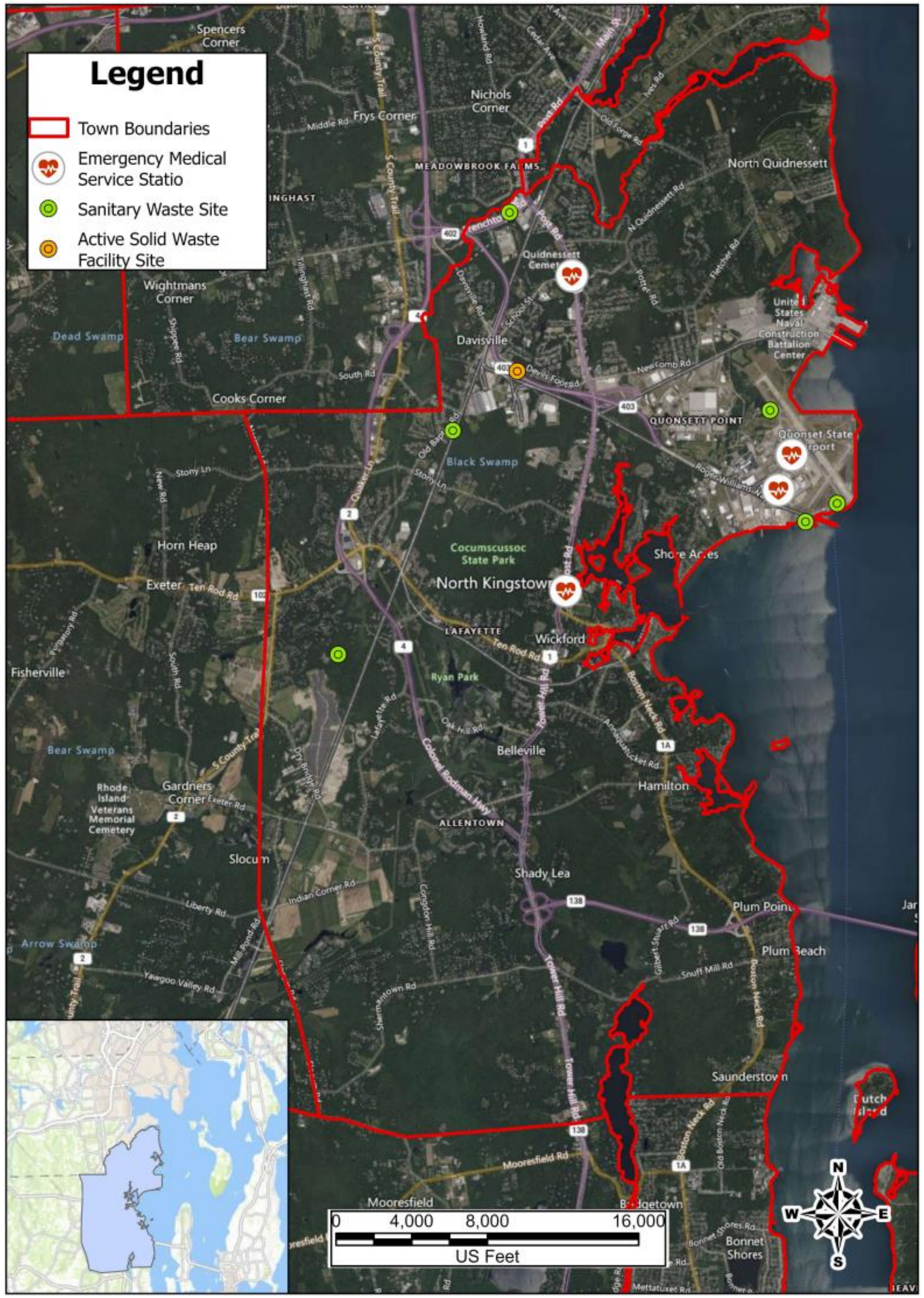
Essential Facilities

- Police Station: 2
- Fire/Rescue: 5
- Emergency Medical Service Stations: 4



Hazardous Materials Facilities

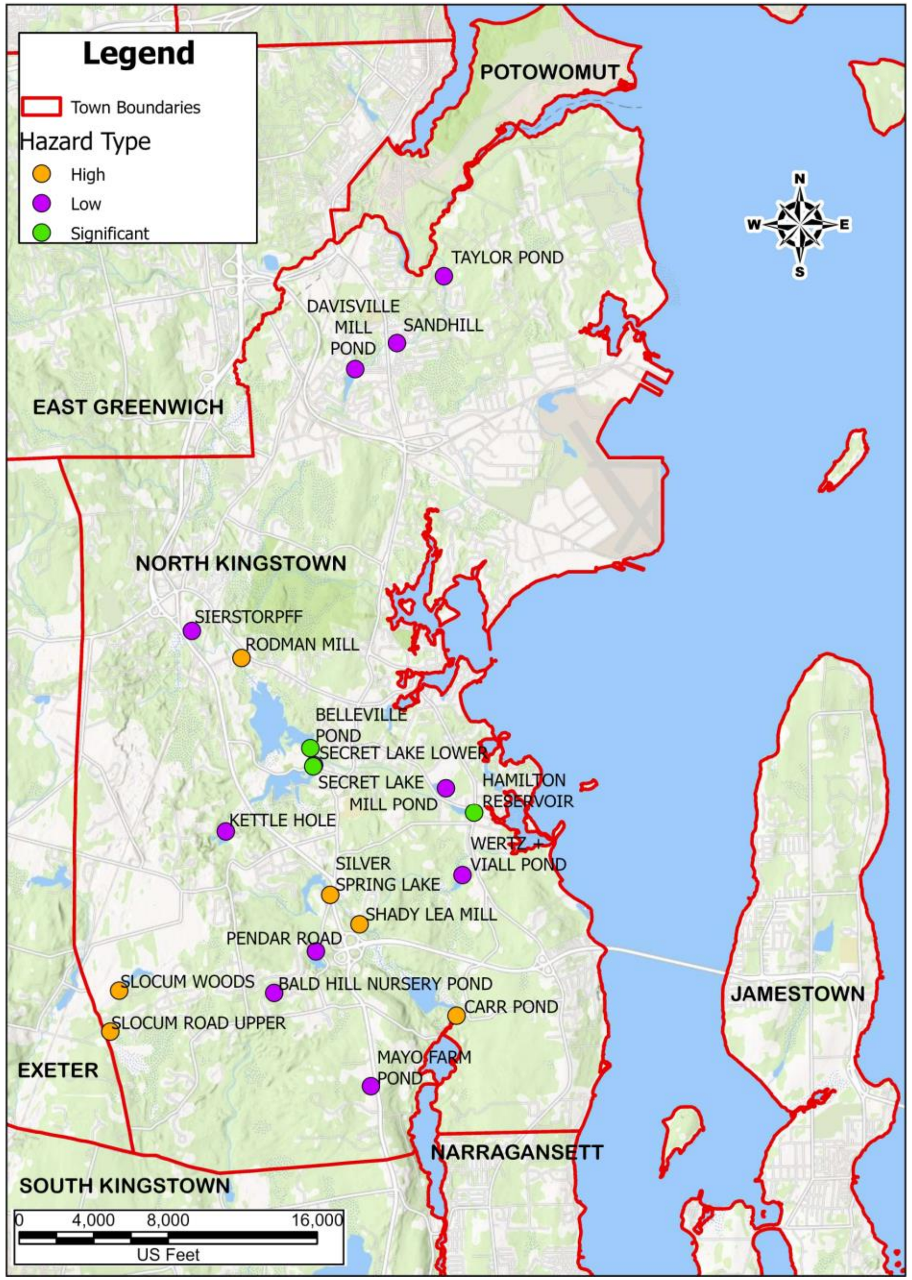
- HazMat Facilities – 11 Total
    - Emergency Medical Service Stations (4)
    - Active Solid Waste Facility Sites (1)
    - Sanitary Waste Sites (6)



High Loss Potential Facilities: Dams

High Loss Potential Facilities:

- Dams: 22
- High Hazard Dams: 6



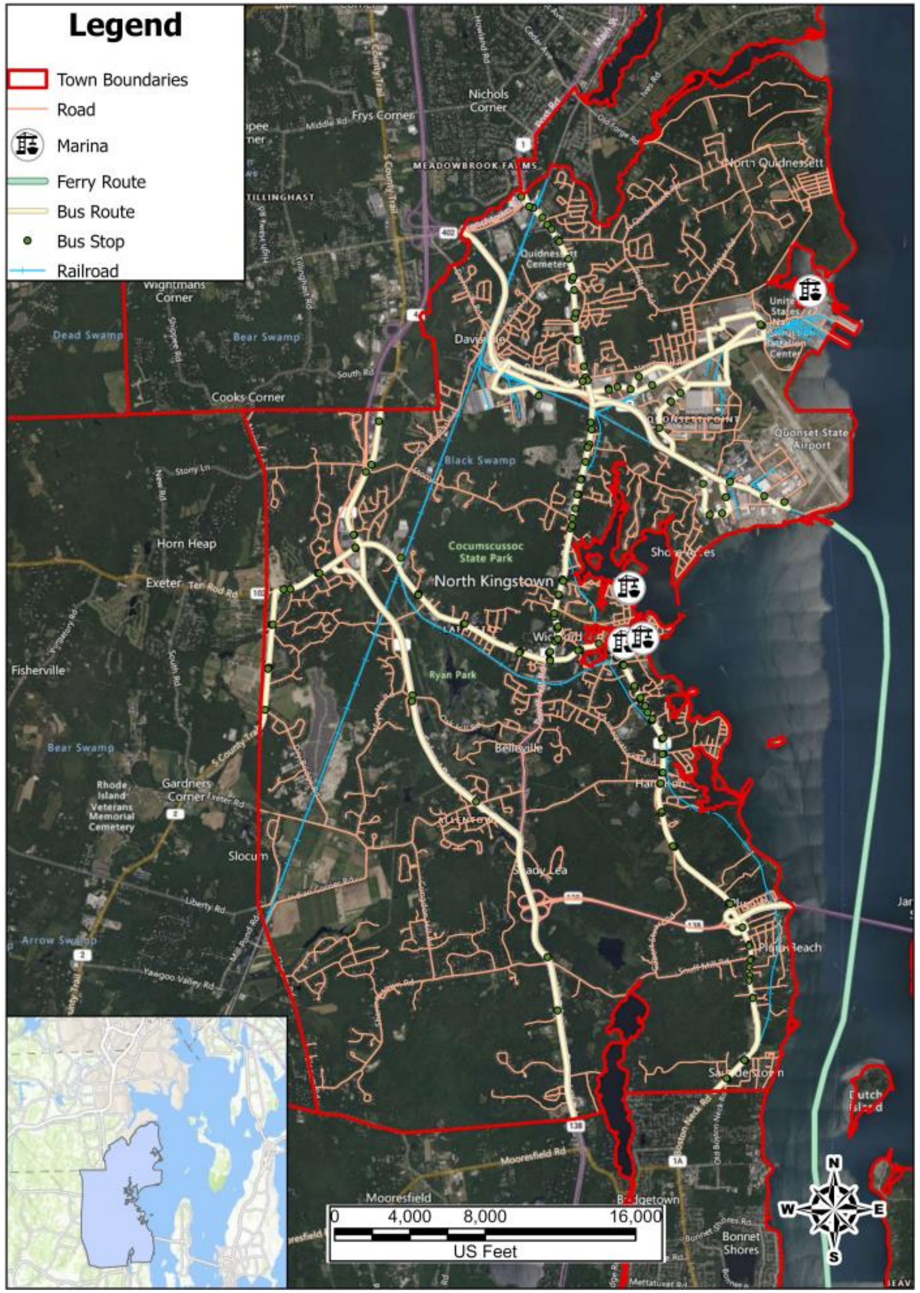
Transportation Systems

ROADS/RAIL

- Roadways: 284 miles
- Rail
  - Public: Seaview RR
  - Private: AMTRAK, Wickford Junction Branch

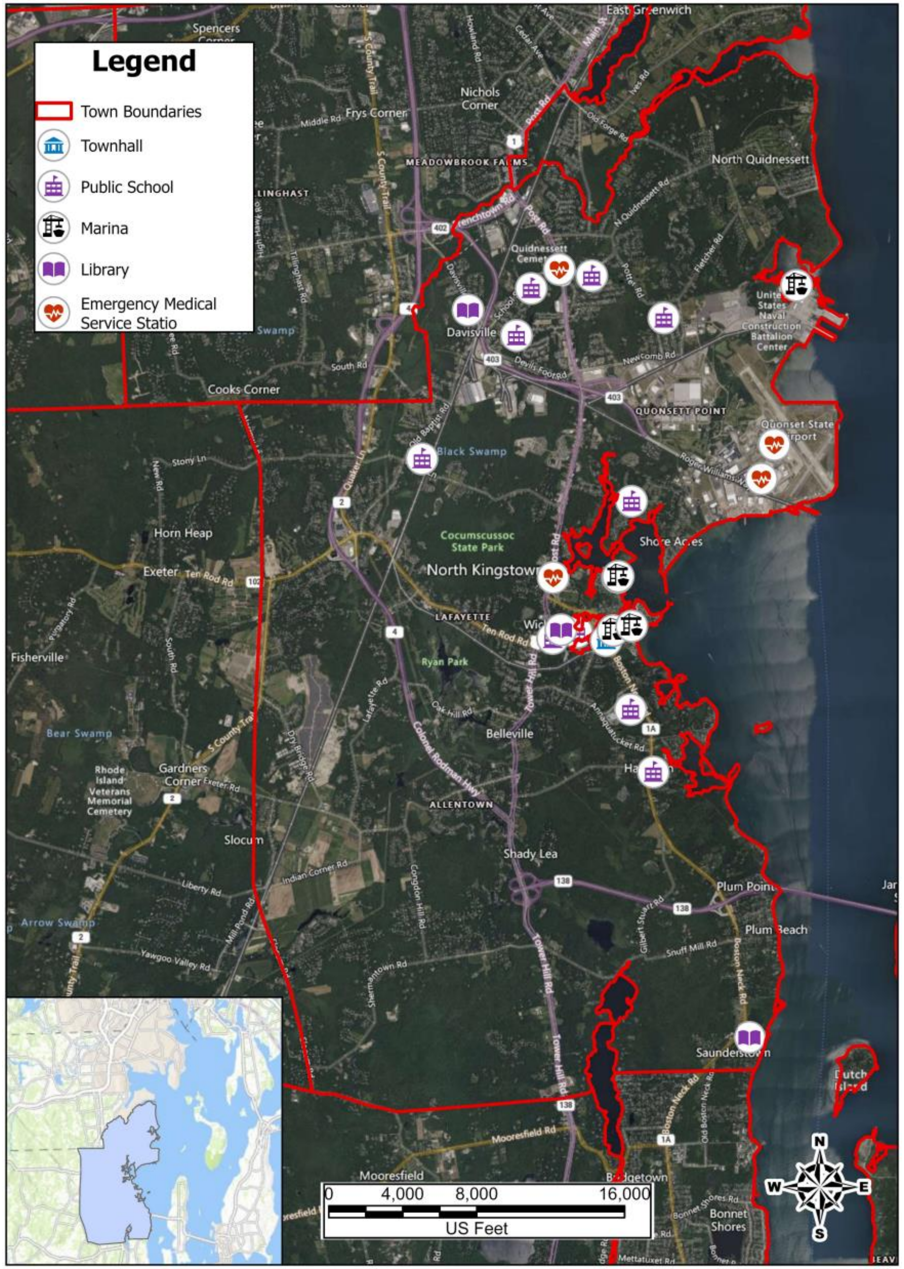
BRIDGES

- Town Bridges: 4
- RIDOT Bridges: 13



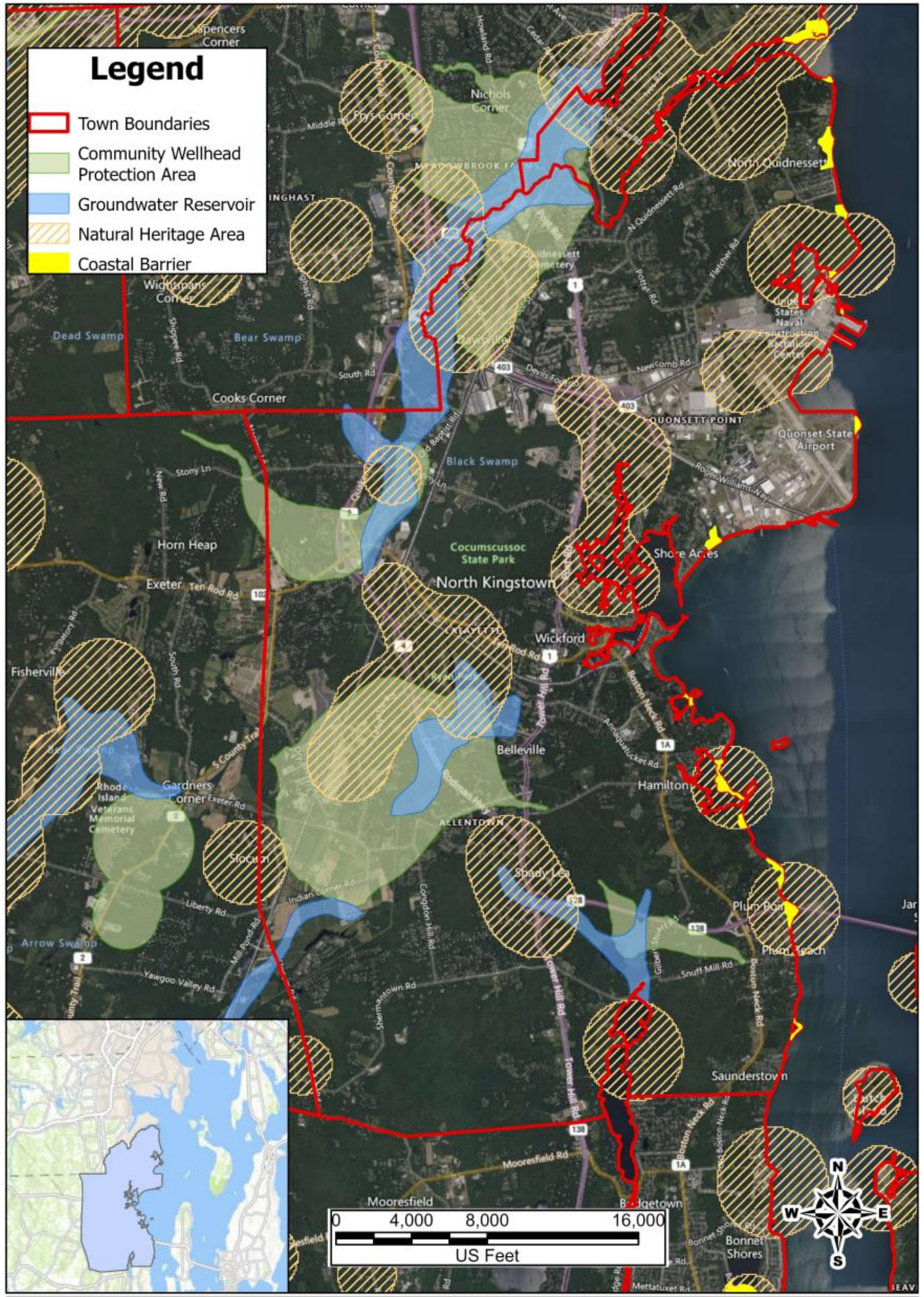
Support, High Occupancy and Vulnerable Population

- Town Administration Buildings - 1
- Public Schools – 10
- Emergency Medical Service Stations – 4
- Libraries - 3
- Marina – 5



Natural Resources

- Natural Heritage Areas
- Groundwater Reservoir
- Coastal Barriers
- Community Wellhead Protection Areas



Natural Hazards Overview

- Severe Weather Hazards
  - Hurricanes and Tropical Storms
  - Nor'easters
  - Riverine Flooding
  - Intense Rainfall and Hail
  - Heavy Snowfall and Ice Storms
- Climate Related Hazards
  - Extreme Temperatures
  - Drought
  - Wildfire
- Geologic Hazards
  - Earthquake

Figure credit FEMA

Severe Weather Hazards:

Severe Wind:

- Hurricanes/Tropical Storms
- Thunderstorms
- Tornadoes

Lightning

Intense Rainfall

Hail

Flood:

- Riverine/Overbank Flooding
- Dam Failure/Beaver Dams
- Poor Drainage Flooding

Severe Winter Weather:

- Snowfall
- Ice Storms

Climate-Related Hazards:

Extreme Temperature:

- Extreme Heat
- Extreme Cold

Drought

Wildfire

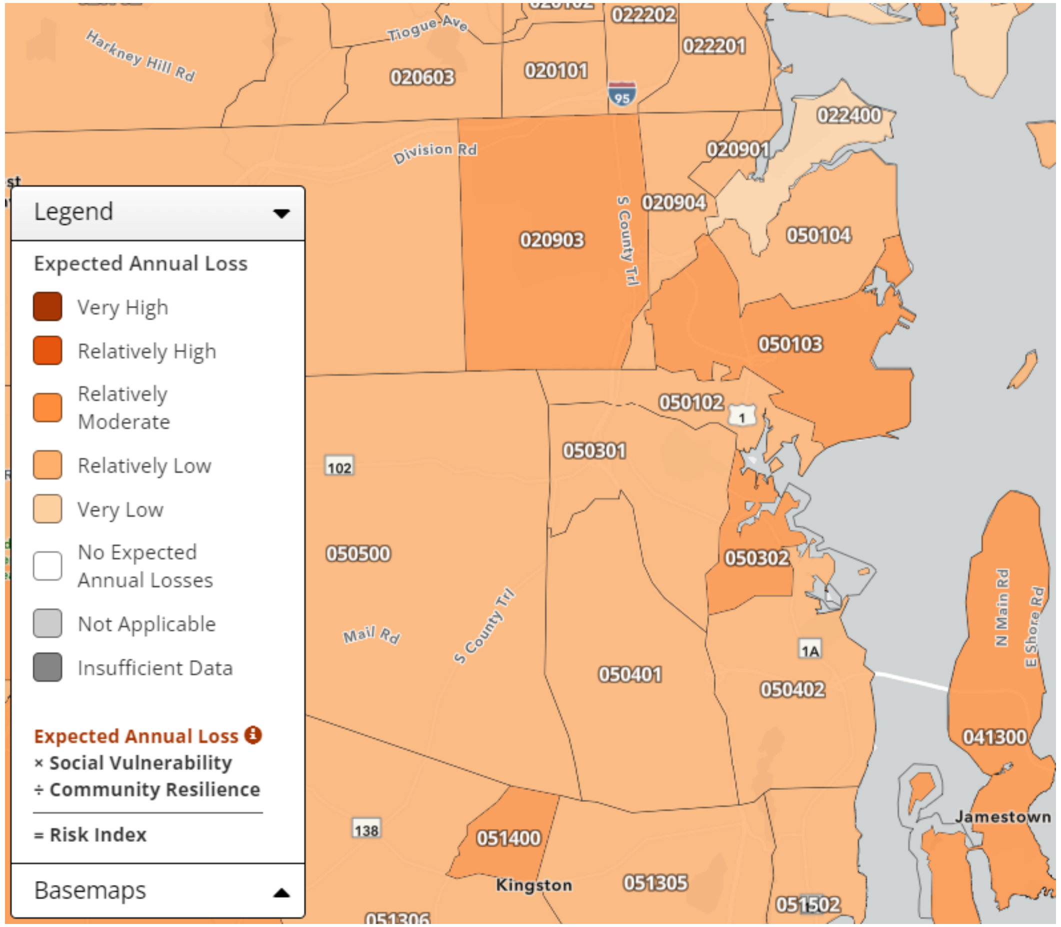
Geologic Hazards:

Earthquake

2024 Natural Hazards

	Severe Weather Hazards:	Hazard Index	Hazard Rating
	Strong Wind	24.5	Very Low
	Tornadoes	27.3	Relatively Low
2	Hurricanes/Tropical Storms	74.7	Relatively Moderate
	Lightning	44.6	Relatively Low
	Hail	24.8	Very Low
1	Coastal Flooding	87.4	Relatively Moderate
3	Riverine Flooding	71.4	Relatively Moderate
	Severe Winter Weather	32.9	Very Low
	Ice Storms	64.6	Relatively Moderate
	Climate-Related Hazards:		
	Heat Wave/ Extreme Heat	18.3	Relatively Low
	Cold Wave/ Extreme Cold	44.6	Relatively Low
	Drought	35.1	Relatively Low
	Wildfire	59.6	Very Low
	Geologic Hazards:		
	Earthquake	29.5	Very Low
	Landslides	37.7	Relatively Moderate

Natural Hazards

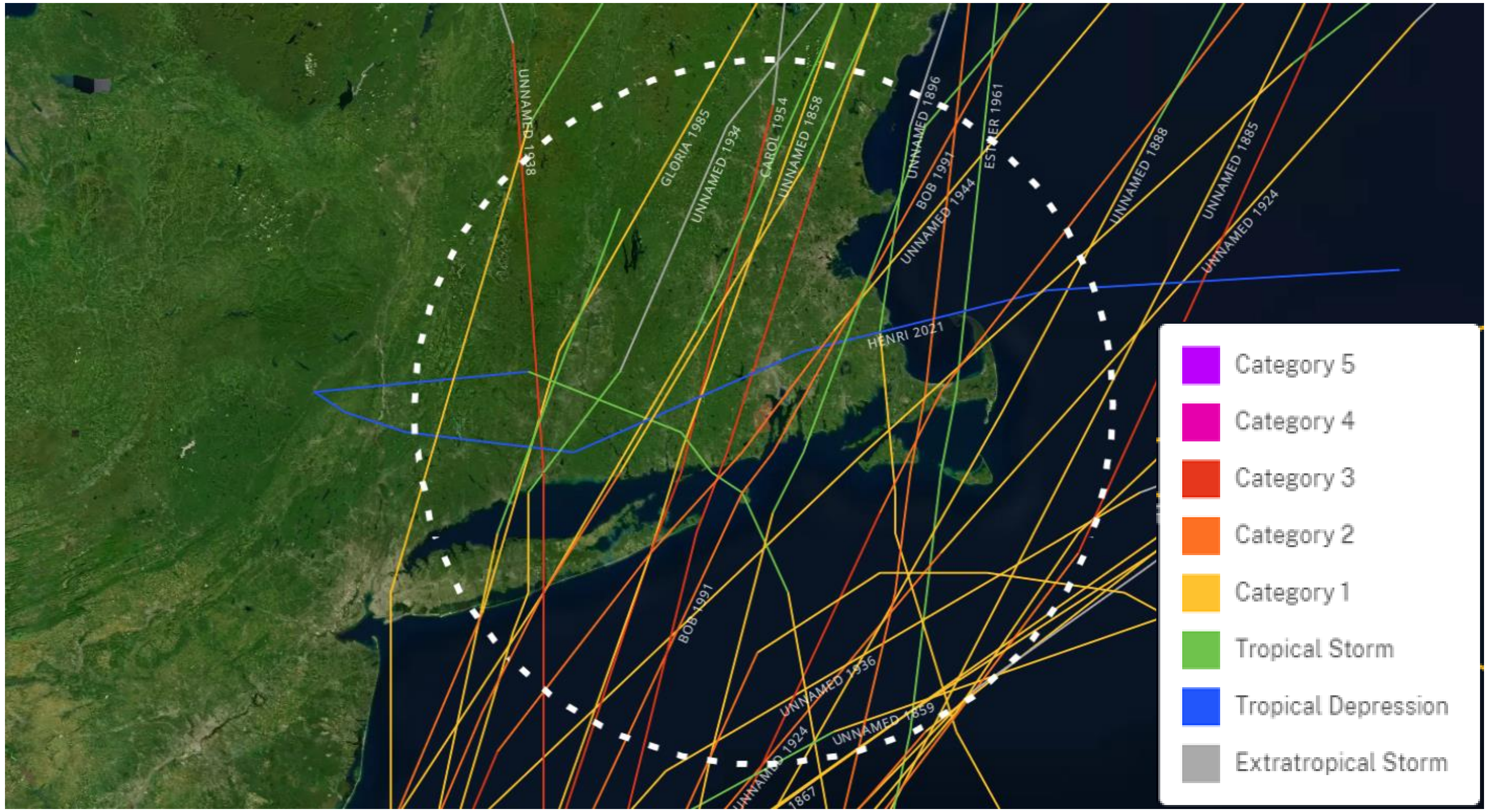


Hazard Type	Period of Record	Average Annualized Frequency (event/year)
Coastal Flooding	Various	2.6
Cold Wave	2005-2021 (16 years)	0.1
Drought	2000-2021 (22 years)	2.2
Earthquake	2021 dataset	0.0
Hail	1986-2021 (34 years)	1.7
Heat Wave	2005-2021 (16 years)	0.6
Hurricane	East 1851-2021 (171 years) / West 1949-2021 (73 years)	0.2
Ice Storm	1946-2014 (67 years)	1.2
Landslide	2010-2021 (12 years)	0.0
Lightning	1991-2012 (22 years)	12.0
Riverine Flooding	1996-2019 (24 years)	0.8
Strong Wind	1986-2021 (34 years)	1.1
Tornado	1950-2021 (72 years)	0.0
Tsunami	1800-2021 (222 years)	#N/A
Volcanic Activity	--	#N/A
Wildfire	2021 dataset	Less than 0.001% chance per year
Winter Weather	2005-2021 (16 years)	3.9

Severe Weather Hazards: Hurricanes

Notable Hurricane Tracks within 20 miles of North Kingstown

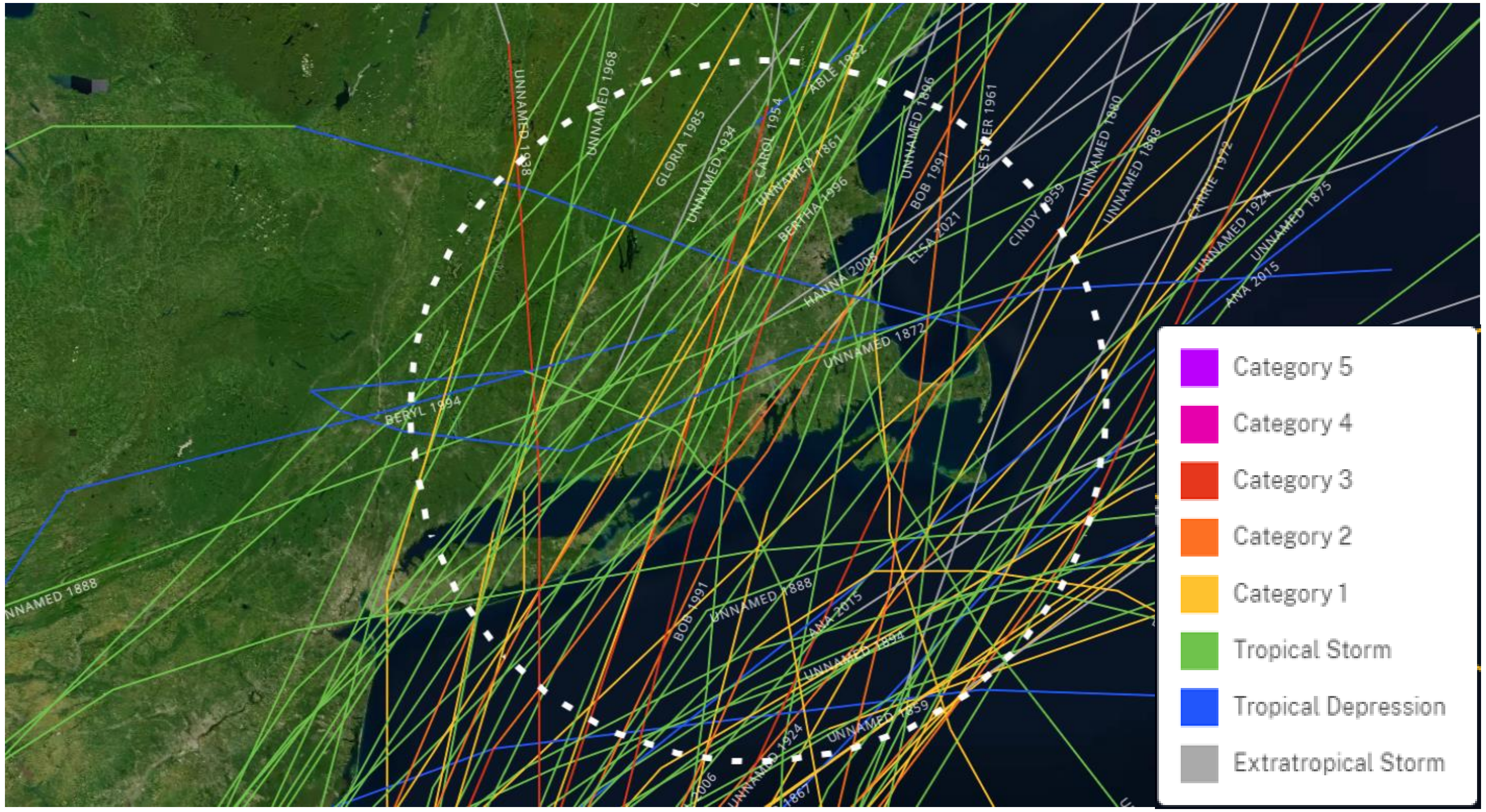
- Unnamed, 1858: Cat 1 at landfall
- Unnamed, 1869: Cat 3 at landfall
- Unnamed, 1944: Cat 2 at landfall
- Carol, 1954: Cat 3 at landfall
- Bob, 1991: Cat 2 at landfall



Severe Weather Hazards: Hurricanes and Tropical Storms

- Near North Kingstown, the hurricane passing recurrence interval is about 17 years
- This means that a hurricane is likely to pass near North Kingstown, on average, about 6 times per 100 years

Rank	Community	EAL Value	NRI Score
1	Quonset	$672,595	85.9
2	Lafayette	$331,569	78.9
3	Slocum	$309,847	78.2
4	Quidnessett	$270,003	76.6
5	Wickford	$255,996	75.9
6	Saunderstown	$232,416	74.8
7	Davisville	$200,264	73



Severe Weather Hazards:

Flooding

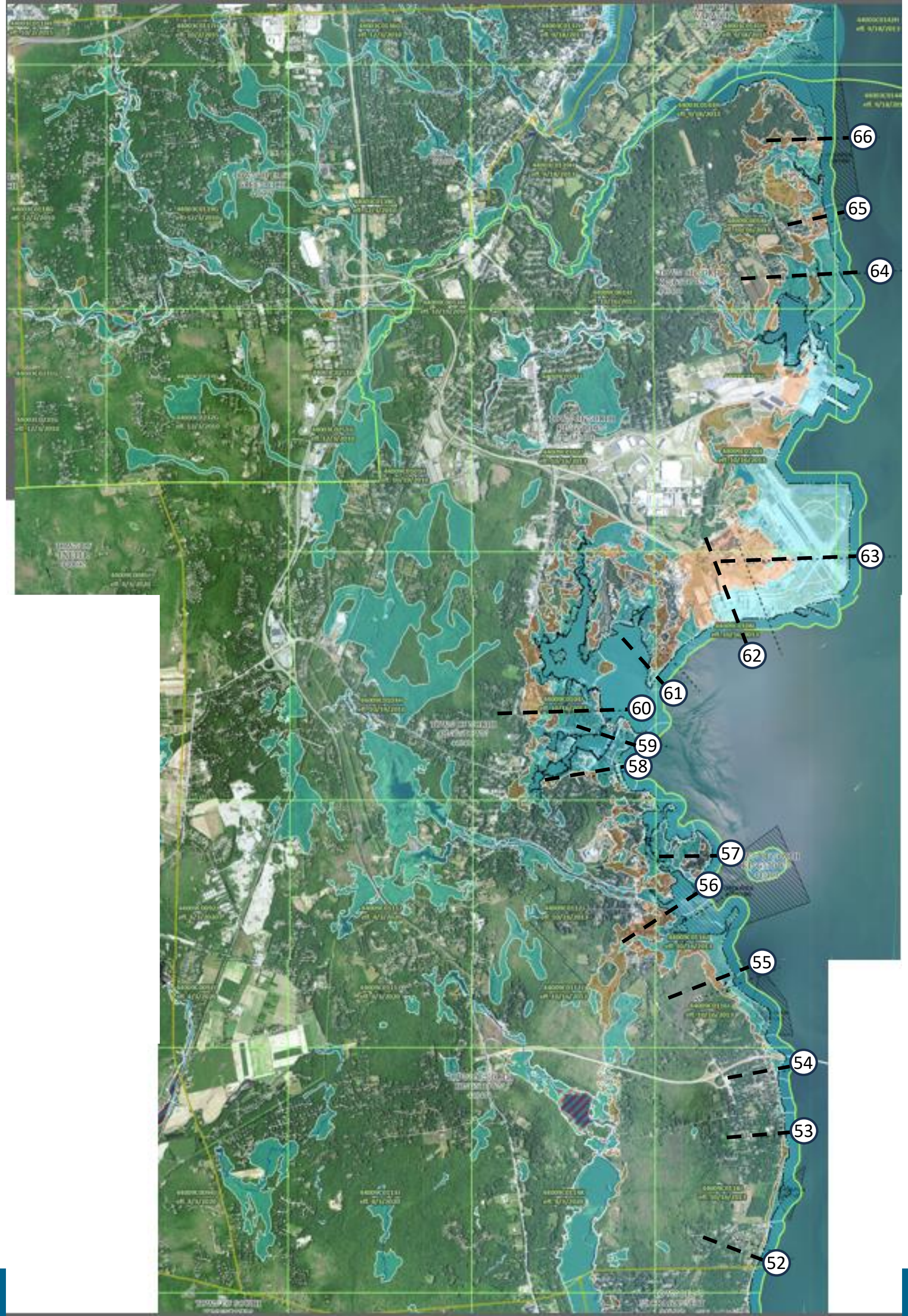
Effective FEMA Flood Insurance Rate Map (FIRM) – (10/19/2010; 12/03/2010; 09/18/2013; 10/16/2013; 4/3/2020)

Riverine Flooding:

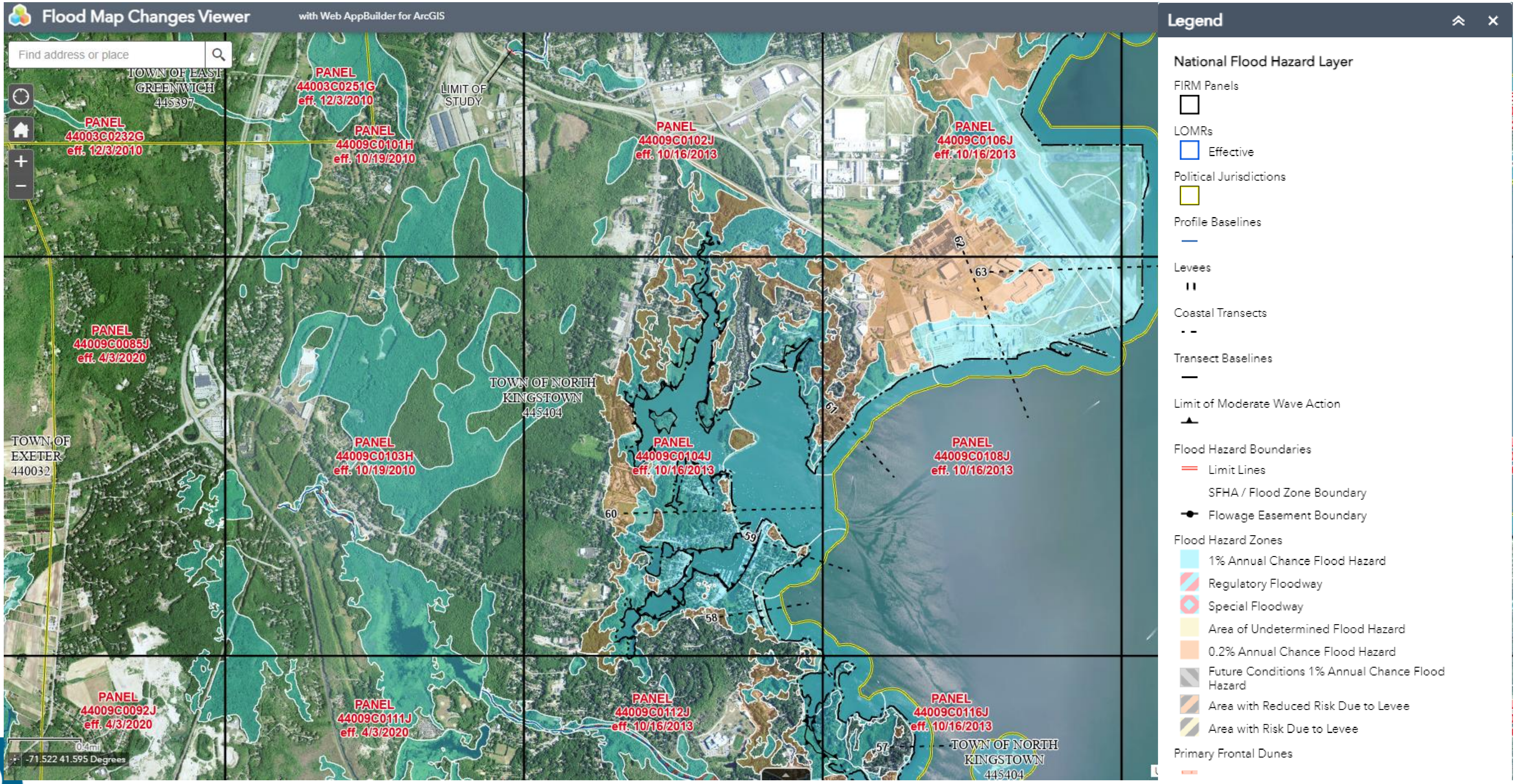
Rank	Community	EAL Value	NRI Score
1	Wickford	$239,504	93.6
2	Quonset	$129,077	88.9
3	Davisville	$65,570	81.5
4	Saunderstown	$63,313	81.1
5	Quidnessett	$30,179	70.8
6	Lafayette	$22,098	66.2
7	Slocum	$3,969	43.8

Coastal Flooding:

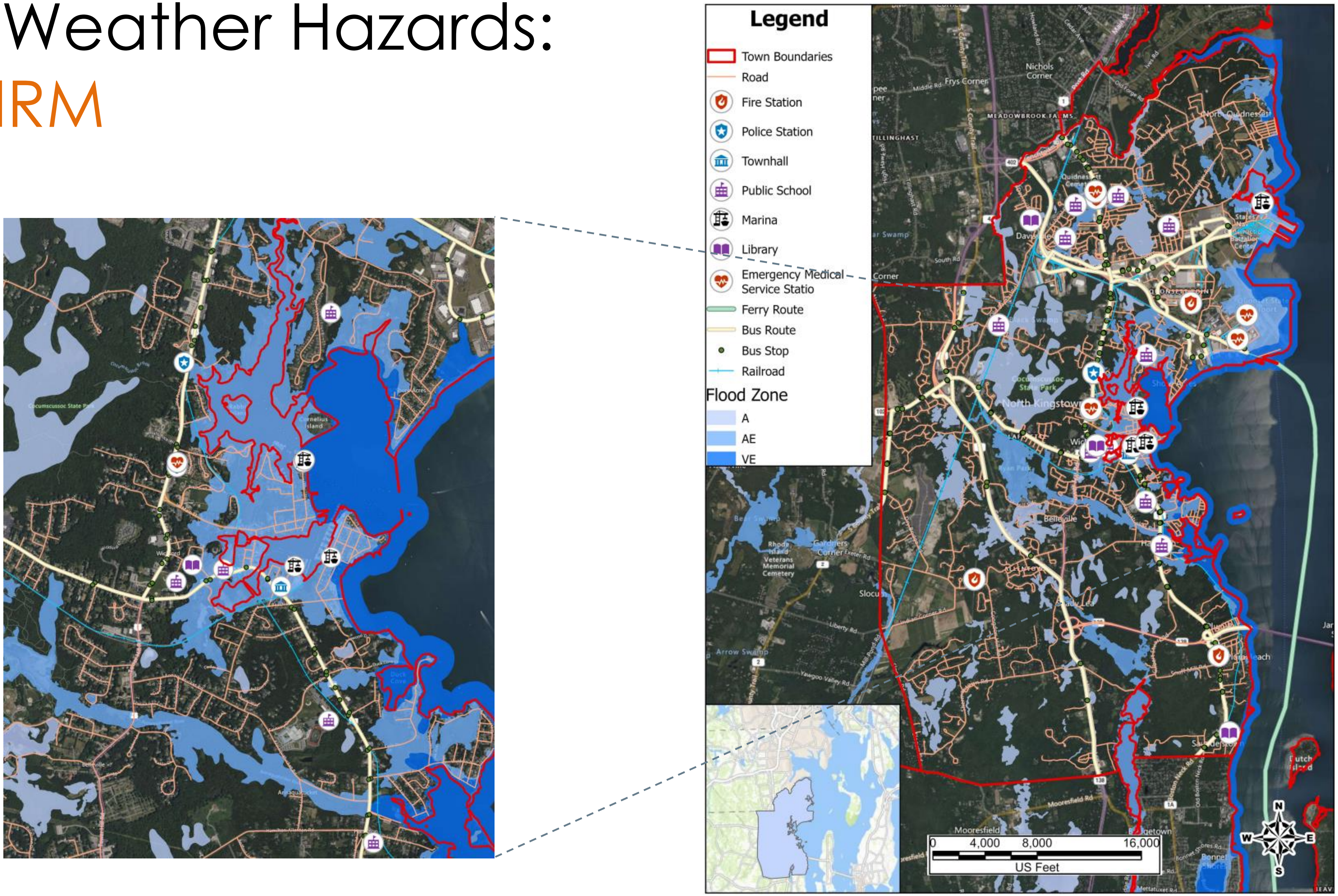
Rank	Community	EAL Value	NRI Score
1	Wickford	$145,781	97.1
2	Saunderstown	$73,080	95.5
3	Davisville	$46,015	94.3
4	Quidnessett	$17,613	91.5
5	Quonset	$10,558	89.8
6	Lafayette	$73	74.3
7	Slocum	$1	70.8



Severe Weather Hazards: FEMA FIRM



Severe Weather Hazards: FEMA FIRM

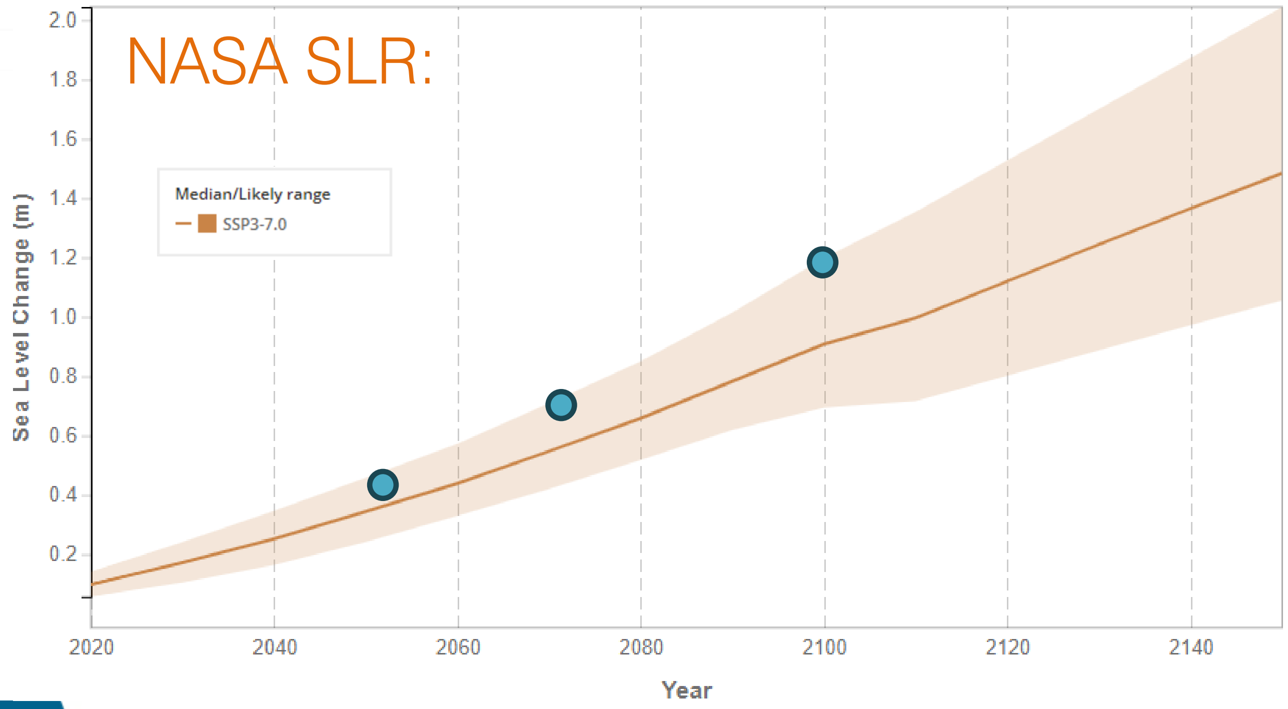


Sea Level Rise Projections

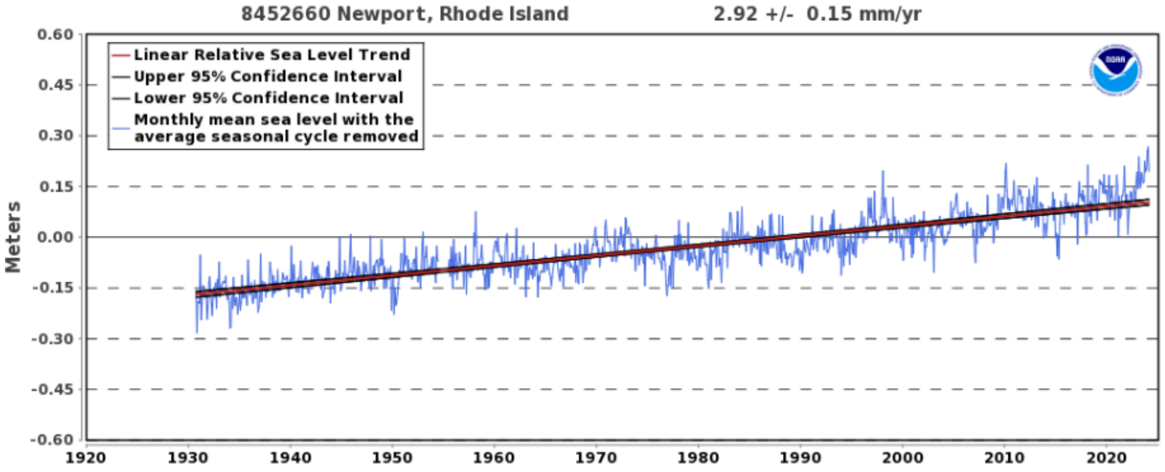
Resilient Rhody follows NOAA 2017 Projections for a high sea level rise scenario for Newport:

2.20 feet by 2040 | 8.99 feet by 2100

NASA SLR:



NOAA - Relative Sea Level Trend



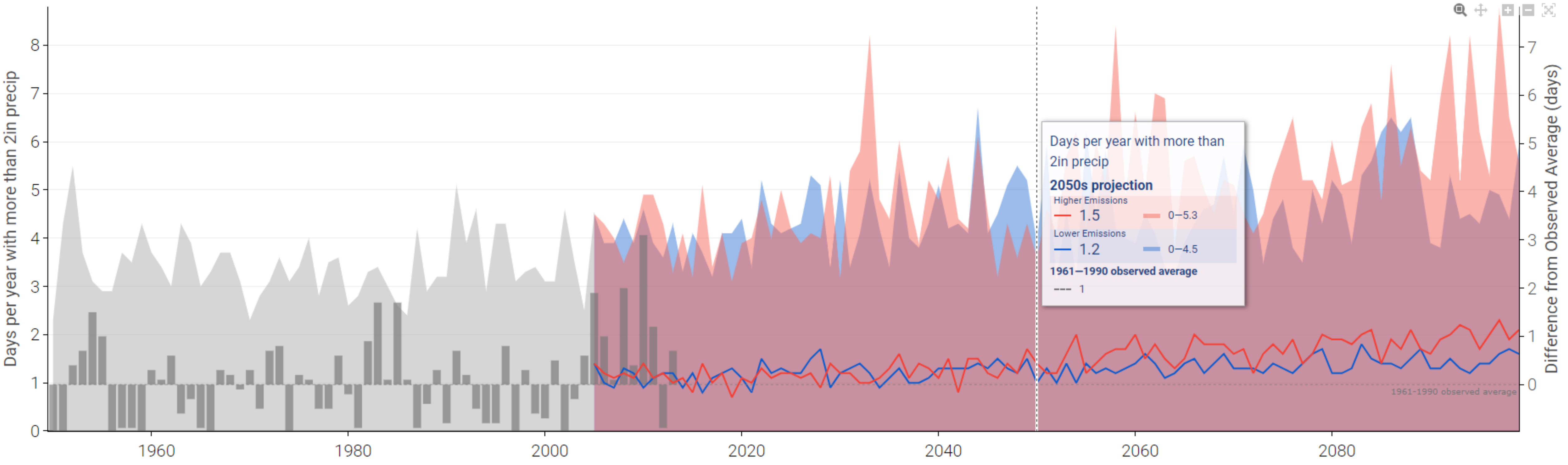
NOAA 2022 Intermediate Projected Sea Level Rise (●):

2050: 1.4 feet (0.43 m)

2070: 2.2 feet (0.67 m)

2100: 3.9 feet (1.19 m)

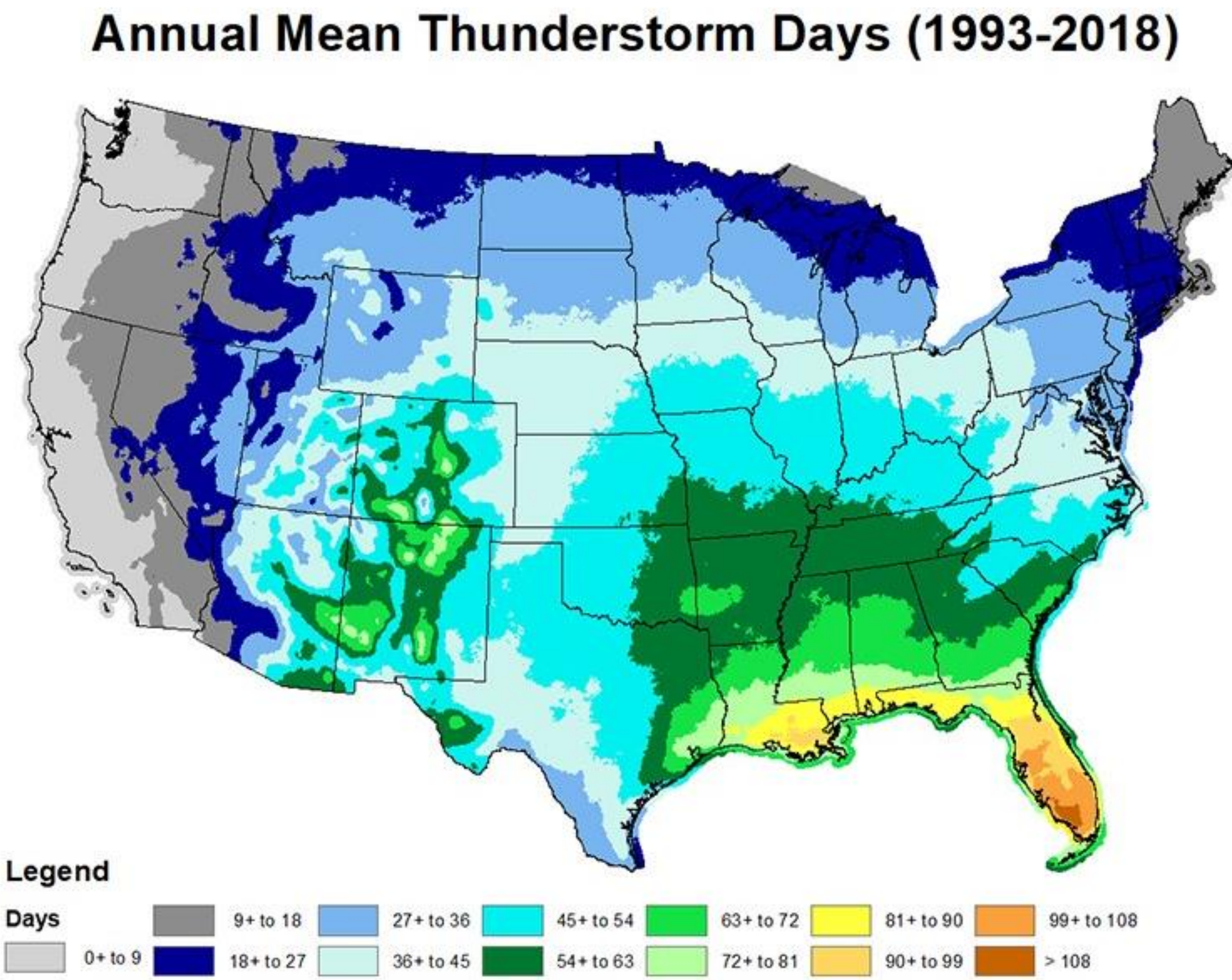
Severe Weather Hazards: Intense Precipitation



[Source: Climate Explorer (nemac.org)]()

Severe Weather Hazards: Thunderstorms

- Severe Thunderstorm winds are defined as speeds of at least 58 mph or of any speed producing a fatality, injury or damage
- Between 1950 to 2024
  - 22 Severe Thunderstorms
  - $922,250 damages
  - No deaths or injuries reported



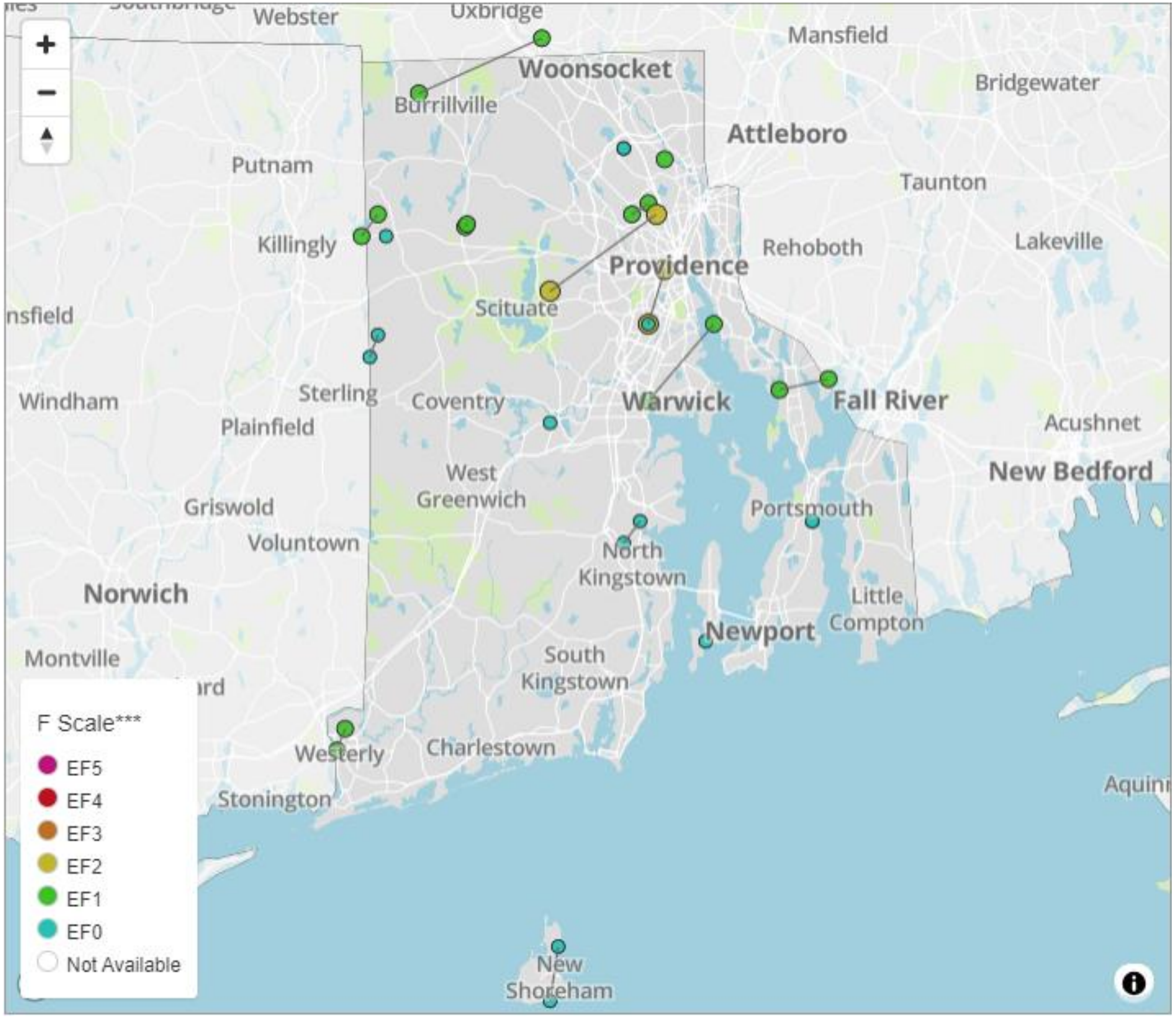
Severe Weather Hazards: Tornadoes

Location of Rhode Island Tornadoes:

Rhode Island Tornado Data for the period of 1950 to 2024

Magnitude	No of Days with Event	No. of Injuries	No. of Deaths	Property Damage
F0/EF0	9	3	0	$380,000
F1/EF1	8	0	0	$1,865,000
F2/EF2	2	21	0	$2,750,000
F3/EF3	0	0	0	0
F4/E4	0	0	0	0

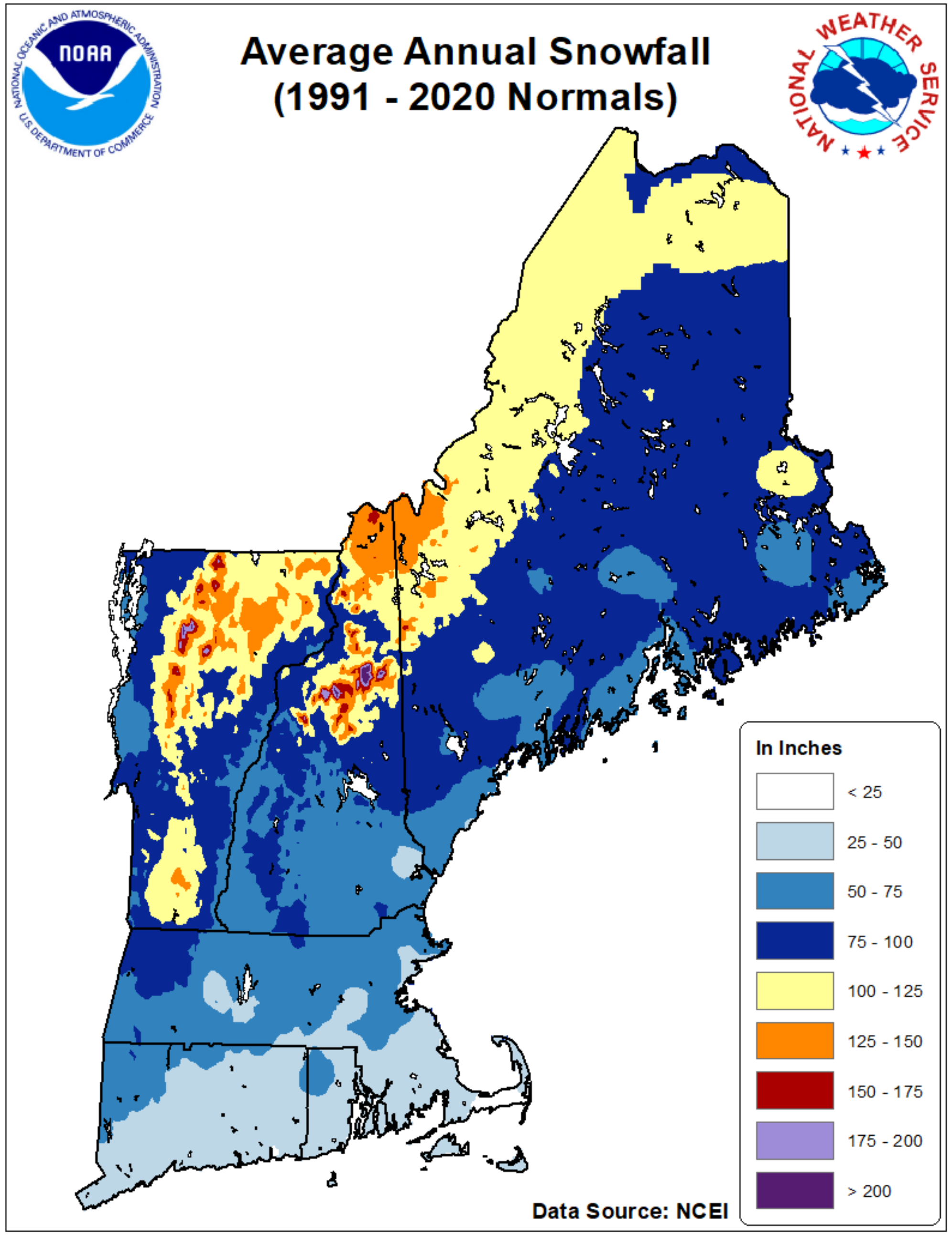
Rank	Community	EAL Value	NRI Score
1	Quonset	$39,630	45
2	Lafayette	$27,412	38.7
3	Slocum	$23,531	36.3
4	Quidnessett	$15,373	30.8
5	Davisville	$12,243	28.2
6	Wickford	$10,450	26.4
7	Saunderstown	$7,144	20.9



Severe Winter Weather

- Present Average Annual Snowfall
  - 25-50 Inches
- Future Climate Snowfall Projections from NOAA National Centers for Environmental Information State Climate Summaries 2022:
  - Extreme precipitation has increased since 1950
  - Continued increases in frequency and intensity of extreme precipitation events are projected, but by the end of the century most of this precipitation is likely to fall as rain instead of snow

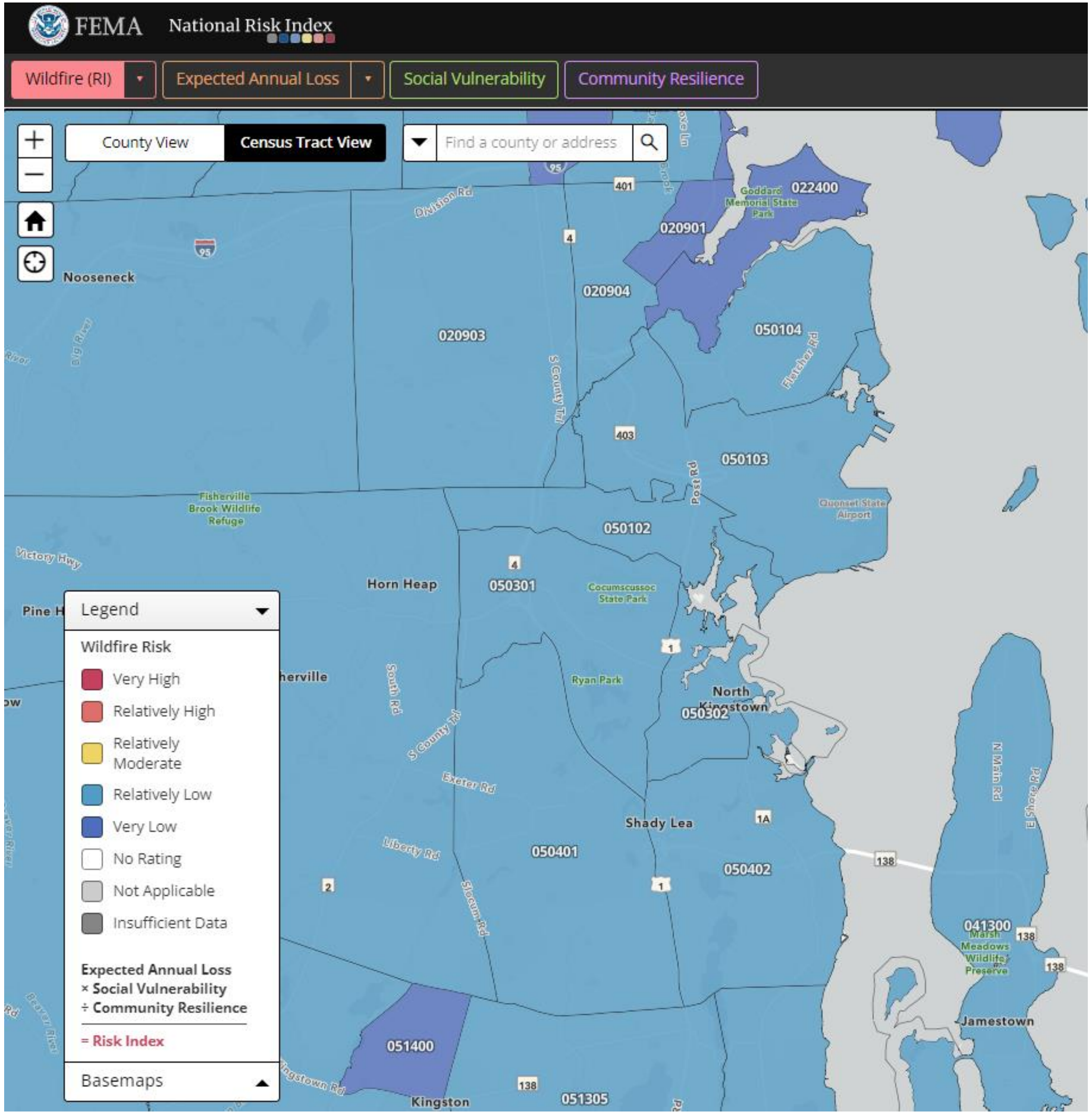
Rank	Community	EAL Value	Score
1	Quonset	$904	43.2
2	Lafayette	$716	39.6
3	Slocum	$715	39.6
4	Quidnessett	$582	36.8
5	Wickford	$416	33
6	Saunderstown	$414	33
7	Davisville	$362	31.7



Climate Related Hazards: Wildfire

- Present Wildfire Hazard Potential
  - Relatively Low
- Future Wildfire Hazard Potential
  - Increased air temperatures and evapotranspiration, as well as increases in drought, can increase Wildfire potential.

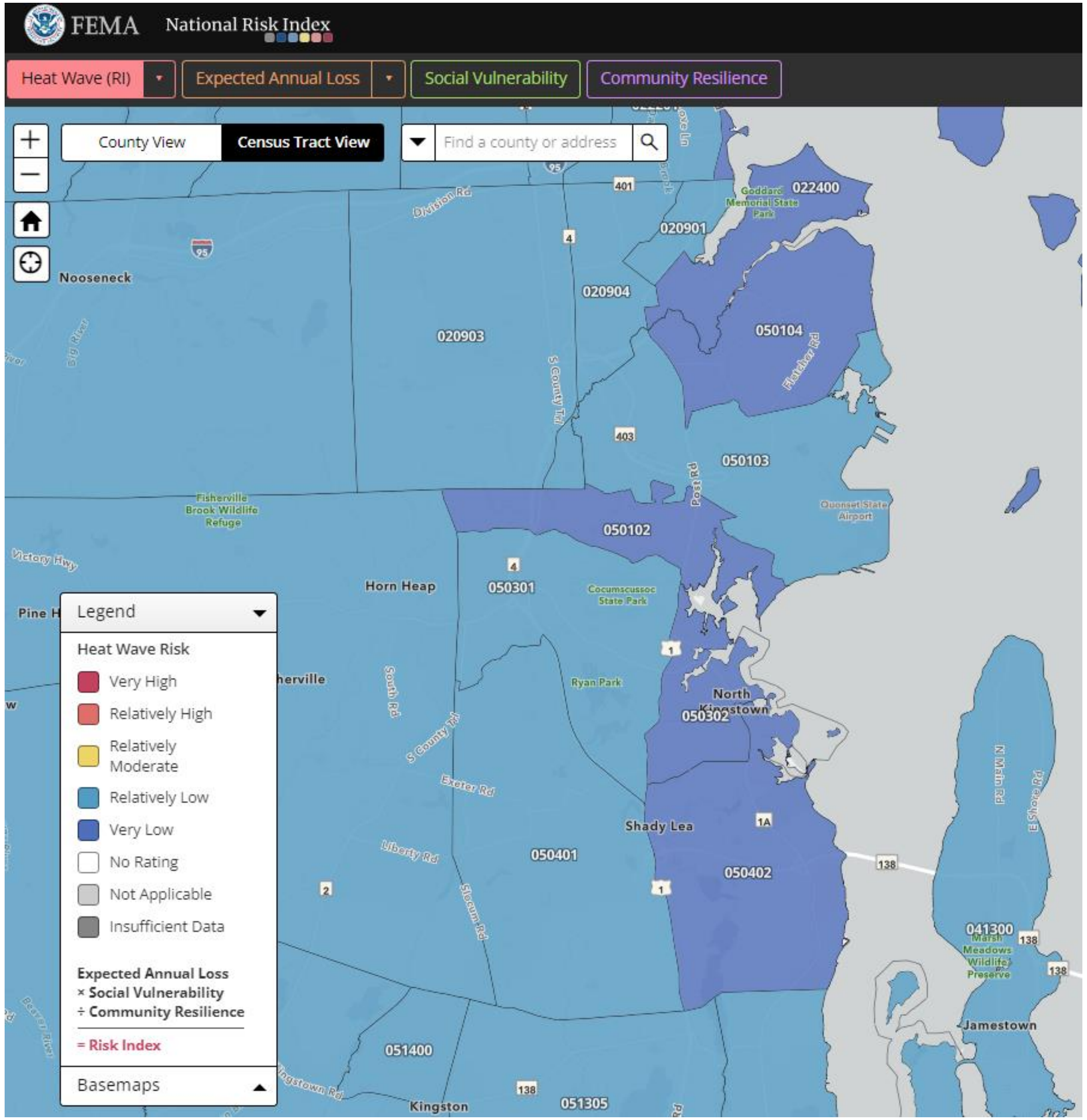
Rank	Community	EAL Value	NRI Score
1	Slocum	$1,606	72
2	Quidnessett	$1,111	67.1
3	Saunderstown	$987	65.4
4	Davisville	$727	61.2
5	Lafayette	$688	60.4
6	Quonset	$664	59.9
7	Wickford	$491	55.7



Climate Related Hazards: Extreme Heat

- Present Heat Hazard Potential
  - Very - Relatively Low
- Future Heat Hazard Potential
  - Heat waves are projected to increase in intensity
  - May experience more heat-related deaths, most dangerous in urban areas due to the heat-island effect.

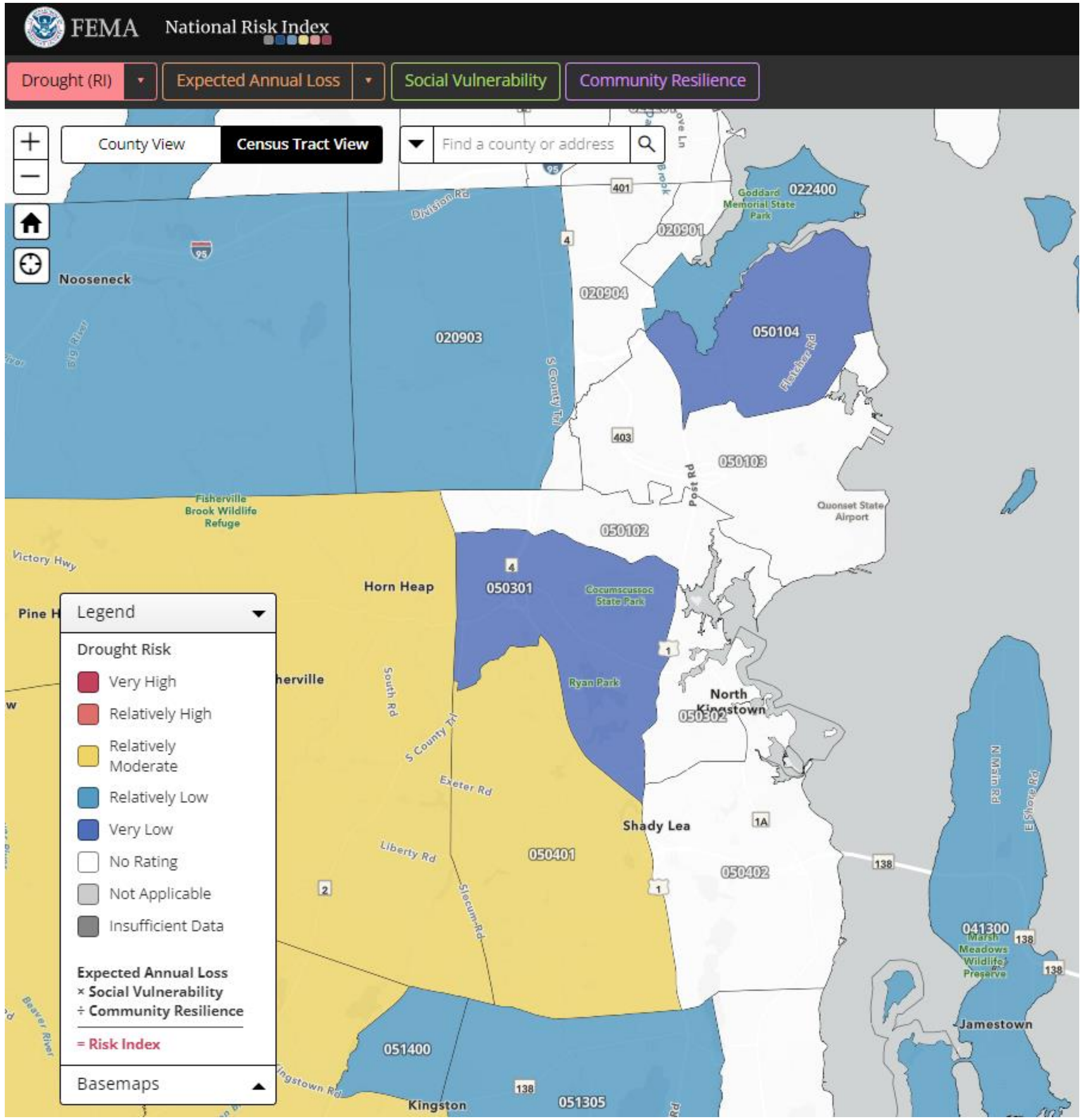
Rank	Community	EAL Value	Score
1	Quonset	$794	21.6
2	Slocum	$739	21.1
3	Lafayette	$645	20.4
4	Quidnessett	$525	19.5
5	Saunderstown	$372	18.6
6	Wickford	$371	18.6
7	Davisville	$324	18.3



Climate Related Hazards: Drought

- Present Drought Hazard Potential
  - Relatively Low
- Types of Drought:
  - Meteorological Drought - lack of precipitation
  - Agricultural Drought - lack of soil moisture
  - Hydrologic Drought - reduced streamflow or groundwater levels

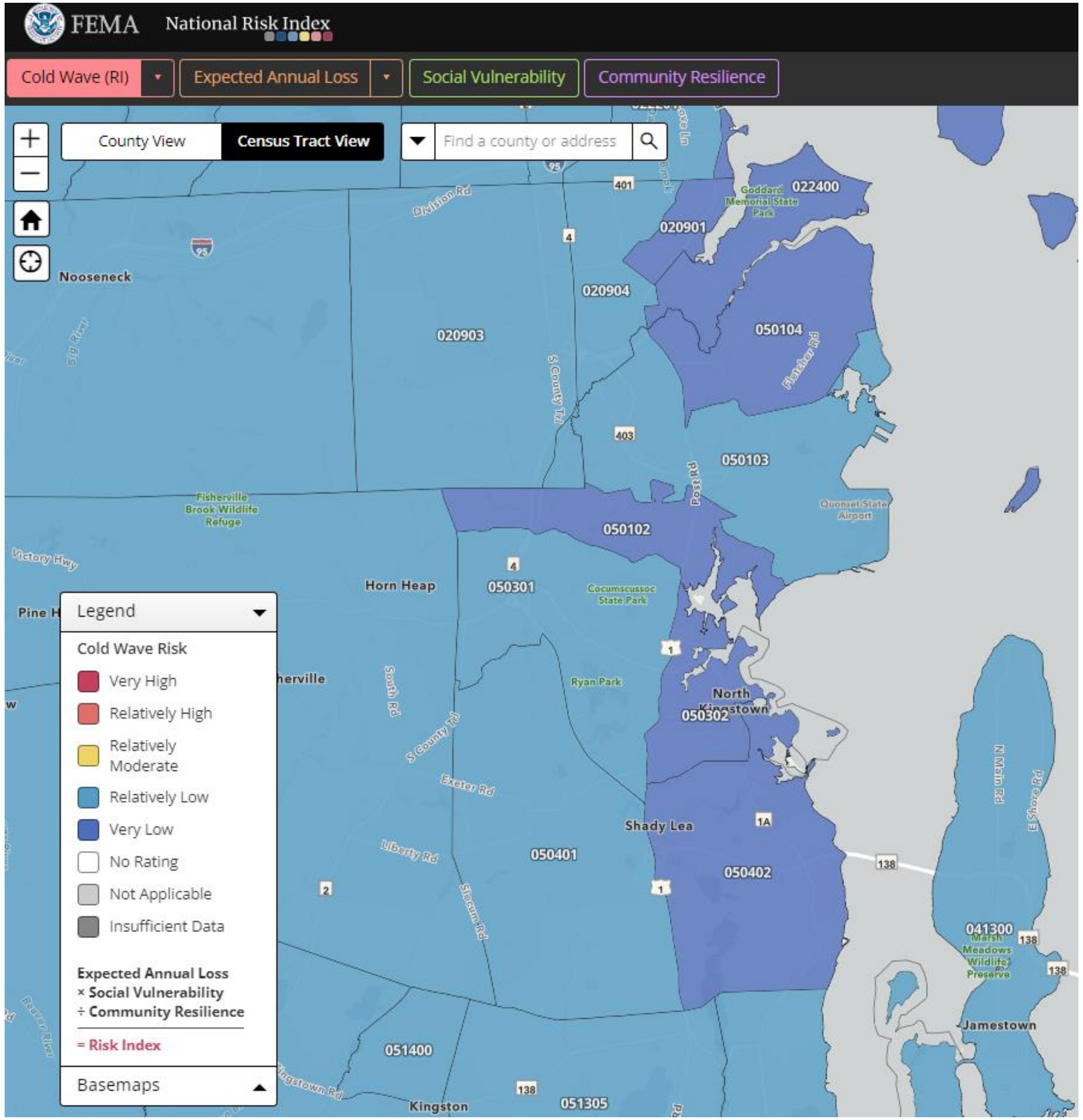
Rank	Community	EAL Value	NRI Score
1	Slocum	$31,217	95.6
2	Quidnessett	$335	80.6
3	Lafayette	$23	73.2
	Davisville	$0	0
	Quonset	$0	0
	Wickford	$0	0
	Saunderstown	$0	0



Climate Related Hazards: Extreme Cold

- Present Cold Hazard Potential
  - Very - Relatively Low
- Future Cold Hazard Potential
  - Cold waves are projected to become less intense

Rank	Community	EAL Value	NRI Score
1	Quonset	$522	47.6
2	Slocum	$482	47.1
3	Lafayette	$419	46.5
4	Quidnessett	$341	45.6
5	Saunderstown	$242	44.6
6	Wickford	$242	44.6
7	Davisville	$211	44.3



2024 Natural Hazards – National Risk Index (NRI)

Population: 27,732

- Population change since 2000: 1,246 (+4.7%)

Expected Annual Loss (EAL): $3,487,613

- Quonset: $907,293
- Wickford: $668,940
- Lafayette: $422,399
- Slocum: $401,059
- Saunderstown: $388,361
- Quidnessett: $357,819
- Davisville: $341,742

Next Steps

1. Complete and Present Vulnerability Assessment Results to the Planning Team
2. Update Community Capabilities to Address
3. Conduct Risk Assessment
4. Update Mitigation Strategies & Actions
5. Prepare Draft Plan
6. Plan Reviews, Approval, and Adoption

Old Saybrook Public Meeting (GZA)

GZA

Proactive By Design.
Our Company Commitment

Natural Hazard Mitigation Plan Update
North Kingstown, Rhode Island

NORTH KINGSTOWN

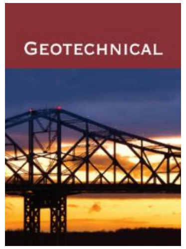
Public Meeting #2

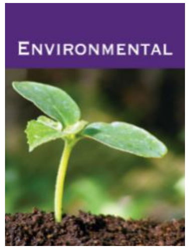
June 24, 2024

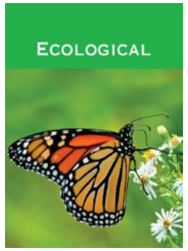
Project Hazard Mitigation Planning Consultant

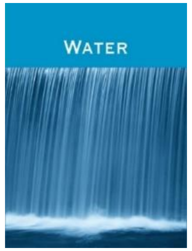
About GZA

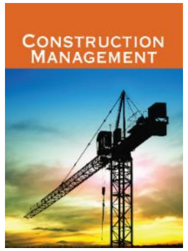
32 offices, 7000 Engineers, Scientists, Planners, and Technical Specialists providing expert, risk-informed and pragmatic advice and solutions in the following ***Core Service*** *areas:*











Today’s Meeting

Public Meeting #2: June 24, 2024

- ✓ Project Overview & Background
- ✓ Hazards Characterization Overview
- ✓ Risk Assessment Results Overview
- ✓ Mitigation Actions Approach
- ✓ Review and Discuss 2024 Mitigation Actions
- ✓ Discuss Next Steps

Flooding in Wickford during December 18, 2023 storm (image ref. RI MyCoast)

HAZARD MITIGATION PLANNING BACKGROUND

What is it? Why is it being done?

PURPOSE: Hazard Mitigation Planning is a proactive effort to identify actions that can reduce the dangers to life and property from natural hazard events, such as hurricanes, tornadoes, winter storms, and earthquakes.

REQUIREMENTS: The Federal Disaster Mitigation Act of 2000 requires all municipalities that wish to be eligible to receive FEMA funding for hazard mitigation grants, to adopt a local multi-hazard mitigation plan and update this plan in five-year intervals.

Figure credit FEMA

Wickford – Source: Town of North Kingstown

HAZARD MITIGATION PLANNING BACKGROUND

What is it? Why is it being done?

Figure credit FEMA

BENEFITS OF HAZARD MITIGATION PLANNING

- Act now, before a disaster, to reduce losses
- Increase public safety and prevent loss of life and injury
- Reduce damage to existing and future development
- Prevent harm to economic, cultural, and environmental assets
- Reduce downtime, speed up recovery, and lower response costs
- Meet other community objectives such as: capital improvements, infrastructure protection, and open space preservation

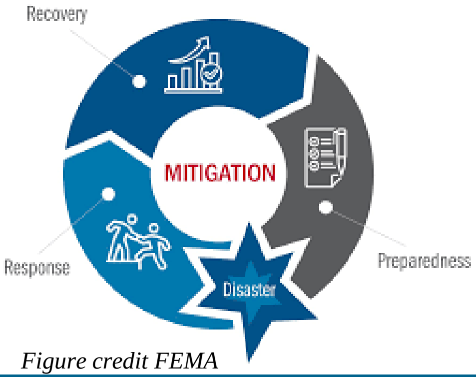


Figure credit FEMA

Natural Hazard Mitigation Plan Update

Goals:

- Update Town assets
- Document progress made per the 2019 Plan Update
- Characterize and assess natural hazard and climate-related hazard risks
- Provide public education and outreach during the planning process
- Revise and develop strategies and actions to mitigate the hazard risks
- Adopt plan update

Planning Process

Planning Process:

2. Assess Risk:
   - Community Demographics/Social Vulnerability
   - Asset Inventory
   - Natural Hazards Characterization
   - Risk Assessment
3. Mitigation Strategy and Actions
4. Plan Adoption and Maintenance

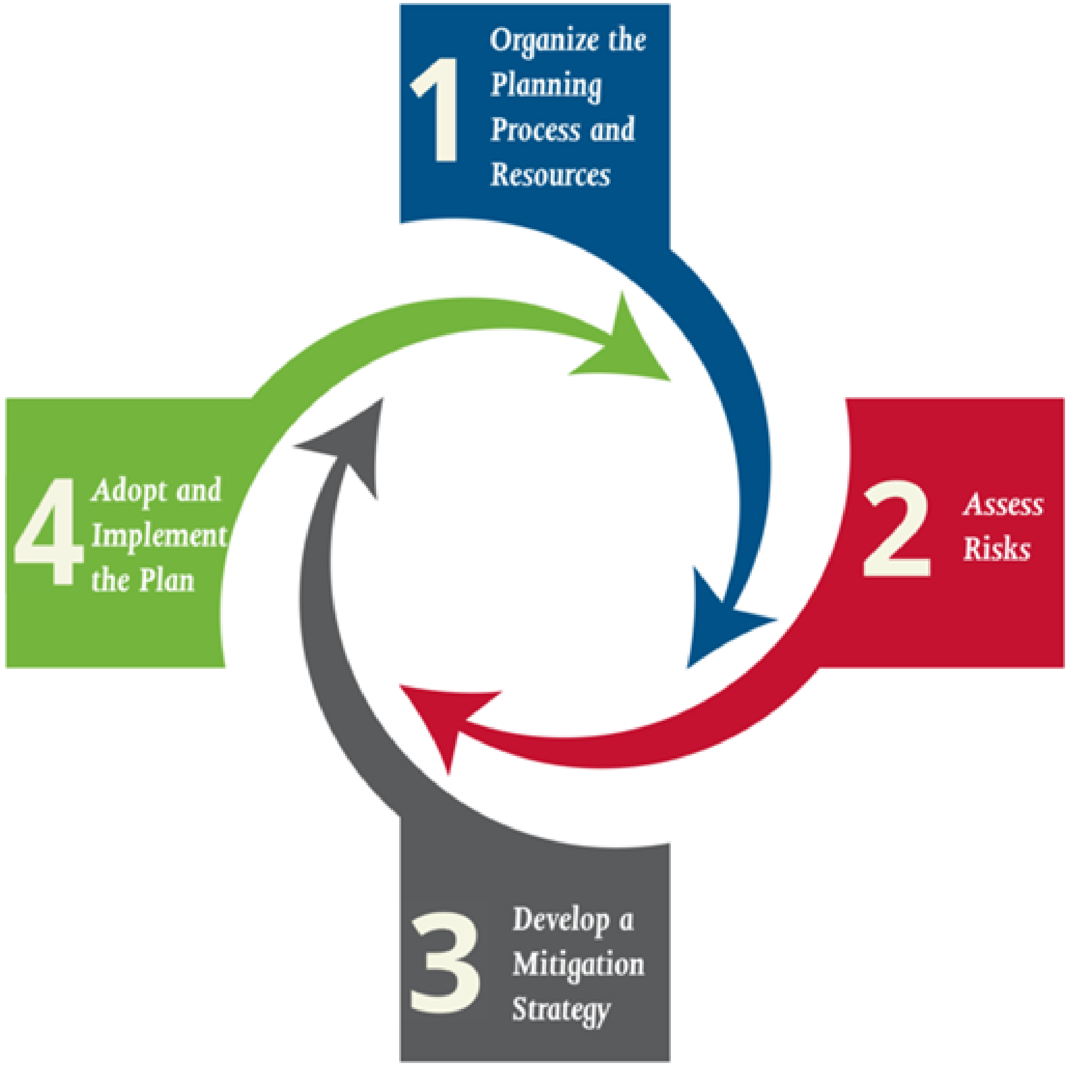


Figure credit FEMA/Jenny Burmester – Aug 21, 2017

Planning Tasks:

- Document progress made per the 2019 Plan Update
- Update City asset inventory
- Characterize the natural hazards and climate-change effects updates
- Assess current and future hazard vulnerability
- Document hazard mitigation progress made by the City
- Provide public education and outreach during the planning process
- Revise and develop strategies and actions to mitigate the hazard risks
- Coordinate with RIEMA & FEMA Plan Reviews
- Adopt the Plan Update

Working Group Team Members

Local Planning Team
Ralph Mollis – Town Manager
Nicole LaFontaine - Director of Planning and Development
Becky Lamond - Supervising Planner
Elle Moore - Planning Technician
Donald Peck - Building Department
Scott Kettelle - Fire Department
John Urban - Police Department
Marie Marcotte - Director
Mark Zamperini - Lakeside Nursing and Rehabilitation Center

Local Planning Team
Adam White - Public Works Director
Aly Sparks - Deputy Public Works
Meg Kerr - Planning Commission
Eli Mulligan - Administrative Captain
Scott Lessard - Fire Department
Rita Lavoie - Quonset Development Corporation
John Linacre - Fire Department
Matthew Souza - Building Official
Robert Corrente – School Facilities Director
Joel Rocha - Storm Water Specialist
Jim Broccoli - Harbormaster

Public Outreach

Public Meeting:

- 1st Public Meeting - May 21
- 2nd Public Meeting - June 24
- Public survey
    - QR Code:

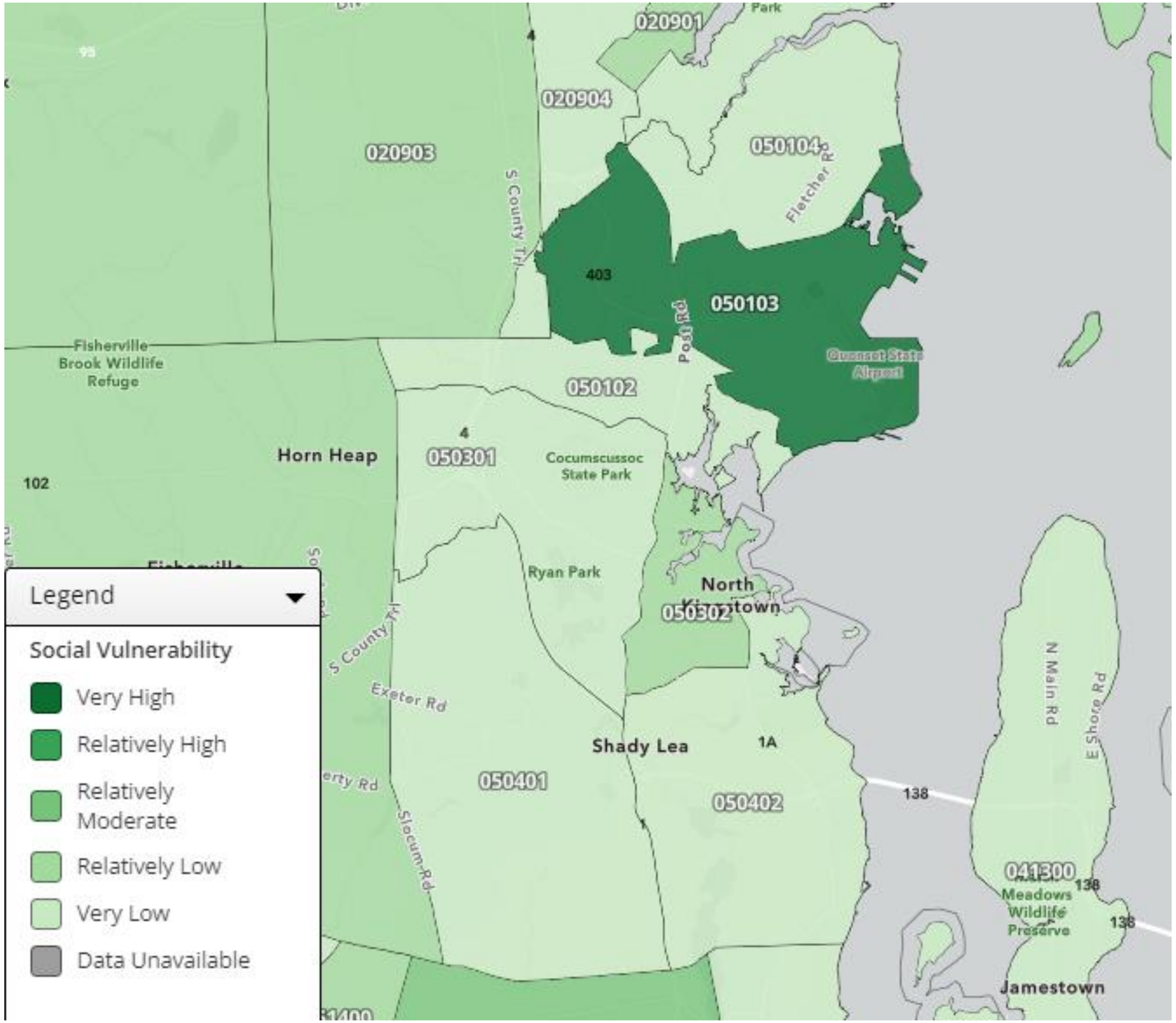
Scan Me!

Community Profile Overview

- Population: +/- 27,732 people
- Population change since 2000: 1,246 (+4.7%)
- Land Area: about 43.6 square miles
- Water Area: about 14.8 square miles
- Population Density: about 642.4 people per square mile
- Households: 11,341
- Median household income: $116,053 (compared to State average of $81,370)

Social Vulnerability Index (SVI)

- SVI Index Themes
  - Socioeconomic
  - Household Composition/Disability
  - Minority/Language
  - Housing/Transportation



Natural Hazards Overview

- Severe Weather Hazards
  - Hurricanes and Tropical Storms
  - Nor’easters
  - Riverine Flooding
  - Intense Rainfall and Hail
  - Heavy Snowfall and Ice Storms
- Climate Related Hazards
  - Extreme Temperatures
  - Drought
  - Wildfire
- Geologic Hazards
  - Earthquake

Figure credit FEMA

Severe Weather Hazards:
Severe Wind:
Hurricanes/Tropical Storms
Thunderstorms
Tornadoes
Lightning
Intense Rainfall
Hail
Flood:
Riverine/Overbank Flooding
Dam Failure/Beaver Dams
Poor Drainage Flooding
Severe Winter Weather:
Snowfall
Ice Storms
Climate-Related Hazards:
Extreme Temperature:
Extreme Heat
Extreme Cold
Drought
Wildfire
Geologic Hazards:
Earthquake

Natural Hazard Rankings Approach

- FEMA National Risk Index
  - Expected Annual Loss
  - Social Vulnerability
  - Community Resilience

$$\text{Risk} = \frac{\text{Expected Annual Loss} \times \text{Social Vulnerability}}{\text{Community Resilience}}$$

Natural Hazard Rankings Approach

Expected Annual Loss :

The EAL represents the average economic loss in dollars resulting from a certain natural hazard each year.

The EAL for each hazard is calculated as the product of exposure, annualized frequency, and historic loss ratio.

- Exposure represents the value of buildings, population, or agriculture potentially exposed to a natural hazard occurrence.
- Annualized frequency represents the expected frequency or probability of a natural hazard occurrence per year.
- Historic loss ratio represents the estimated percentage of the exposed building value, population, or agriculture value expected to be lost due to a natural hazard occurrence.

Natural Hazard Rankings Criteria

Social Vulnerability:

- Social vulnerability is the susceptibility of social groups to the adverse impacts of natural hazards.
- The score is a relative score and indicates the relative level of a community's social vulnerability compared to other communities at the same level.

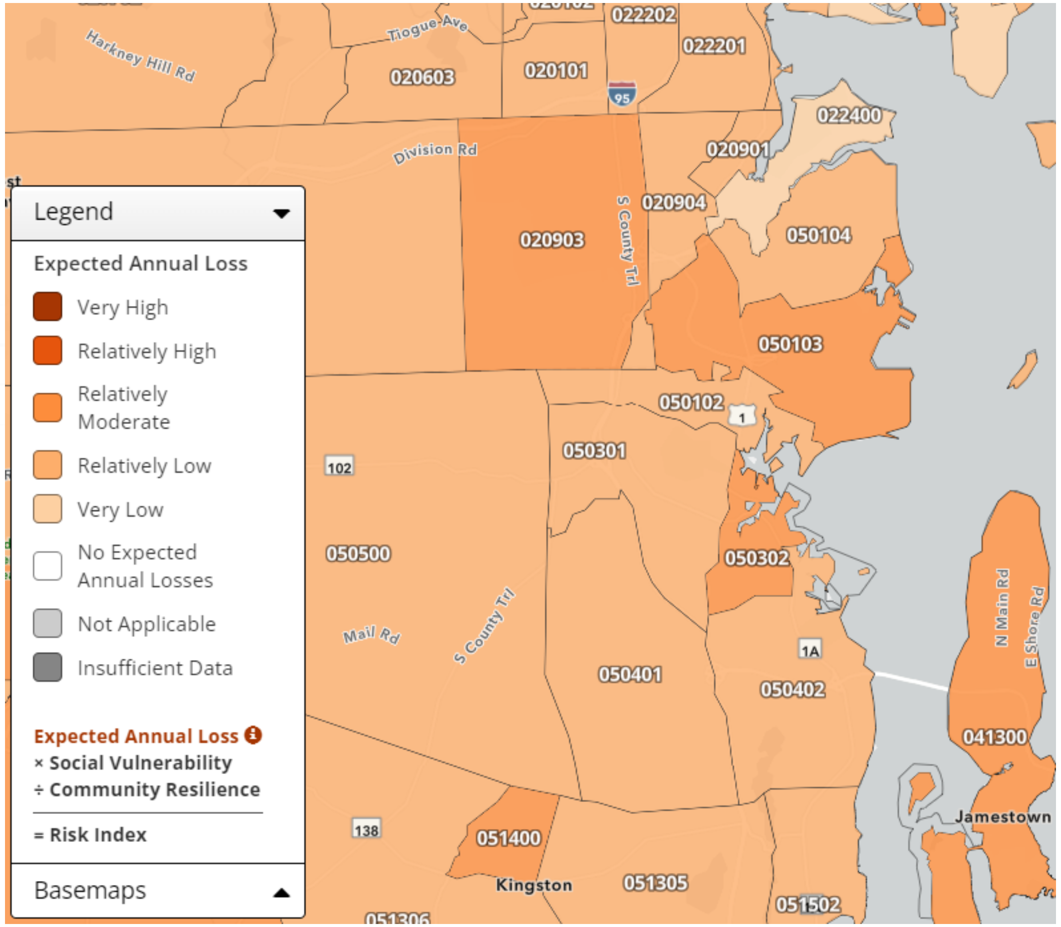
Community Resilience:

- Community resilience is the ability of a community to prepare for a natural disaster, adapt to changing conditions, and withstand and recover rapidly from disruptions.
- The score is a relative score and represents the community's relative level compared to other communities at the same level.

2024 Natural Hazards

	Severe Weather Hazards:	Hazard Index	Hazard Rating
	Strong Wind	24.5	Very Low
	Tornadoes	27.3	Relatively Low
Rank 2	Hurricanes/Tropical Storms	74.7	Relatively Moderate
	Lightning	44.6	Relatively Low
	Hail	24.8	Very Low
Rank1	Coastal Flooding	87.4	Relatively Moderate
Rank 3	Riverine Flooding	71.4	Relatively Moderate
	Severe Winter Weather	32.9	Very Low
	Ice Storms	64.6	Relatively Moderate
	Climate-Related Hazards:		
	Heat Wave/ Extreme Heat	18.3	Relatively Low
	Cold Wave/ Extreme Cold	44.6	Relatively Low
	Drought	35.1	Relatively Low
	Wildfire	59.6	Very Low
	Geologic Hazards:		
	Earthquake	29.5	Very Low
	Landslides	37.7	Relatively Moderate

Natural Hazards



Hazard Type	Period of Record	Average Annualized Frequency (event/year)
Coastal Flooding	Various	2.6
Cold Wave	2005-2021 (16 years)	0.1
Drought	2000-2021 (22 years)	2.2
Earthquake	2021 dataset	0.0
Hail	1986-2021 (34 years)	1.7
Heat Wave	2005-2021 (16 years)	0.6
Hurricane	East 1851-2021 (171 years) / West 1949-2021 (73 years)	0.2
Ice Storm	1946-2014 (67 years)	1.2
Landslide	2010-2021 (12 years)	0.0
Lightning	1991-2012 (22 years)	12.0
Riverine Flooding	1996-2019 (24 years)	0.8
Strong Wind	1986-2021 (34 years)	1.1
Tornado	1950-2021 (72 years)	0.0
Tsunami	1800-2021 (222 years)	#N/A
Volcanic Activity	--	#N/A
Wildfire	2021 dataset	Less than 0.001% chance per year
Winter Weather	2005-2021 (16 years)	3.9

2024 Natural Hazards – National Risk Index (NRI)

Population: 27,732	
• Population change since 2000:	1,246 (+4.7%)
Expected Annual Loss (EAL):	$3,487,613
• Quonset:	$907,293
• Wickford:	$668,940
• Lafayette:	$422,399
• Slocum:	$401,059
• Saunderstown:	$388,361
• Quidnessett:	$357,819
• Davisville:	$341,742

Mitigation Actions **Approach**

1) Identified and integrated ongoing and yet to be completed actions from 2019 HMP Update
   - **37 Actions - 2019 HMP Update**
2) Focused development of new actions on top ranked hazards
3) Proposed Estimated Timeline for Implementation
4) Prepared Planning Level Estimated Project Costs
5) Identifying Responsible Department(s) for City
6) Identifying Potential Funding Sources

Plan Update Mitigation and Resilience **Actions**

21 new (2024) mitigation actions:

- 10 Multiple Hazards Actions
  - **4 High Priority Actions**
- 7 Flood-Related Hazards Actions
  - **5 High Priority Actions**
- 3 Climate Related Hazards: Drought, Wildfire & Extreme Temperatures
  - **1 High Priority Action**
- 1 Severe Winter Weather Hazard
  - **1 High Priority Action**

Multiple Hazards

NEW, 2024 MITIGATION ACTIONS	Benefits	Costs	Timeline	Estimated Project Costs	Priority	Responsible Agencies	Potential Funding Sources
MULTIPLE HAZARDS							
Possible Actions to Add:							
Action 1. **Local Hazard Mitigation Plan (Tracking and Updates).** The North Kingstown ____ will monitor and evaluate progress in implementing action items in this Plan and include those accomplishments in its annual report to the Town. The Town will also reconvene its multi-agency Committee every 5 years to update the Plan.	High	Low	2024 to 2029	Low	High	North Kingstown Planning Commission (PC) and Land Use Department (LUD)	TBD
Action 2. **Grants. Grant Application Plan (GAP).** Prepare a detailed application plan for grant opportunities, including FEMA Hazard Mitigation Grant, USACE, NOAA, HUD, RIDOT, and EPA programs. Initiate grant applications. Based on the GAP, apply for grants to fund mitigation tasks identified in this plan including a benefit-cost analysis for each opportunity including the three FEMA Hazard Mitigation Assistance (HMA) grant programs: HMGP, PDM, and FMA.	High	Low	2024 to 2026	Low to Medium	High	OSB BOS/BOF, All Departments FEN W&B, All Departments	FEMA, USACE, NOAA, HUD, EPA, RI DOT, NK CIP
Action 3: **Education and Outreach to residents and community stakeholders** to 1) promote owner participation in mitigation efforts to protect their property; 2) educate public on how the Town uses conservation planning, regulations to mitigation natural and climate related hazards; 3) educate residents and community stakeholders at high risk to impacts from natural hazards on the hazards relative to where they live.	High	Low	Annually	Low	High	Building Official, TBD	TBD
Action 4: Conduct **Natural Hazard Mitigation Training** on an annual basis using FEMA's training modules, support materials, and guidance.	High	Low to Medium	Annually	Low to Medium	High	TBD	TBD
Action 5. Evaluate, purchase, and install a **generator** for back-up power for **Public Buildings/ key town assets**, where necessary.	Medium	Medium	2024 to 2029	Medium to High	Medium	Police Department, Fire Department, Department of Public Works, TBD	DEMHS, FEMA, TBD
Action 6. **Telecommunication Tower Generators (Private).** Evaluate whether generators are needed for back-up power at telecommunications facilities.	Med	Low	2024 to 2029	Low	Medium	BOS, OEM	DEMHS FEMA CIP
Action 7: Encourage **privately owned gas stations** to install and maintain **emergency back-up generators.**	Med	Low	2024—2027	Low	Medium	TBD	TBD

Multiple Hazards

MULTIPLE HAZARDS							
Possible Actions to Add:							
NEW, 2024 MITIGATION ACTIONS	**Benefits**	**Costs**	**Timeline**	**Estimated**	**Priority**	**Responsible**	**Potential Funding**
Action 8: **Local Social Resources Impacts Analysis.** Identify local resources to assist with those populations (i.e. elderly, disabled, non-English speakers, who may frequent, reside, or work) in North Kingstown. Seek grants to provide funding for developing more detailed data to assist in the social – demographic analysis of how North Kingstown will be affected by natural hazards.	High	Medium	TBD	Low to Medium	Medium	TBD	HUD, FEMA, TBD
Action 9: **Temporary Housing Assessment.** Evaluate the need for post disaster housing for residents displaced by flood or other natural disaster.	Medium	Medium	TBD	Low to Medium	Medium	TBD	HUD, FEMA, TBD
Action 10: **Immobile Evacuees Planning:** Review annually the program to evacuate persons without means of transportation, including registration and house numbering. Also identify refugees of last resort that are unable to reach a designated shelter.	High	Low	Annually	Low	Medium	TBD	TBD

Flood Hazards

FLOOD HAZARDS							
Possible Actions to Add:							
Action 11. Participate in reviews of regulatory **floodplain maps updates** and revisions.	High	Medium to High	Ongoing	Low	High	TBD	FEMA, TBD
Action 12: **Road Evaluation**: Evaluate roads at least annually to develop plans for improvement or elevation for emergency access and evacuation. **Develop conceptual plans and prioritization** for pursuing engineering, design, and construction funding **of identified roadways.**	High	Medium	Annually	Medium to High	High	TBD, RI DOT	FHWA, RI DOT, TBD
Action 13: **Repetitive Loss Area Analysis (RLAA).** Repetitive loss (RL) structures can be demolished and rebuilt or elevated to higher standards than minimum FEMA requirements. It is recommended to perform a formal RLAA to identify the impact to Town's NFIP insurance rate due to repetitive loss. The results from the RLLA will help further support Town and property owner resilience and mitigation activities, including acquiring, relocating and/or flood mitigation of RL properties. Encourage Repetitive Loss Property Owners to **pursue flood mitigation funding** for actions such as elevation or acquisition of structures where appropriate on a voluntary basis	Medium	Low	Ongoing	Low to Medium	High	TBD	TBD
Action 14. Continue to participate in **National Flood Insurance Program (NFIP)** (or other) training offered by the State and/or FEMA that addresses flood hazard planning and management.	High	Low	Ongoing	Low	High	TBD	FEMA, RIEMA, TBD
Action 15: STORMWATER. **Analyze the existing stormwater infrastructure** to identify the need for additional catch basins/pump stations/additional tide gates/green infrastructure.	High	Medium	2024—2029	Medium	High	TBD	EPA, RI DEM, TBD
Action 16. Incorporate the procedures for tracking **high water marks** following a flood into emergency response plans.	Medium	Low	Ongoing	Low	Medium	TBD	FEMA, Silver Jackets (USACE), TBD
Action 17: Employ **living shoreline solutions** for select areas including low wave energy environments such as tidal marsh borders and river mouths.	High	Medium	2024-2029	Medium to High	Medium	TBD, Beach Associations	FEMA HMGP, TBD

Climate Related Hazards: Drought, Wildfire, & Extreme Heat

NEW, 2024 MITIGATION ACTIONS	Benefits	Costs	Timeline	Estimated Project Costs	Priority	Responsible Agencies	Potential Funding Sources
CLIMATE RELATED HAZARDS: DROUGHT, WILDFIRE, & EXTREME HEAT							
Possible Actions to Add:							
Action 18: **Firefighting Infrastructure Analysis**: Evaluate existing firefighting infrastructure to identify needs for improvement to cover gaps in availability.	High	Low	2024-2029	Low	High	Fire Department, TBD	FEMA EMPG, HMGP, TBD
Action 19: **Wildfire Education**: Conduct public education and outreach to the public on potential wildfire hazards caused by campfires & open air burning.	High	Low to Medium	Annually	Low	Medium	Fire Department, TBD	FEMA EMPG, HMGP, TBD
Action 20: **Protect Vulnerable Populations** by: 1) Organize outreach to vulnerable populations to educate citizens on the dangers of extreme heat & cold, and the steps they can take to protect themselves when extreme temperatures occur.	High	Medium	2024-2029	Medium	Medium	TBD	FEMA, RI DEM, TBD

Severe Winter Weather Hazards

NEW, 2024 MITIGATION ACTIONS	Benefits	Costs	Timeline	Estimated Project Costs	Priority	Responsible Agencies	Potential Funding Sources
SEVERE WINTER WEATHER HAZARDS							
Action 21: Maintain adequate supply of sand, salt, and other **road treatment** materials.	High	Low	Annually	Low	High	TBD	TBD

Next Steps

1. Finish Mitigation Strategies & Actions Update
2. Advisory Committee Meeting to Review Actions
3. Prepare Draft Plan
4. Submit Plan Update to RIEMA/FEMA for review
5. Revise Plan Update, if necessary
6. Plan approval and local adoption

Old Saybrook Public Meeting (GZA)

ATTACHMENT 7: REFERENCES AND RESOURCES

- Centers for Disease Control and Prevention/ Agency for Toxic Substances and Disease Registry/ Geospatial Research, Analysis, and Services Program. https://www.atsdr.cdc.gov/place-health/php/svi/svi-interactive-map.html?CDC_AAref_Val=https://www.atsdr.cdc.gov/placeandhealth/svi/interactive_map.html
- Federal Emergency Management Agency (FEMA), Local Mitigation Plan Review Guide, October 2011. https://www.fema.gov/sites/default/files/2020-06/fema-local-mitigation-plan-review-guide_09_30_2011.pdf
- Federal Emergency Management Agency (FEMA), Local Mitigation Planning Policy Guide, April 2023. https://www.fema.gov/sites/default/files/documents/fema_local-mitigation-planning-policy-guide_042022.pdf
- FEMA, Mitigation Ideas, January 2013. https://www.fema.gov/sites/default/files/2020-06/fema-mitigation-ideas_02-13-2013.pdf
- FEMA, Hazus Inventory Technical Manual, November 2022. https://www.fema.gov/sites/default/files/documents/fema_hazus-6-inventory-technical-manual.pdf
- FEMA, Local Mitigation Planning Handbook, May 2023. https://www.fema.gov/sites/default/files/documents/fema_local-mitigation-planning-handbook_052023.pdf
- FEMA, Hazard Mitigation Assistance Guidance, February 2015. https://www.fema.gov/sites/default/files/2020-07/fy15_HMA_Guidance.pdf
- FEMA, National Flood Insurance Program Flood Insurance Manual, April 2024. https://www.fema.gov/sites/default/files/documents/fema_nfip_flood-insurance-manual_042024.pdf
- FEMA, Flood Insurance Rate Maps (5 panels) for North Kingstown, RI. https://northkingstownri.gov/217/Know-Your-Flood-Hazard
- FEMA, National Risk Index Technical Documentation, March 2023. https://www.fema.gov/sites/default/files/documents/fema_national-risk-index_technical-documentation.pdf
- FEMA, The National Risk Index Interactive Map, Accessed April 2024. https://hazards.fema.gov/nri/
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- FEMA, 2024, FEMA Major Disaster Declarations. https://www.fema.gov/disaster/declarations
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- NOAA Atlas 14, Precipitation Frequency Data Server. https://hdsc.nws.noaa.gov/hdsc/pfds/
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- NOAA National Hurricane Center, Tropical Cyclone Climatology. https://www.nhc.noaa.gov/climo/#bac
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- Rhode Island Geographic Information System. https://www.rigis.org/
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ATTACHMENT 8: KEY CONTACTS

THE STATE OF RHODE ISLAND EMERGENCY MANAGEMENT AGENCY (RIEMA)

645 New London Ave, Cranston
RI 02920
Contact RIEMA:
Phone: (401) 946-9996
Fax: (401) 944-1891

Director: Marc Pappas
Phone: 401-946-9996
Email: marc.pappas@ema.ri.gov

Executive Administrator: Tom Guthlein
Phone: 401-462-7121
Email: thomas.guthlein@ema.ri.gov

Assistant Director Communications: Armand Randolph
Phone: 401-462-7183
Email: armand.randolph@ema.ri.gov

Associate Director, Operations: John Washburn
Phone: 401-946-9996
Email: john.washburn@ema.ri.gov

Planning Branch Chief: Melinda Hopkins
Phone: 401-462-7141
Email: melinda.hopkins@ema.ri.gov

Recovery Branch Chief: Larry Macedo
Phone: 401-462-7534
Email: lawrence.macedo@ema.ri.gov

State Hazard Mitigation Officer: Rae-Anne Culp

https://riema.ri.gov/planning-mitigation/resources-government

TOWN OF NORTH KINGSTOWN

Town Hall & Municipal Offices:
100 Fairway Dr
North Kingstown, RI 02852

Fire Department
8150 Post Road
North Kingstown, RI 02852
401-294-3346

Police Department
8166 Post Road
North Kingstown, RI 02852
401-294-3316
911 Emergency

Highway Department
Deb Knauss
Highway Clerk
DKnauss@northkingstownri.gov
(401) 268-1500, Ext. 622

FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA):

FEMA Region 1 Office
Lori Ehrlich, Regional Administrator
99 High St.
Boston, MA 02110
1-877-336-2734
fema-r1-info@fema.dhs.gov

DEPARTMENT OF ENVIRONMENTAL MANAGEMENT (DEM)

RI DEM

235 Promenade Street
Providence, RI 02908
General Information: 401-222-4700
After Hours Emergencies: 401-222-3070

State National Flood Insurance Program (NFIP) coordinator

Morgan Reilly, CFM
Rhode Island Emergency Mgmt. Agency
645 New London Ave.
Cranston, RI
(401) 451-2606
morgan.reilly@ema.ri.gov

RI OFFICE OF ENERGY RESOURCES

One Capitol Hill
Providence, RI 02908
Phone: (401) 574-9117
Fax: (401) 574-9125
Energy.Resources@energy.ri.gov

AMERICAN RED CROSS:

Rhode Island Chapter

100 Niantic Ave Suite A
Providence, RI 02907
Phone: 877-287-3327

https://www.redcross.org/local/rhode-island/about-us/our-work/preparedness-programs.html
https://www.redcross.org/local/rhode-island/about-us/our-work.html

SALVATION ARMY

Salvation Army Rhode Island Area Services
34 Commercial Street
Cranston, Rhode Island 02905
1-800-SAL-ARMY

https://easternusa.salvationarmy.org/southern-new-england/providence/

ATTACHMENT 9: HMP SURVEY

Public Survey

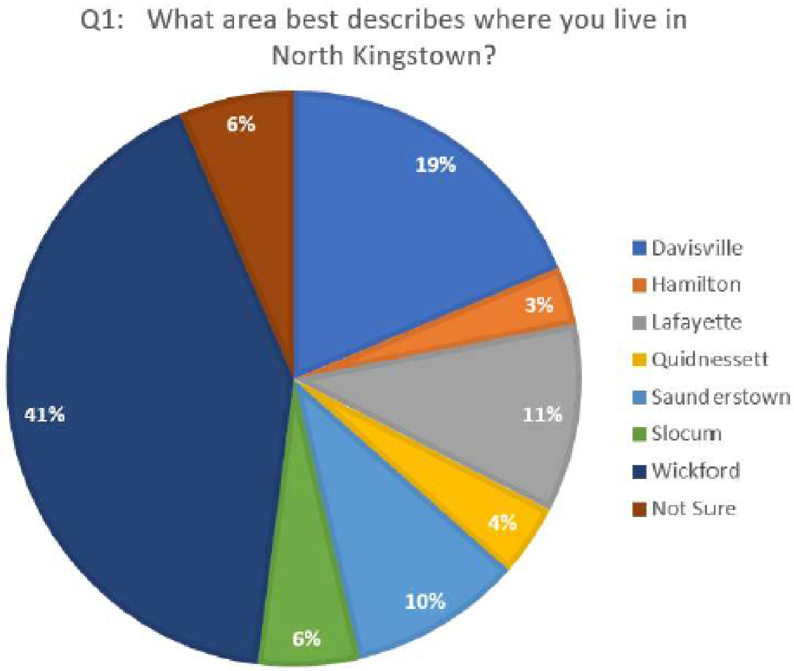
An online survey was posted for community members, to inquire about natural hazards from extreme events which have been experienced recently and those which may occur in the future impacting the town's infrastructure, social resources, and environmental resources. The following is a summarized list of the survey questions posed.

1. What area best describes where you live in North Kingstown?
2. This plan addresses a number of different natural hazards to help decision-makers with future resilience planning. Please indicate if you have experienced issues related to the following natural hazards (you can check more than one box).
3. What types of issues have you experienced or observed due to heavy rainfall events (you can check more than one box)?
4. What issues have you experienced relative to extreme temperatures (you can check more than one box)?
5. How would you prioritize or rank the asset categories (below) in North Kingstown in order of most important to least important (in terms of adaptation/resilience to climate change) in your opinion?
6. How vulnerable are the following issues to natural hazards, in your opinion?
7. Which action(s) do you take to be well prepared for potentially disruptive natural hazard events? Check all that apply.
8. What are the most important things that your municipal government and leaders can do to help residents and businesses be prepared for a disaster, and become more resilient over time?
9. What is the most effective way to communicate – OR - To assist the Town in better communicating about what to do before, during, and after a disaster, please select the TOP TWO (2) methods you would prefer to receive information.
10. Is your property located in a flood zone?
11. If you would like to be contacted by the Project Team to provide more input and/or share additional thoughts, please leave your name and contact information (phone, email, etc.) below.

One hundred and twenty-three (123) people responded to the survey, including ninety-seven town residents (97), fifteen (15) work for or with the Town, and eleven (11) work in the Town North Kingstown. Fifty-one (51) people live within the Wickford census area, twenty-three (23) live within the Davisville census area, thirteen (13) within the Lafayette census area, twelve (12) within the Saunderstown census area, seven (7) within the Slocum census area, five (5) within the Quidnessett census area, four (4) within the Hamilton census area, and eight (8) people were unsure of their location.

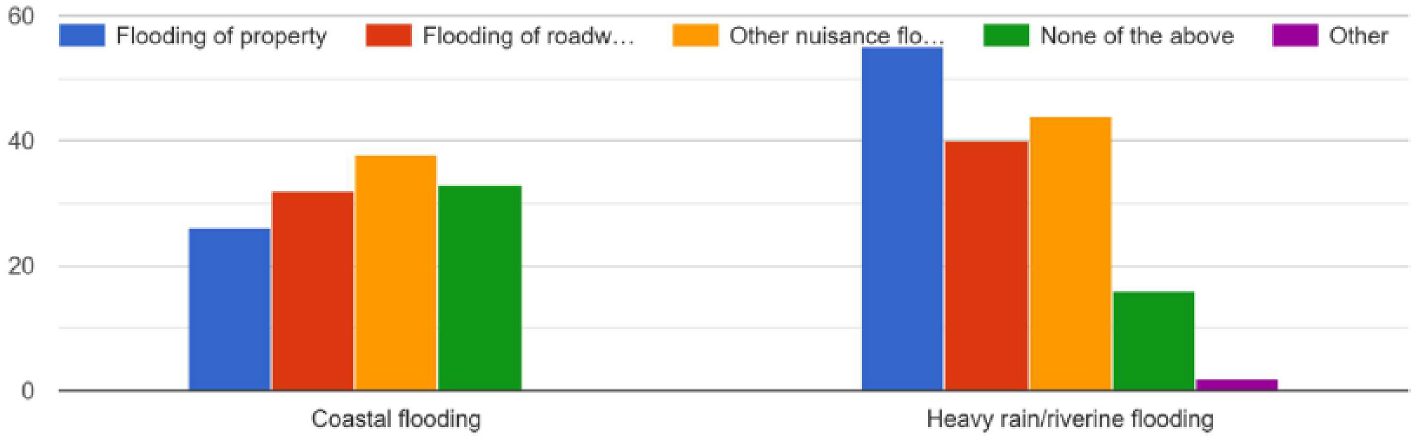
The following re-iterates the survey questions along with their responses and results.

1. What area best describes where you live in North Kingstown?



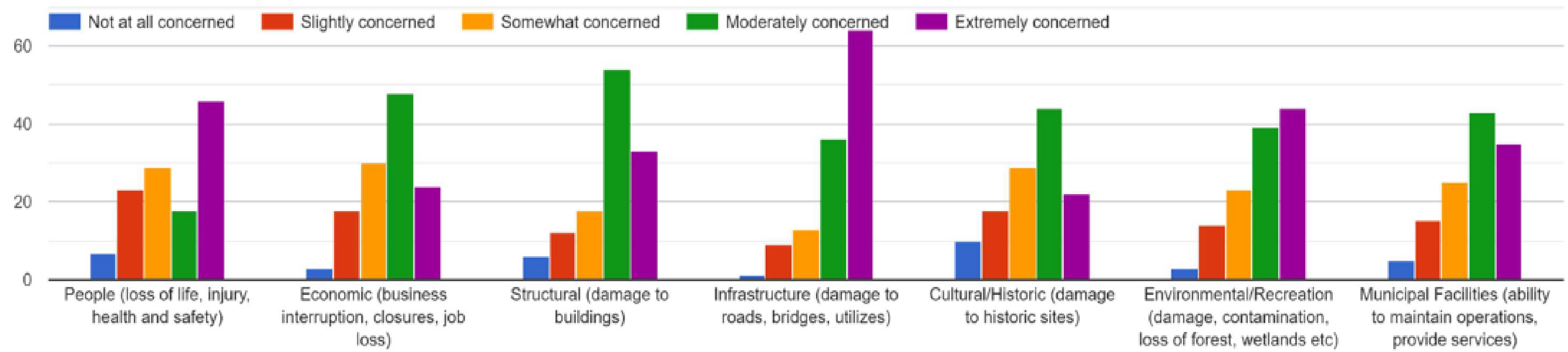
2. This plan addresses a number of different natural hazards to help decision-makers with future resilience planning. Please indicate if you have experienced issues related to the following natural hazards (you can check more than one box). (Parentheses indicate # of ranked votes)
   a. Flooding and Erosion (74)
   b. Strong Wind and/ or Tornado (67)
   c. Winter weather and extreme cold (43)
   d. Heat Wave (extreme heat) (36)
   e. Drought (29)
   f. Earthquake (6)
   g. Wildfire (6)
   h. Other:
      i. None (6)
      ii. Increased north-easterly storms (1)
      iii. Sea Level Rise (1)

3. What types of issues have you experienced or observed due to heavy rainfall events (you can check more than one box)?
    a. Flooding of property
    b. Flooding of roadway
    c. Other nuisance flooding
    d. None of the above
    e. Other

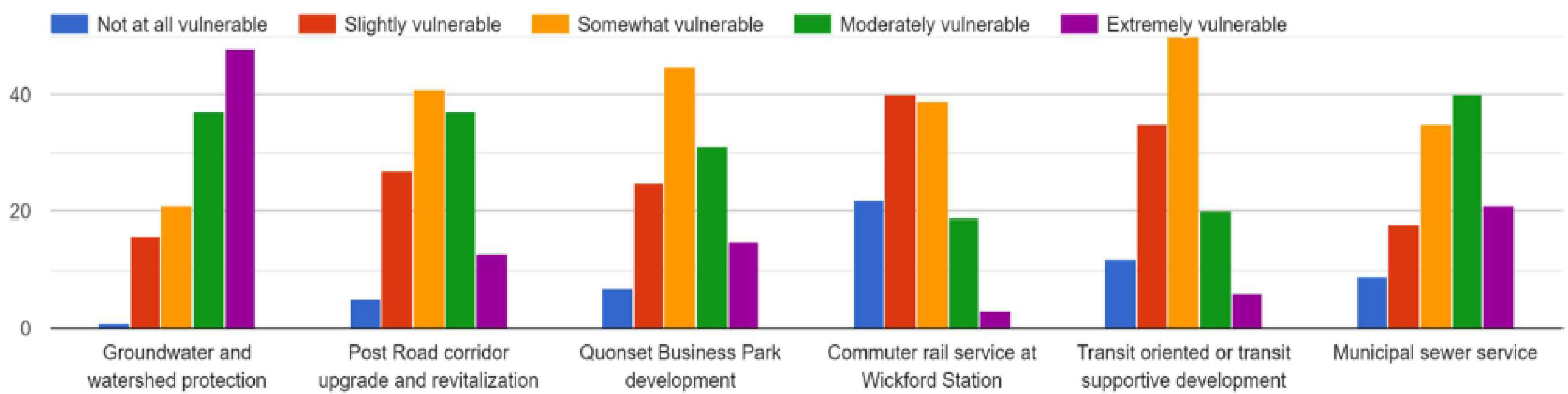


4. What issues have you experienced relative to extreme temperatures (you can check more than one box)? (Parentheses indicate # of ranked votes)
    a. None of the above (64)
    b. New or worsening health issues (35)
    c. New or worsening wear and tear of property, buildings, or other sensitive equipment (26)
    d. New or worsening health issues (16)
    e. Other: (6)
        i. "Tornado went through our property"
        ii. "Limitations on outdoor activities"
        iii. "Vegetation loss"
        iv. "Even compared to 22 years ago when we moved to NK the problems of really cold weather are largely diminished with much less snowfall. The few weeks of heat are largely spent indoors with air conditioning. Long term that's not a solution."
        v. "Increased energy costs"
        vi. "Need for AC"

5. How would you prioritize or rank the asset categories (below) in North Kingstown in order of most important to least important (in terms of adaptation/resilience to climate change) in your opinion?



6. How vulnerable are the following issues to natural hazards, in your opinion?



7. Which action(s) do you take to be well prepared for potentially disruptive natural hazard events? Check all that apply. (Parentheses indicate # of ranked votes)
    a. I generally follow news sources such as radio/TV/internet (110)
    b. I have equipment or other measures to mitigate hazards (e.g., backup power generator, floodproofing equipment, etc.) (73)
    c. I monitor weather radio (67)
    d. I monitor the Town's website/social media feed (48)
    e. I have a personal pre-disaster plan, evacuation plan, or "go kit" in the event of an emergency (34)
    f. I do not have a preparedness plan (22)
    g. I have a Town Emergency Management phone number to call (not 911) during a natural hazard event (21)
    h. Other: (4)
        i. "I receive text alerts for national disasters"
        ii. "code red"
        iii. "stock up on food and fuel ahead of impending heavy storms"
8. What are the most important things that your municipal government and leaders can do to help residents and businesses be prepared for a disaster, and become more resilient over time?

Summary of the responses:

1. ***Mitigation and Preparedness:*** *There is a strong emphasis on investing in mitigation measures to prevent and prepare for disasters. This includes elevating infrastructure, preparing emergency kits, and ensuring residents understand how to protect their homes and prepare for power outages.*

2. ***Communication and Information:*** *Clear and proactive communication is highlighted as crucial. Residents need to be kept informed through various channels, including updates on the town website, phone alerts, and public forums.*

3. ***Infrastructure Improvements:*** *Maintaining and upgrading infrastructure is vital for resilience. This includes enhancing roads, sewers, water systems, and electricity grids, and planning for sea level rise and flooding.*

4. ***Community Education and Engagement:*** *Educating residents about disaster preparedness and involving them in planning is seen as essential. This includes training neighborhoods, holding workshops, and providing detailed information on hazards and preparation.*

5. ***Sustainability and Planning:*** *There is a call for smart, sustainable planning to prevent over-development in vulnerable areas and incorporate climate change impacts into planning decisions. This includes protecting watersheds, reducing emissions, and investing in renewable energy.*

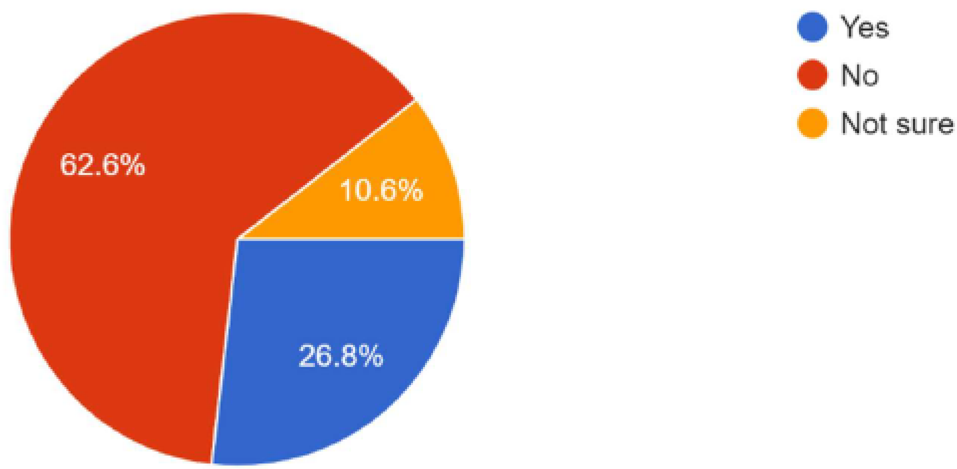
Some quoted response highlights:

1. ***Mitigation and Preparedness:***
   - *"Help identify what residents can do at their homes. Elevate basement infra, build a kit, Plan for grid outages."*
   - *"Incentives and rebates for preparedness items (i.e: generators)."*
2. ***Communication and Information:***
   - *"Communication is key." - "Provide information. Build infrastructure."*
   - *"Clear, non-jargony communication of risks and opportunities for assistance."*
3. ***Infrastructure Improvements:***
   - *"Maintain updated infrastructure (roads, sewers, water, electricity)."*
   - *"The electric power is very vulnerable to weather conditions with power lines above ground, the town needs better electric power infrastructure."*
4. ***Community Education and Engagement:***
   - *"Educate people about what to do before an emergency happens so people don't need to find that information during a disaster event."*
   - *"Engage the community in planning for climate-related disasters."*
5. ***Sustainability and Planning:***
   - *"Keep development off water sensitive areas, for example, reservoir and watershed areas."*
   - *"Invest in solar and wind power." "Prepare, train people, and adapt improve infrastructure."*

9. What is the most effective way to communicate – OR - To assist the Town in better communicating about what to do before, during, and after a disaster, please select the TOP TWO (2) methods you would prefer to receive information.
   a. Call/text (74)
   b. Email (71)
   c. Social media (46)
   d. Town website (36)
   e. Television (25)
   f. Direct mailing (24)
   g. Radio (15)

h. Public workshops (15)
i. Newspaper (4)
j. Other: (2)
    i. "text messages ONLY in case of emergencies"
    ii. "Hybrid in person/zoom workshops"

10. Is your property located in a flood zone?



ATTACHMENT 10: FEMA NATIONAL RISK INDEX COMPARISON REPORT FOR NORTH KINGSTOWN

National Risk Index

May 01, 2024

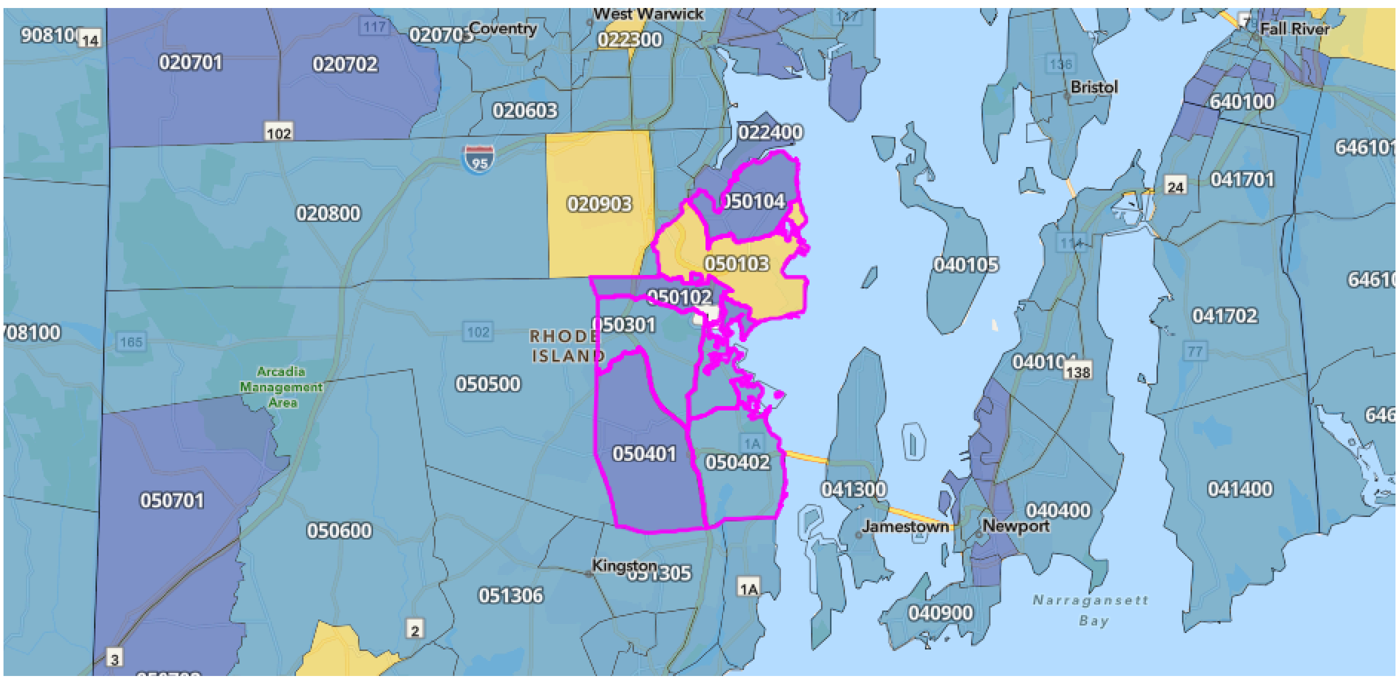
Risk Comparison Report

Use this report to determine how risk factors in selected communities compare to each other. Click a community name in any table below to open an individual risk profile report for that community and review its risk factors in more detail.

While reviewing this report, keep in mind that low risk is driven by lower loss due to natural hazards, lower social vulnerability, and higher community resilience.

For more information about the National Risk Index, its data, and how to interpret the information it provides, please review the **About the National Risk Index** and **How to Take Action** sections at the end of this report. Or, visit the National Risk Index website at hazards.fema.gov/nri/learn-more to access supporting documentation and links.

Risk Index



Risk Index Legend

Very High | Relatively High | Relatively Moderate | Relatively Low | Very Low

No Rating | Not Applicable | Insufficient Data

Rank	Community	State	Risk Index Rating	Risk Index Score	National Percentile
1	Census tract 44009050103	RI	Relatively Moderate	77.08	0 100
2	Census tract 44009050302	RI	Relatively Low	54.08	0 100
3	Census tract 44009050301	RI	Relatively Low	33.93	0 100

Rank	Community	State	Risk Index Rating	Risk Index Score	National Percentile
4	Census tract 44009050402	RI	Relatively Low	28.26	0 100
5	Census tract 44009050104	RI	Very Low	27.1	0 100
6	Census tract 44009050401	RI	Very Low	26.28	0 100
7	Census tract 44009050102	RI	Very Low	19.24	0 100

Rank	Community	State	EAL Value	Social Vulnerability	Community Resilience	CRF	Risk Value	Risk Index Score
1	Census tract 44009050103	RI	$907,293	Very High	Very High	1.39	$1,265,131	77.08
2	Census tract 44009050302	RI	$668,940	Relatively Low	Very High	0.89	$596,667	54.08
3	Census tract 44009050301	RI	$422,399	Very Low	Very High	0.81	$342,336	33.93
4	Census tract 44009050402	RI	$388,361	Very Low	Very High	0.75	$290,500	28.26
5	Census tract 44009050104	RI	$357,819	Very Low	Very High	0.78	$280,285	27.1
6	Census tract 44009050401	RI	$401,059	Very Low	Very High	0.68	$273,914	26.28
7	Census tract 44009050102	RI	$341,742	Very Low	Very High	0.63	$216,740	19.24

Hazard Type Risk Index

Hazard type Risk Index scores are calculated using data for only a single hazard type, and reflect a community's relative risk for only that hazard type.

Avalanche

Rank	Community	State	Risk Index Rating	Risk Index Score	National Percentile
	Census tract 44009050102	RI	Not Applicable		
	Census tract 44009050103	RI	Not Applicable		
	Census tract 44009050104	RI	Not Applicable		
	Census tract 44009050301	RI	Not Applicable		
	Census tract 44009050302	RI	Not Applicable		
	Census tract 44009050401	RI	Not Applicable		
	Census tract 44009050402	RI	Not Applicable		

Rank	Community	State	EAL Value	Social Vulnerability	Community Resilience	CRF	Risk Value	Risk Index Score
	Census tract 44009050102	RI	N/A	Very Low	Very High	0.63	N/A	N/A
	Census tract 44009050103	RI	N/A	Very High	Very High	1.39	N/A	N/A
	Census tract 44009050104	RI	N/A	Very Low	Very High	0.78	N/A	N/A
	Census tract 44009050301	RI	N/A	Very Low	Very High	0.81	N/A	N/A
	Census tract 44009050302	RI	N/A	Relatively Low	Very High	0.89	N/A	N/A
	Census tract 44009050401	RI	N/A	Very Low	Very High	0.68	N/A	N/A
	Census tract 44009050402	RI	N/A	Very Low	Very High	0.75	N/A	N/A

Coastal Flooding

Rank	Community	State	Risk Index Rating	Risk Index Score	National Percentile
1	Census tract 44009050302	RI	Relatively Moderate	96.93	0 100
2	Census tract 44009050402	RI	Relatively Moderate	94.89	0 100
3	Census tract 44009050102	RI	Relatively Moderate	93.2	0 100
4	Census tract 44009050103	RI	Relatively Low	91	0 100
5	Census tract 44009050104	RI	Relatively Low	90.82	0 100
6	Census tract 44009050301	RI	Very Low	73.91	0 100

Rank	Community	State	Risk Index Rating	Risk Index Score	National Percentile
7	Census tract 44009050401	RI	Very Low	70.78	0 100

Rank	Community	State	EAL Value	Social Vulnerability	Community Resilience	CRF	Risk Value	Risk Index Score
1	Census tract 44009050302	RI	$145,781	Relatively Low	Very High	0.89	$130,030	96.93
2	Census tract 44009050402	RI	$73,080	Very Low	Very High	0.75	$54,665	94.89
3	Census tract 44009050102	RI	$46,015	Very Low	Very High	0.63	$29,184	93.2
4	Census tract 44009050103	RI	$10,558	Very High	Very High	1.39	$14,721	91
5	Census tract 44009050104	RI	$17,613	Very Low	Very High	0.78	$13,797	90.82
6	Census tract 44009050301	RI	$73	Very Low	Very High	0.81	$60	73.91
7	Census tract 44009050401	RI	$1	Very Low	Very High	0.68	$1	70.78

Cold Wave

Rank	Community	State	Risk Index Rating	Risk Index Score	National Percentile
1	Census tract 44009050103	RI	Relatively Low	48.33	0 100
2	Census tract 44009050301	RI	Relatively Low	44.78	0 100
3	Census tract 44009050401	RI	Relatively Low	44.7	0 100
4	Census tract 44009050104	RI	Very Low	44.06	0 100
5	Census tract 44009050302	RI	Very Low	43.69	0 100
6	Census tract 44009050402	RI	Very Low	43.41	0 100
7	Census tract 44009050102	RI	Very Low	43.07	0 100

Rank	Community	State	EAL Value	Social Vulnerability	Community Resilience	CRF	Risk Value	Risk Index Score
1	Census tract 44009050103	RI	$522	Very High	Very High	1.39	$728	48.33
2	Census tract 44009050301	RI	$419	Very Low	Very High	0.81	$339	44.78
3	Census tract 44009050401	RI	$482	Very Low	Very High	0.68	$329	44.7
4	Census tract 44009050104	RI	$341	Very Low	Very High	0.78	$267	44.06
5	Census tract 44009050302	RI	$242	Relatively Low	Very High	0.89	$216	43.69
6	Census tract 44009050402	RI	$242	Very Low	Very High	0.75	$181	43.41

Rank	Community	State	EAL Value	Social Vulnerability	Community Resilience	CRF	Risk Value	Risk Index Score
7	Census tract 44009050102	RI	$211	Very Low	Very High	0.63	$134	43.07

Drought

Rank	Community	State	Risk Index Rating	Risk Index Score	National Percentile
1	Census tract 44009050401	RI	Relatively Moderate	94.14	0 100
2	Census tract 44009050104	RI	Very Low	79.29	0 100
3	Census tract 44009050301	RI	Very Low	72.41	0 100
	Census tract 44009050102	RI	No Rating	0	0 100
	Census tract 44009050103	RI	No Rating	0	0 100
	Census tract 44009050302	RI	No Rating	0	0 100
	Census tract 44009050402	RI	No Rating	0	0 100

Rank	Community	State	EAL Value	Social Vulnerability	Community Resilience	CRF	Risk Value	Risk Index Score
1	Census tract 44009050401	RI	$31,217	Very Low	Very High	0.68	$21,321	94.14
2	Census tract 44009050104	RI	$335	Very Low	Very High	0.78	$263	79.29
3	Census tract 44009050301	RI	$23	Very Low	Very High	0.81	$18	72.41
	Census tract 44009050102	RI	$0	Very Low	Very High	0.63	$0	0
	Census tract 44009050103	RI	$0	Very High	Very High	1.39	$0	0
	Census tract 44009050302	RI	$0	Relatively Low	Very High	0.89	$0	0
	Census tract 44009050402	RI	$0	Very Low	Very High	0.75	$0	0

Earthquake

Rank	Community	State	Risk Index Rating	Risk Index Score	National Percentile
1	Census tract 44009050103	RI	Relatively Low	63.95	0 100
2	Census tract 44009050302	RI	Very Low	32.15	0 100
3	Census tract 44009050301	RI	Very Low	30.09	0 100
4	Census tract 44009050104	RI	Very Low	28.46	0 100
5	Census tract 44009050402	RI	Very Low	18.58	0 100
6	Census tract 44009050401	RI	Very Low	17.4	0 100

Rank	Community	State	Risk Index Rating	Risk Index Score	National Percentile
7	Census tract 44009050102	RI	Very Low	15.62	0 100

Rank	Community	State	EAL Value	Social Vulnerability	Community Resilience	CRF	Risk Value	Risk Index Score
1	Census tract 44009050103	RI	$18,751	Very High	Very High	1.39	$26,147	63.95
2	Census tract 44009050302	RI	$6,136	Relatively Low	Very High	0.89	$5,473	32.15
3	Census tract 44009050301	RI	$6,067	Very Low	Very High	0.81	$4,917	30.09
4	Census tract 44009050104	RI	$5,781	Very Low	Very High	0.78	$4,528	28.46
5	Census tract 44009050402	RI	$3,343	Very Low	Very High	0.75	$2,501	18.58
6	Census tract 44009050401	RI	$3,374	Very Low	Very High	0.68	$2,304	17.4
7	Census tract 44009050102	RI	$3,155	Very Low	Very High	0.63	$2,001	15.62

Hail

Rank	Community	State	Risk Index Rating	Risk Index Score	National Percentile
1	Census tract 44009050103	RI	Very Low	38.38	0 100
2	Census tract 44009050401	RI	Very Low	33.06	0 100
3	Census tract 44009050301	RI	Very Low	27.42	0 100
4	Census tract 44009050104	RI	Very Low	21.77	0 100
5	Census tract 44009050302	RI	Very Low	19.98	0 100
6	Census tract 44009050102	RI	Very Low	16.76	0 100
7	Census tract 44009050402	RI	Very Low	15.91	0 100

Rank	Community	State	EAL Value	Social Vulnerability	Community Resilience	CRF	Risk Value	Risk Index Score
1	Census tract 44009050103	RI	$560	Very High	Very High	1.39	$781	38.38
2	Census tract 44009050401	RI	$699	Very Low	Very High	0.68	$477	33.06
3	Census tract 44009050301	RI	$365	Very Low	Very High	0.81	$296	27.42
4	Census tract 44009050104	RI	$230	Very Low	Very High	0.78	$180	21.77
5	Census tract 44009050302	RI	$171	Relatively Low	Very High	0.89	$152	19.98
6	Census tract 44009050102	RI	$175	Very Low	Very High	0.63	$111	16.76

Rank	Community	State	EAL Value	Social Vulnerability	Community Resilience	CRF	Risk Value	Risk Index Score
7	Census tract 44009050402	RI	$137	Very Low	Very High	0.75	$102	15.91

Heat Wave

Rank	Community	State	Risk Index Rating	Risk Index Score	National Percentile
1	Census tract 44009050103	RI	Relatively Low	22.58	0 100
2	Census tract 44009050301	RI	Relatively Low	18.44	0 100
3	Census tract 44009050401	RI	Relatively Low	18.34	0 100
4	Census tract 44009050104	RI	Very Low	17.75	0 100
5	Census tract 44009050302	RI	Very Low	17.34	0 100
6	Census tract 44009050402	RI	Very Low	17.08	0 100
7	Census tract 44009050102	RI	Very Low	16.71	0 100

Rank	Community	State	EAL Value	Social Vulnerability	Community Resilience	CRF	Risk Value	Risk Index Score
1	Census tract 44009050103	RI	$794	Very High	Very High	1.39	$1,107	22.58
2	Census tract 44009050301	RI	$645	Very Low	Very High	0.81	$523	18.44
3	Census tract 44009050401	RI	$739	Very Low	Very High	0.68	$505	18.34
4	Census tract 44009050104	RI	$525	Very Low	Very High	0.78	$411	17.75
5	Census tract 44009050302	RI	$371	Relatively Low	Very High	0.89	$331	17.34
6	Census tract 44009050402	RI	$372	Very Low	Very High	0.75	$278	17.08
7	Census tract 44009050102	RI	$324	Very Low	Very High	0.63	$205	16.71

Hurricane

Rank	Community	State	Risk Index Rating	Risk Index Score	National Percentile
1	Census tract 44009050103	RI	Relatively High	88.19	0 100
2	Census tract 44009050301	RI	Relatively Moderate	76.95	0 100
3	Census tract 44009050302	RI	Relatively Moderate	74.72	0 100
4	Census tract 44009050401	RI	Relatively Moderate	73.67	0 100
5	Census tract 44009050104	RI	Relatively Moderate	73.66	0 100
6	Census tract 44009050402	RI	Relatively Moderate	70.57	0 100

Rank	Community	State	Risk Index Rating	Risk Index Score	National Percentile
7	Census tract 44009050102	RI	Relatively Low	65.43	0 100

Rank	Community	State	EAL Value	Social Vulnerability	Community Resilience	CRF	Risk Value	Risk Index Score
1	Census tract 44009050103	RI	$672,595	Very High	Very High	1.39	$937,868	88.19
2	Census tract 44009050301	RI	$331,569	Very Low	Very High	0.81	$268,722	76.95
3	Census tract 44009050302	RI	$255,996	Relatively Low	Very High	0.89	$228,338	74.72
4	Census tract 44009050401	RI	$309,847	Very Low	Very High	0.68	$211,618	73.67
5	Census tract 44009050104	RI	$270,003	Very Low	Very High	0.78	$211,497	73.66
6	Census tract 44009050402	RI	$232,416	Very Low	Very High	0.75	$173,851	70.57
7	Census tract 44009050102	RI	$200,264	Very Low	Very High	0.63	$127,012	65.43

Ice Storm

Rank	Community	State	Risk Index Rating	Risk Index Score	National Percentile
1	Census tract 44009050103	RI	Relatively High	89.39	0 100
2	Census tract 44009050301	RI	Relatively Moderate	80.67	0 100
3	Census tract 44009050401	RI	Relatively Moderate	75.11	0 100
4	Census tract 44009050104	RI	Relatively Low	66.68	0 100
5	Census tract 44009050102	RI	Relatively Low	59.84	0 100
6	Census tract 44009050302	RI	Relatively Low	55.09	0 100
7	Census tract 44009050402	RI	Very Low	25.48	0 100

Rank	Community	State	EAL Value	Social Vulnerability	Community Resilience	CRF	Risk Value	Risk Index Score
1	Census tract 44009050103	RI	$19,714	Very High	Very High	1.39	$27,489	89.39
2	Census tract 44009050301	RI	$15,972	Very Low	Very High	0.81	$12,944	80.67
3	Census tract 44009050401	RI	$13,094	Very Low	Very High	0.68	$8,943	75.11
4	Census tract 44009050104	RI	$7,050	Very Low	Very High	0.78	$5,522	66.68
5	Census tract 44009050102	RI	$6,210	Very Low	Very High	0.63	$3,939	59.84
6	Census tract 44009050302	RI	$3,605	Relatively Low	Very High	0.89	$3,215	55.09

Rank	Community	State	EAL Value	Social Vulnerability	Community Resilience	CRF	Risk Value	Risk Index Score
7	Census tract 44009050402	RI	$1,252	Very Low	Very High	0.75	$937	25.48

Landslide

Rank	Community	State	Risk Index Rating	Risk Index Score	National Percentile
1	Census tract 44009050301	RI	Relatively Moderate	89.77	0 100
2	Census tract 44009050401	RI	Relatively Low	68.48	0 100
3	Census tract 44009050102	RI	Relatively Low	61.92	0 100
4	Census tract 44009050402	RI	Relatively Low	43.99	0 100
	Census tract 44009050103	RI	No Rating	0	0 100
	Census tract 44009050104	RI	No Rating	0	0 100
	Census tract 44009050302	RI	No Rating	0	0 100

Rank	Community	State	EAL Value	Social Vulnerability	Community Resilience	CRF	Risk Value	Risk Index Score
1	Census tract 44009050301	RI	$6,107	Very Low	Very High	0.81	$4,950	89.77
2	Census tract 44009050401	RI	$1,858	Very Low	Very High	0.68	$1,269	68.48
3	Census tract 44009050102	RI	$1,317	Very Low	Very High	0.63	$835	61.92
4	Census tract 44009050402	RI	$108	Very Low	Very High	0.75	$81	43.99
	Census tract 44009050103	RI	$0	Very High	Very High	1.39	$0	0
	Census tract 44009050104	RI	$0	Very Low	Very High	0.78	$0	0
	Census tract 44009050302	RI	$0	Relatively Low	Very High	0.89	$0	0

Lightning

Rank	Community	State	Risk Index Rating	Risk Index Score	National Percentile
1	Census tract 44009050103	RI	Relatively Moderate	71.67	0 100
2	Census tract 44009050301	RI	Relatively Moderate	48.82	0 100
3	Census tract 44009050104	RI	Relatively Low	46.34	0 100
4	Census tract 44009050401	RI	Relatively Low	44.17	0 100
5	Census tract 44009050302	RI	Relatively Low	38.61	0 100
6	Census tract 44009050402	RI	Relatively Low	34.99	0 100

Rank	Community	State	Risk Index Rating	Risk Index Score	National Percentile
7	Census tract 44009050102	RI	Relatively Low	27.87	0 100

Rank	Community	State	EAL Value	Social Vulnerability	Community Resilience	CRF	Risk Value	Risk Index Score
1	Census tract 44009050103	RI	$9,089	Very High	Very High	1.39	$12,673	71.67
2	Census tract 44009050301	RI	$7,183	Very Low	Very High	0.81	$5,822	48.82
3	Census tract 44009050104	RI	$6,767	Very Low	Very High	0.78	$5,300	46.34
4	Census tract 44009050401	RI	$7,153	Very Low	Very High	0.68	$4,885	44.17
5	Census tract 44009050302	RI	$4,388	Relatively Low	Very High	0.89	$3,914	38.61
6	Census tract 44009050402	RI	$4,469	Very Low	Very High	0.75	$3,343	34.99
7	Census tract 44009050102	RI	$3,734	Very Low	Very High	0.63	$2,368	27.87

Riverine Flooding

Rank	Community	State	Risk Index Rating	Risk Index Score	National Percentile
1	Census tract 44009050302	RI	Relatively High	91.87	0 100
2	Census tract 44009050103	RI	Relatively Moderate	90.56	0 100
3	Census tract 44009050402	RI	Relatively Moderate	75.85	0 100
4	Census tract 44009050102	RI	Relatively Moderate	74.09	0 100
5	Census tract 44009050104	RI	Relatively Low	66.04	0 100
6	Census tract 44009050301	RI	Relatively Low	61.96	0 100
7	Census tract 44009050401	RI	Relatively Low	39.54	0 100

Rank	Community	State	EAL Value	Social Vulnerability	Community Resilience	CRF	Risk Value	Risk Index Score
1	Census tract 44009050302	RI	$239,504	Relatively Low	Very High	0.89	$213,627	91.87
2	Census tract 44009050103	RI	$129,077	Very High	Very High	1.39	$179,985	90.56
3	Census tract 44009050402	RI	$63,313	Very Low	Very High	0.75	$47,359	75.85
4	Census tract 44009050102	RI	$65,570	Very Low	Very High	0.63	$41,586	74.09
5	Census tract 44009050104	RI	$30,179	Very Low	Very High	0.78	$23,640	66.04
6	Census tract 44009050301	RI	$22,098	Very Low	Very High	0.81	$17,909	61.96

Rank	Community	State	EAL Value	Social Vulnerability	Community Resilience	CRF	Risk Value	Risk Index Score
7	Census tract 44009050401	RI	$3,969	Very Low	Very High	0.68	$2,710	39.54

Strong Wind

Rank	Community	State	Risk Index Rating	Risk Index Score	National Percentile
1	Census tract 44009050103	RI	Relatively Low	40.4	0 100
2	Census tract 44009050301	RI	Relatively Low	26.86	0 100
3	Census tract 44009050401	RI	Very Low	24	0 100
4	Census tract 44009050104	RI	Very Low	22.15	0 100
5	Census tract 44009050302	RI	Very Low	20.84	0 100
6	Census tract 44009050102	RI	Very Low	18.85	0 100
7	Census tract 44009050402	RI	Very Low	18.07	0 100

Rank	Community	State	EAL Value	Social Vulnerability	Community Resilience	CRF	Risk Value	Risk Index Score
1	Census tract 44009050103	RI	$4,436	Very High	Very High	1.39	$6,185	40.4
2	Census tract 44009050301	RI	$3,063	Very Low	Very High	0.81	$2,482	26.86
3	Census tract 44009050401	RI	$2,774	Very Low	Very High	0.68	$1,895	24
4	Census tract 44009050104	RI	$1,929	Very Low	Very High	0.78	$1,511	22.15
5	Census tract 44009050302	RI	$1,389	Relatively Low	Very High	0.89	$1,239	20.84
6	Census tract 44009050102	RI	$1,436	Very Low	Very High	0.63	$911	18.85
7	Census tract 44009050402	RI	$1,084	Very Low	Very High	0.75	$811	18.07

Tornado

Rank	Community	State	Risk Index Rating	Risk Index Score	National Percentile
1	Census tract 44009050103	RI	Relatively Low	48.76	0 100
2	Census tract 44009050301	RI	Relatively Low	33.69	0 100
3	Census tract 44009050401	RI	Very Low	29.49	0 100
4	Census tract 44009050104	RI	Very Low	25.69	0 100
5	Census tract 44009050302	RI	Very Low	21.71	0 100
6	Census tract 44009050102	RI	Very Low	18.65	0 100

Rank	Community	State	Risk Index Rating	Risk Index Score	National Percentile
7	Census tract 44009050402	RI	Very Low	12.84	0 100

Rank	Community	State	EAL Value	Social Vulnerability	Community Resilience	CRF	Risk Value	Risk Index Score
1	Census tract 44009050103	RI	$39,630	Very High	Very High	1.39	$55,260	48.76
2	Census tract 44009050301	RI	$27,412	Very Low	Very High	0.81	$22,216	33.69
3	Census tract 44009050401	RI	$23,531	Very Low	Very High	0.68	$16,071	29.49
4	Census tract 44009050104	RI	$15,373	Very Low	Very High	0.78	$12,042	25.69
5	Census tract 44009050302	RI	$10,450	Relatively Low	Very High	0.89	$9,321	21.71
6	Census tract 44009050102	RI	$12,243	Very Low	Very High	0.63	$7,764	18.65
7	Census tract 44009050402	RI	$7,144	Very Low	Very High	0.75	$5,344	12.84

Tsunami

Rank	Community	State	Risk Index Rating	Risk Index Score	National Percentile
	Census tract 44009050102	RI	Insufficient Data		
	Census tract 44009050103	RI	Insufficient Data		
	Census tract 44009050104	RI	Insufficient Data		
	Census tract 44009050301	RI	Insufficient Data		
	Census tract 44009050302	RI	Insufficient Data		
	Census tract 44009050401	RI	Insufficient Data		
	Census tract 44009050402	RI	Insufficient Data		

Rank	Community	State	EAL Value	Social Vulnerability	Community Resilience	CRF	Risk Value	Risk Index Score
	Census tract 44009050102	RI	N/A	Very Low	Very High	0.63	N/A	N/A
	Census tract 44009050103	RI	N/A	Very High	Very High	1.39	N/A	N/A
	Census tract 44009050104	RI	N/A	Very Low	Very High	0.78	N/A	N/A
	Census tract 44009050301	RI	N/A	Very Low	Very High	0.81	N/A	N/A
	Census tract 44009050302	RI	N/A	Relatively Low	Very High	0.89	N/A	N/A
	Census tract 44009050401	RI	N/A	Very Low	Very High	0.68	N/A	N/A

Rank	Community	State	EAL Value	Social Vulnerability	Community Resilience	CRF	Risk Value	Risk Index Score
	Census tract 44009050402	RI	N/A	Very Low	Very High	0.75	N/A	N/A

Volcanic Activity

Rank	Community	State	Risk Index Rating	Risk Index Score	National Percentile
	Census tract 44009050102	RI	Not Applicable		
	Census tract 44009050103	RI	Not Applicable		
	Census tract 44009050104	RI	Not Applicable		
	Census tract 44009050301	RI	Not Applicable		
	Census tract 44009050302	RI	Not Applicable		
	Census tract 44009050401	RI	Not Applicable		
	Census tract 44009050402	RI	Not Applicable		

Rank	Community	State	EAL Value	Social Vulnerability	Community Resilience	CRF	Risk Value	Risk Index Score
	Census tract 44009050102	RI	N/A	Very Low	Very High	0.63	N/A	N/A
	Census tract 44009050103	RI	N/A	Very High	Very High	1.39	N/A	N/A
	Census tract 44009050104	RI	N/A	Very Low	Very High	0.78	N/A	N/A
	Census tract 44009050301	RI	N/A	Very Low	Very High	0.81	N/A	N/A
	Census tract 44009050302	RI	N/A	Relatively Low	Very High	0.89	N/A	N/A
	Census tract 44009050401	RI	N/A	Very Low	Very High	0.68	N/A	N/A
	Census tract 44009050402	RI	N/A	Very Low	Very High	0.75	N/A	N/A

Wildfire

Rank	Community	State	Risk Index Rating	Risk Index Score	National Percentile
1	Census tract 44009050401	RI	Relatively Low	66.39	0 100
2	Census tract 44009050103	RI	Relatively Low	63.91	0 100
3	Census tract 44009050104	RI	Relatively Low	62.99	0 100
4	Census tract 44009050402	RI	Relatively Low	60.66	0 100
5	Census tract 44009050301	RI	Relatively Low	56.54	0 100
6	Census tract 44009050102	RI	Relatively Low	53.87	0 100

Rank	Community	State	Risk Index Rating	Risk Index Score	National Percentile
7	Census tract 44009050302	RI	Relatively Low	53.13	0 100

Rank	Community	State	EAL Value	Social Vulnerability	Community Resilience	CRF	Risk Value	Risk Index Score
1	Census tract 44009050401	RI	$1,606	Very Low	Very High	0.68	$1,097	66.39
2	Census tract 44009050103	RI	$664	Very High	Very High	1.39	$926	63.91
3	Census tract 44009050104	RI	$1,111	Very Low	Very High	0.78	$870	62.99
4	Census tract 44009050402	RI	$987	Very Low	Very High	0.75	$738	60.66
5	Census tract 44009050301	RI	$688	Very Low	Very High	0.81	$558	56.54
6	Census tract 44009050102	RI	$727	Very Low	Very High	0.63	$461	53.87
7	Census tract 44009050302	RI	$491	Relatively Low	Very High	0.89	$438	53.13

Winter Weather

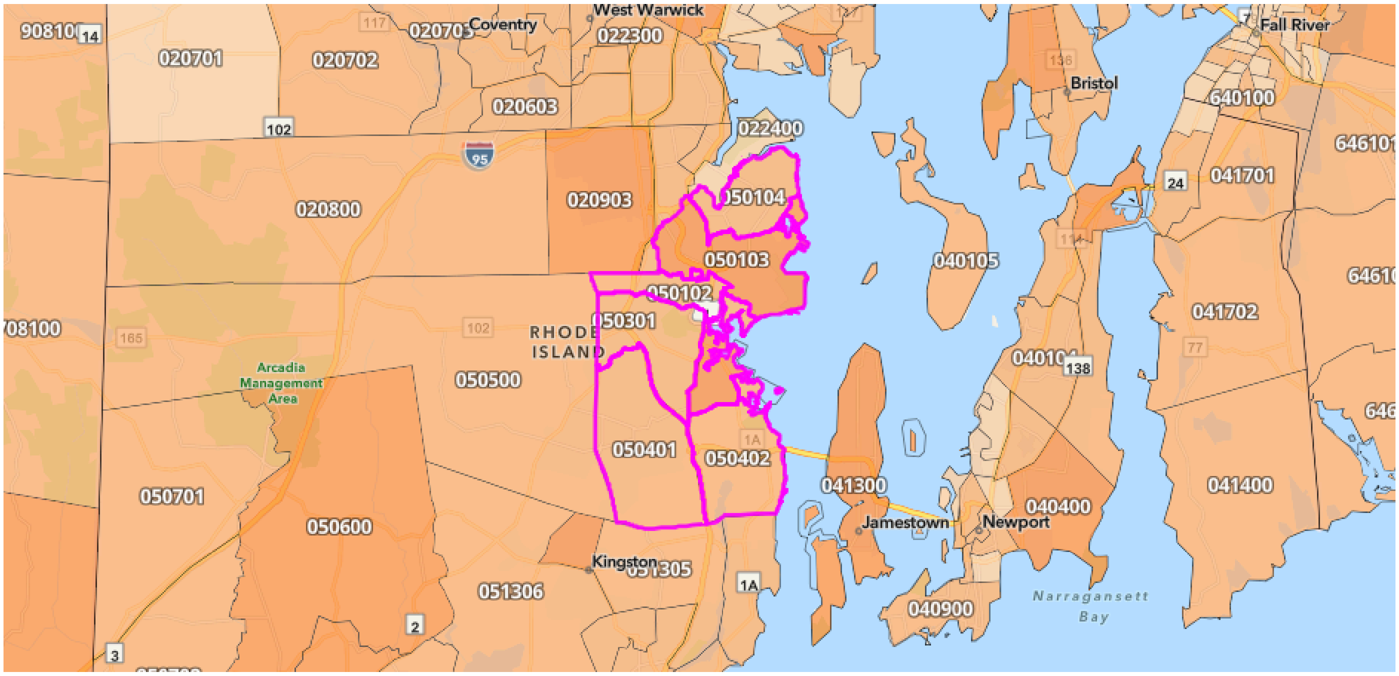
Rank	Community	State	Risk Index Rating	Risk Index Score	National Percentile
1	Census tract 44009050103	RI	Relatively Low	46.68	0 100
2	Census tract 44009050301	RI	Relatively Low	34.69	0 100
3	Census tract 44009050401	RI	Relatively Low	32.71	0 100
4	Census tract 44009050104	RI	Relatively Low	31.97	0 100
5	Census tract 44009050302	RI	Relatively Low	29.96	0 100
6	Census tract 44009050402	RI	Relatively Low	28.33	0 100
7	Census tract 44009050102	RI	Relatively Low	26.23	0 100

Rank	Community	State	EAL Value	Social Vulnerability	Community Resilience	CRF	Risk Value	Risk Index Score
1	Census tract 44009050103	RI	$904	Very High	Very High	1.39	$1,260	46.68
2	Census tract 44009050301	RI	$716	Very Low	Very High	0.81	$580	34.69
3	Census tract 44009050401	RI	$715	Very Low	Very High	0.68	$488	32.71
4	Census tract 44009050104	RI	$582	Very Low	Very High	0.78	$456	31.97
5	Census tract 44009050302	RI	$416	Relatively Low	Very High	0.89	$371	29.96
6	Census tract 44009050402	RI	$414	Very Low	Very High	0.75	$309	28.33

Rank	Community	State	EAL Value	Social Vulnerability	Community Resilience	CRF	Risk Value	Risk Index Score
7	Census tract 44009050102	RI	$362	Very Low	Very High	0.63	$230	26.23

Expected Annual Loss

Expected Annual Loss measures the expected loss each year due to natural hazards.



Expected Annual Loss Legend

Very High | Relatively High | Relatively Moderate | Relatively Low | Very Low

No Expected Annual Losses | Not Applicable | Insufficient Data

Rank	Community	State	EAL Value	Score
1	Census tract 44009050103	RI	$907,293	71.63
2	Census tract 44009050302	RI	$668,940	61.52
3	Census tract 44009050301	RI	$422,399	44.15
4	Census tract 44009050401	RI	$401,059	42.05
5	Census tract 44009050402	RI	$388,361	40.82
6	Census tract 44009050104	RI	$357,819	37.61
7	Census tract 44009050102	RI	$341,742	35.94

Expected Annual Loss for Hazard Types

Expected Annual Loss scores for hazard types are calculated using data for only a single hazard type, and reflect a community's relative expected annual loss for only that hazard type.

Avalanche

Rank	Community	State	EAL Value	Score
	Census tract 44009050102	RI	N/A	--
	Census tract 44009050103	RI	N/A	--
	Census tract 44009050104	RI	N/A	--
	Census tract 44009050301	RI	N/A	--
	Census tract 44009050302	RI	N/A	--
	Census tract 44009050401	RI	N/A	--
	Census tract 44009050402	RI	N/A	--

Coastal Flooding

Rank	Community	State	EAL Value	Score
1	Census tract 44009050302	RI	$145,781	97.1
2	Census tract 44009050402	RI	$73,080	95.5
3	Census tract 44009050102	RI	$46,015	94.3
4	Census tract 44009050104	RI	$17,613	91.5
5	Census tract 44009050103	RI	$10,558	89.8
6	Census tract 44009050301	RI	$73	74.3
7	Census tract 44009050401	RI	$1	70.8

Cold Wave

Rank	Community	State	EAL Value	Score
1	Census tract 44009050103	RI	$522	47.6
2	Census tract 44009050401	RI	$482	47.1
3	Census tract 44009050301	RI	$419	46.5
4	Census tract 44009050104	RI	$341	45.6
5	Census tract 44009050402	RI	$242	44.6

Rank	Community	State	EAL Value	Score
6	Census tract 44009050302	RI	$242	44.6
7	Census tract 44009050102	RI	$211	44.3

Drought

Rank	Community	State	EAL Value	Score
1	Census tract 44009050401	RI	$31,217	95.6
2	Census tract 44009050104	RI	$335	80.6
3	Census tract 44009050301	RI	$23	73.2
	Census tract 44009050102	RI	$0	0.0
	Census tract 44009050103	RI	$0	0.0
	Census tract 44009050302	RI	$0	0.0
	Census tract 44009050402	RI	$0	0.0

Earthquake

Rank	Community	State	EAL Value	Score
1	Census tract 44009050103	RI	$18,751	59.7
2	Census tract 44009050302	RI	$6,136	35.7
3	Census tract 44009050301	RI	$6,067	35.5
4	Census tract 44009050104	RI	$5,781	34.4
5	Census tract 44009050401	RI	$3,374	24.0
6	Census tract 44009050402	RI	$3,343	23.9
7	Census tract 44009050102	RI	$3,155	22.9

Hail

Rank	Community	State	EAL Value	Score
1	Census tract 44009050401	RI	$699	38.7
2	Census tract 44009050103	RI	$560	36.4
3	Census tract 44009050301	RI	$365	32.3
4	Census tract 44009050104	RI	$230	27.3
5	Census tract 44009050102	RI	$175	24.0

Rank	Community	State	EAL Value	Score
6	Census tract 44009050302	RI	$171	23.7
7	Census tract 44009050402	RI	$137	21.2

Heat Wave

Rank	Community	State	EAL Value	Score
1	Census tract 44009050103	RI	$794	21.6
2	Census tract 44009050401	RI	$739	21.1
3	Census tract 44009050301	RI	$645	20.4
4	Census tract 44009050104	RI	$525	19.5
5	Census tract 44009050402	RI	$372	18.6
6	Census tract 44009050302	RI	$371	18.6
7	Census tract 44009050102	RI	$324	18.3

Hurricane

Rank	Community	State	EAL Value	Score
1	Census tract 44009050103	RI	$672,595	85.9
2	Census tract 44009050301	RI	$331,569	78.9
3	Census tract 44009050401	RI	$309,847	78.2
4	Census tract 44009050104	RI	$270,003	76.6
5	Census tract 44009050302	RI	$255,996	75.9
6	Census tract 44009050402	RI	$232,416	74.8
7	Census tract 44009050102	RI	$200,264	73.0

Ice Storm

Rank	Community	State	EAL Value	Score
1	Census tract 44009050103	RI	$19,714	86.7
2	Census tract 44009050301	RI	$15,972	84.3
3	Census tract 44009050401	RI	$13,094	81.9
4	Census tract 44009050104	RI	$7,050	72.8
5	Census tract 44009050102	RI	$6,210	70.7

Rank	Community	State	EAL Value	Score
6	Census tract 44009050302	RI	$3,605	59.6
7	Census tract 44009050402	RI	$1,252	34.5

Landslide

Rank	Community	State	EAL Value	Score
1	Census tract 44009050301	RI	$6,107	93.2
2	Census tract 44009050401	RI	$1,858	75.8
3	Census tract 44009050102	RI	$1,317	69.7
4	Census tract 44009050402	RI	$108	45.3
	Census tract 44009050103	RI	$0	0.0
	Census tract 44009050104	RI	$0	0.0
	Census tract 44009050302	RI	$0	0.0

Lightning

Rank	Community	State	EAL Value	Score
1	Census tract 44009050103	RI	$9,089	64.5
2	Census tract 44009050301	RI	$7,183	57.2
3	Census tract 44009050401	RI	$7,153	57.0
4	Census tract 44009050104	RI	$6,767	55.4
5	Census tract 44009050402	RI	$4,469	43.7
6	Census tract 44009050302	RI	$4,388	43.2
7	Census tract 44009050102	RI	$3,734	39.2

Riverine Flooding

Rank	Community	State	EAL Value	Score
1	Census tract 44009050302	RI	$239,504	93.6
2	Census tract 44009050103	RI	$129,077	88.9
3	Census tract 44009050102	RI	$65,570	81.5
4	Census tract 44009050402	RI	$63,313	81.1
5	Census tract 44009050104	RI	$30,179	70.8

Rank	Community	State	EAL Value	Score
6	Census tract 44009050301	RI	$22,098	66.2
7	Census tract 44009050401	RI	$3,969	43.8

Strong Wind

Rank	Community	State	EAL Value	Score
1	Census tract 44009050103	RI	$4,436	37.0
2	Census tract 44009050301	RI	$3,063	31.6
3	Census tract 44009050401	RI	$2,774	30.3
4	Census tract 44009050104	RI	$1,929	26.2
5	Census tract 44009050102	RI	$1,436	23.6
6	Census tract 44009050302	RI	$1,389	23.4
7	Census tract 44009050402	RI	$1,084	21.7

Tornado

Rank	Community	State	EAL Value	Score
1	Census tract 44009050103	RI	$39,630	45.0
2	Census tract 44009050301	RI	$27,412	38.7
3	Census tract 44009050401	RI	$23,531	36.3
4	Census tract 44009050104	RI	$15,373	30.8
5	Census tract 44009050102	RI	$12,243	28.2
6	Census tract 44009050302	RI	$10,450	26.4
7	Census tract 44009050402	RI	$7,144	20.9

Tsunami

Rank	Community	State	EAL Value	Score
	Census tract 44009050102	RI	N/A	--
	Census tract 44009050103	RI	N/A	--
	Census tract 44009050104	RI	N/A	--
	Census tract 44009050301	RI	N/A	--
	Census tract 44009050302	RI	N/A	--

Rank	Community	State	EAL Value	Score
	Census tract 44009050401	RI	N/A	--
	Census tract 44009050402	RI	N/A	--

Volcanic Activity

Rank	Community	State	EAL Value	Score
	Census tract 44009050102	RI	N/A	--
	Census tract 44009050103	RI	N/A	--
	Census tract 44009050104	RI	N/A	--
	Census tract 44009050301	RI	N/A	--
	Census tract 44009050302	RI	N/A	--
	Census tract 44009050401	RI	N/A	--
	Census tract 44009050402	RI	N/A	--

Wildfire

Rank	Community	State	EAL Value	Score
1	Census tract 44009050401	RI	$1,606	72.0
2	Census tract 44009050104	RI	$1,111	67.1
3	Census tract 44009050402	RI	$987	65.4
4	Census tract 44009050102	RI	$727	61.2
5	Census tract 44009050301	RI	$688	60.4
6	Census tract 44009050103	RI	$664	59.9
7	Census tract 44009050302	RI	$491	55.7

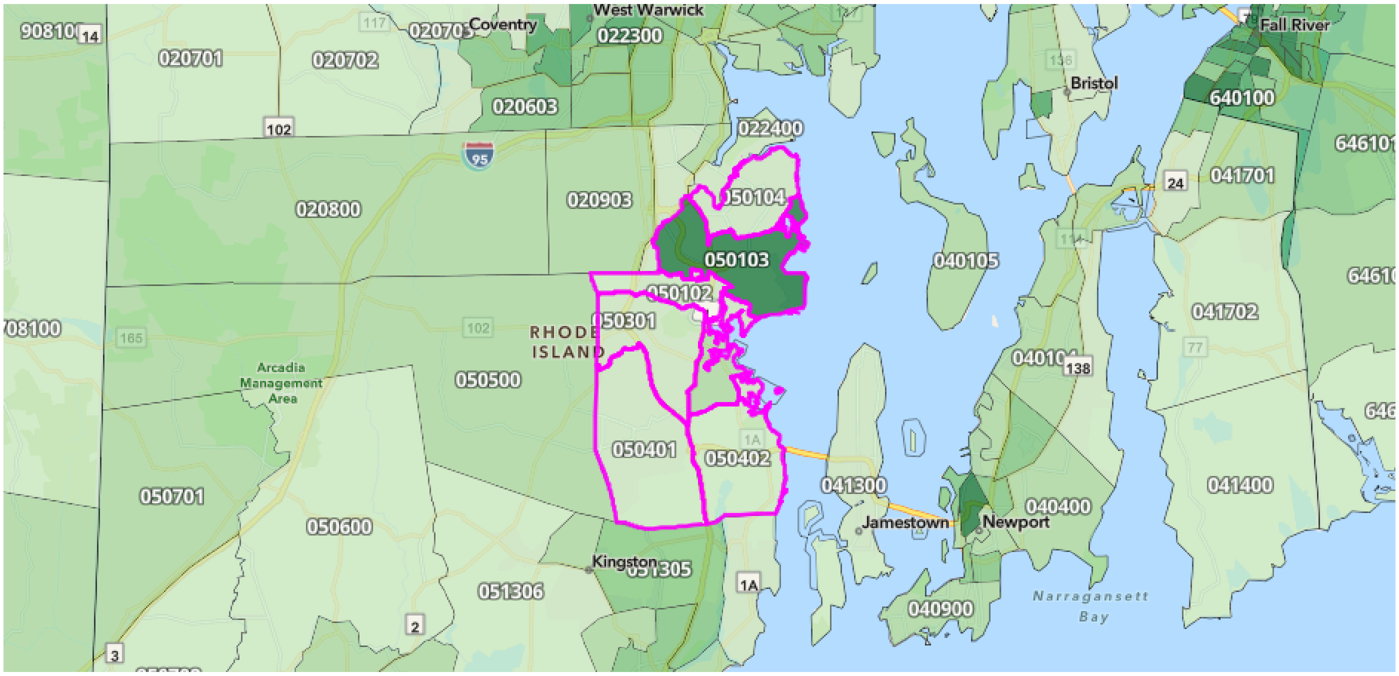
Winter Weather

Rank	Community	State	EAL Value	Score
1	Census tract 44009050103	RI	$904	43.2
2	Census tract 44009050301	RI	$716	39.6
3	Census tract 44009050401	RI	$715	39.6
4	Census tract 44009050104	RI	$582	36.8
5	Census tract 44009050302	RI	$416	33.0

Rank	Community	State	EAL Value	Score
6	Census tract 44009050402	RI	$414	33.0
7	Census tract 44009050102	RI	$362	31.7

Social Vulnerability

Social Vulnerability measures the susceptibility of social groups to the adverse impacts of natural hazards, including disproportionate death, injury, loss, or disruption of livelihood.



Social Vulnerability Legend

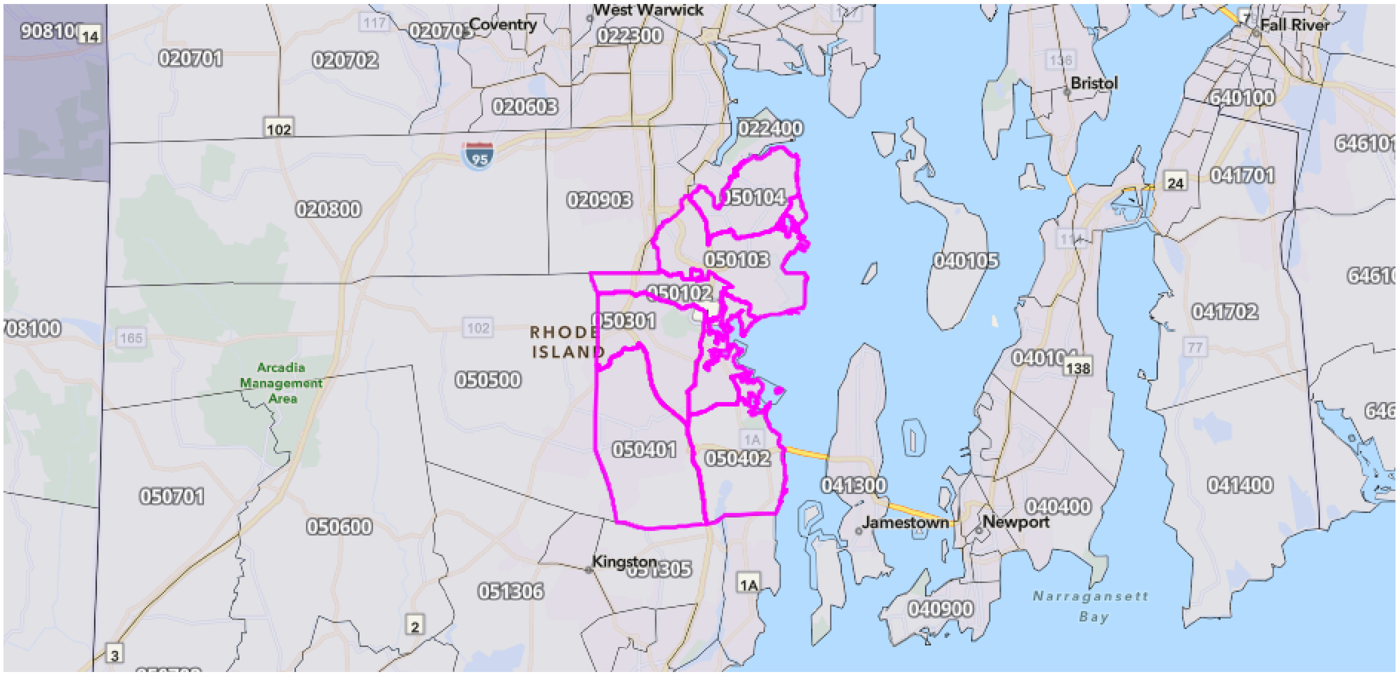
Very High | Relatively High | Relatively Moderate | Relatively Low | Very Low

Data Unavailable

Rank	Community	State	Rating	Score
1	Census tract 44009050103	RI	Very High	82.0
2	Census tract 44009050302	RI	Relatively Low	21.8
3	Census tract 44009050301	RI	Very Low	13.7
4	Census tract 44009050104	RI	Very Low	11.4
5	Census tract 44009050402	RI	Very Low	8.7
6	Census tract 44009050401	RI	Very Low	4.7
7	Census tract 44009050102	RI	Very Low	2.5

Community Resilience

Community Resilience measures a County's ability to prepare for anticipated natural hazards, adapt to changing conditions, and withstand and recover rapidly from disruptions.



Community Resilience Legend

Very High | Relatively High | Relatively Moderate | Relatively Low | Very Low

Data Unavailable

Rank	Community	State	Rating	Score
1	Census tract 44009050102	RI	Very High	95.0
1	Census tract 44009050103	RI	Very High	95.0
1	Census tract 44009050104	RI	Very High	95.0
1	Census tract 44009050301	RI	Very High	95.0
1	Census tract 44009050302	RI	Very High	95.0
1	Census tract 44009050401	RI	Very High	95.0
1	Census tract 44009050402	RI	Very High	95.0

About the National Risk Index

The National Risk Index is a dataset and online tool to help illustrate the United States communities most at risk for 18 natural hazards: Avalanche, Coastal Flooding, Cold Wave, Drought, Earthquake, Hail, Heat Wave, Hurricane, Ice Storm, Landslide, Lightning, Riverine Flooding, Strong Wind, Tornado, Tsunami, Volcanic Activity, Wildfire, and Winter Weather.

The National Risk Index leverages available source data for Expected Annual Loss due to these 18 hazard types, Social Vulnerability, and Community Resilience to develop a baseline relative risk measurement for each United States county and Census tract. These measurements are calculated using average past conditions, but they cannot be used to predict future outcomes for a community. The National Risk Index is intended to fill gaps in available data and analyses to better inform federal, state, local, tribal, and territorial decision makers as they develop risk reduction strategies.

Explore the National Risk Index Map at **hazards.fema.gov/nri/map**.

Visit the National Risk Index website at **hazards.fema.gov/nri/learn-more** to access supporting documentation and links.

Calculating the Risk Index

Risk Index scores are calculated using an equation that combines scores for Expected Annual Loss due to natural hazards, Social Vulnerability and Community Resilience:

Risk Index = Expected Annual Loss × Social Vulnerability ÷ Community Resilience

Risk Index scores are presented as a composite score for all 18 hazard types, as well as individual scores for each hazard type.

For more information, visit **hazards.fema.gov/nri/determining-risk**.

Calculating Expected Annual Loss

Expected Annual Loss scores are calculated using an equation that combines values for exposure, annualized frequency, and historic loss ratios for 18 hazard types:

Expected Annual Loss = **Exposure** × **Annualized Frequency** × **Historic Loss Ratio**

Expected Annual Loss scores are presented as a composite score for all 18 hazard types, as well as individual scores for each hazard type.

For more information, visit **hazards.fema.gov/nri/expected-annual-loss**.

Calculating Social Vulnerability

Social Vulnerability is measured using the Social Vulnerability Index (SVI) published by the Centers for Disease Control and Prevention (CDC).

For more information, visit **hazards.fema.gov/nri/social-vulnerability**.

Calculating Community Resilience

Community Resilience is measured at the County level using the Baseline Resilience Indicators for Communities (HVRI BRIC) published by the University of South Carolina's Hazards and Vulnerability Research Institute (HVRI).

For more information, visit **hazards.fema.gov/nri/community-resilience**.

How to Take Action

There are many ways to reduce natural hazard risk through mitigation. Communities with high National Risk Index scores can take action to reduce risk by decreasing Expected Annual Loss due to natural hazards, decreasing Social Vulnerability, and increasing Community Resilience.

For information about how to take action and reduce your risk, visit **hazards.fema.gov/nri/take-action**.

Disclaimer

The National Risk Index (the Risk Index or the Index) and its associated data are meant for planning purposes only. This tool was created for broad nationwide comparisons and is not a substitute for localized risk assessment analysis. Nationwide datasets used as inputs for the National Risk Index are, in many cases, not as accurate as available local data. Users with access to local data for each National Risk Index risk factor should consider substituting the Risk Index data with local data to recalculate a more accurate risk index. If you decide to download the National Risk Index data and substitute it with local data, you assume responsibility for the accuracy of the data and any resulting data index. Please visit the **Contact Us** page if you would like to discuss this process further.

The methodology used by the National Risk Index has been reviewed by subject matter experts in the fields of natural hazard risk research, risk analysis, mitigation planning, and emergency management. The processing methods used to create the National Risk Index have produced results similar to those from other natural hazard risk analyses conducted on a smaller scale. The breadth and combination of geographic information systems (GIS) and data processing techniques leveraged by the National Risk Index enable it to incorporate multiple hazard types and risk factors, manage its nationwide scope, and capture what might have been missed using other methods.

The National Risk Index does not consider the intricate economic and physical interdependencies that exist across geographic regions. Keep in mind that hazard impacts in surrounding counties or Census tracts can cause indirect losses in your community regardless of your community's risk profile.

Nationwide data available for some risk factors are rudimentary at this time. The National Risk Index will be continuously updated as new data become available and improved methodologies are identified.

The National Risk Index Contact Us page is available at **hazards.fema.gov/nri/contact-us**.

ATTACHMENT 11: HAZUS MH SIMULATION REPORTS

HAZUS™

Hazus: Flood Global Risk Report

Region Name: NK_Flood

Flood Scenario: 100-yr

Print Date: Thursday, June 20, 2024

Disclaimer:

Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Flood. These results can be improved by using enhanced inventory data and flood hazard information.

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HAZUS™

General Description of the Region

Hazus is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences (NIBS). The primary purpose of Hazus is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The flood loss estimates provided in this report were based on a region that included 1 county(ies) from the following state(s):

- Rhode Island

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is approximately 9 square miles and contains 670 census blocks. The region contains over 11 thousand households and has a total population of 27,720 people. The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 11,243 buildings in the region with a total building replacement value (excluding contents) of 6,403 million dollars. Approximately 86.42% of the buildings (and 60.78% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 11,243 buildings in the region which have an aggregate total replacement value of 6,403 million dollars. Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Scenario respectively. Appendix B provides a general distribution of the building value by State and County.

Table 1
Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure ($1000)	Percent of Total
Residential	3,891,740	60.8%
Commercial	1,632,649	25.5%
Industrial	479,800	7.5%
Agricultural	15,179	0.2%
Religion	72,894	1.1%
Government	103,071	1.6%
Education	207,249	3.2%
Total	**6,402,582**	**100%**

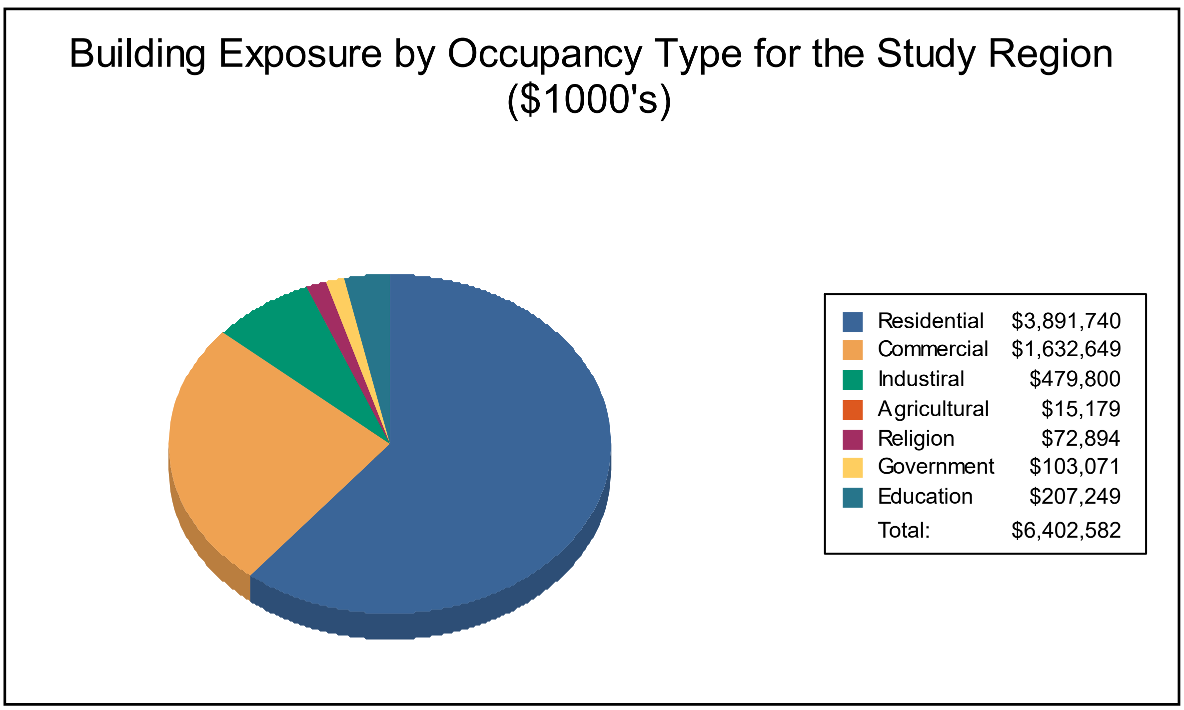
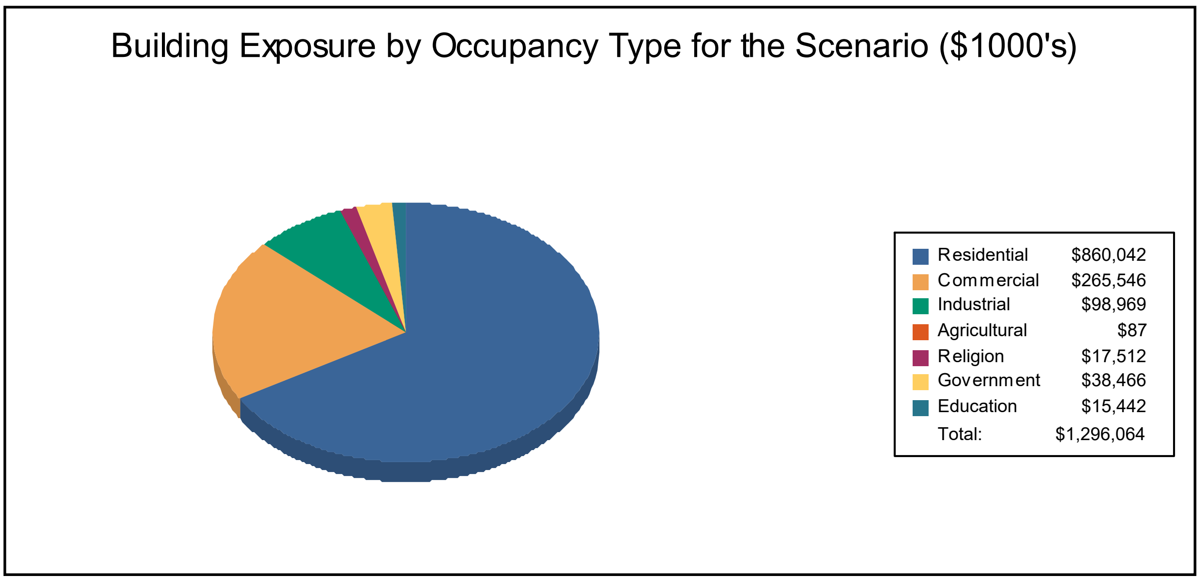


Table 2

Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure ($1000)	Percent of Total
Residential	860,042	66.4%
Commercial	265,546	20.5%
Industrial	98,969	7.6%
Agricultural	87	0.0%
Religion	17,512	1.4%
Government	38,466	3.0%
Education	15,442	1.2%
Total	**1,296,064**	**100%**



Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 10 schools, 4 fire stations, 3 police stations and 1 emergency operation center.

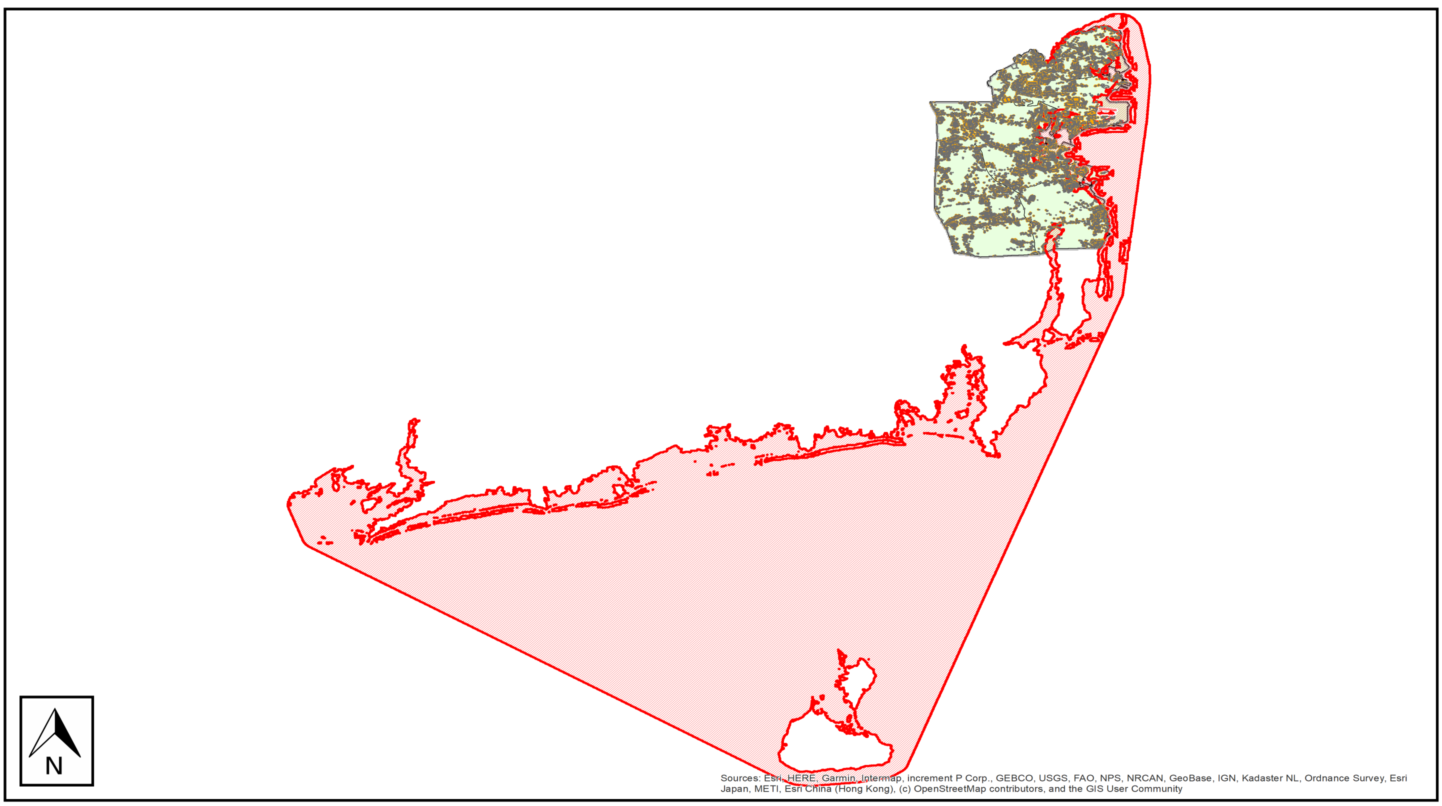
Flood Scenario Parameters

Hazus used the following set of information to define the flood parameters for the flood loss estimate provided in this report.

Study Region Name:	NK_Flood
Scenario Name:	100-yr
Return Period Analyzed:	100
Analysis Options Analyzed:	No What-Ifs

Study Region Overview Map

Illustrating scenario flood extent, as well as exposed essential facilities and total exposure



Building Damage

General Building Stock Damage

Hazus estimates that about 180 buildings will be at least moderately damaged. This is over 45% of the total number of buildings in the scenario. There are an estimated 23 buildings that will be completely destroyed. The definition of the 'damage states' is provided in the Hazus Flood Technical Manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

Total Economic Loss (1 dot = $300K) Overview Map

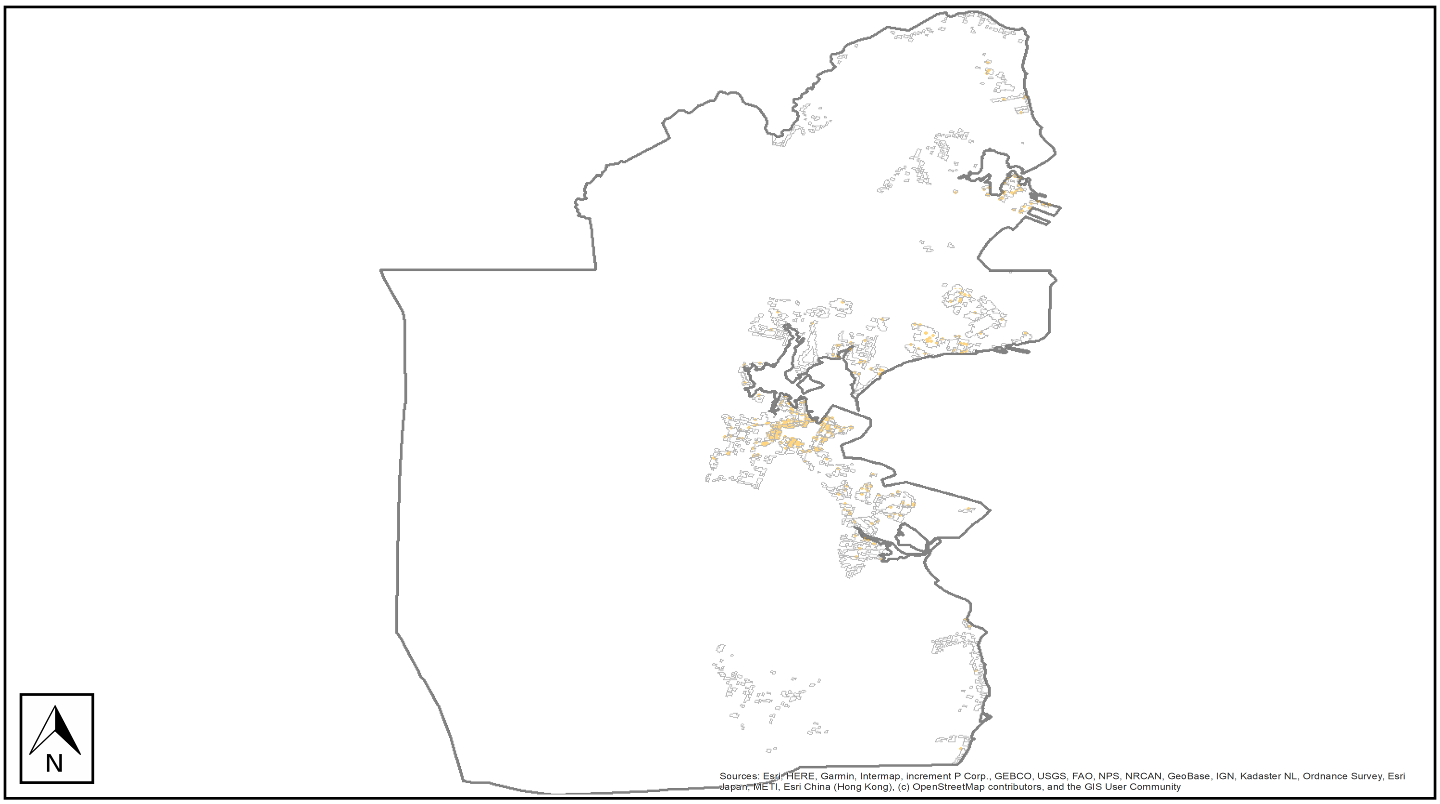
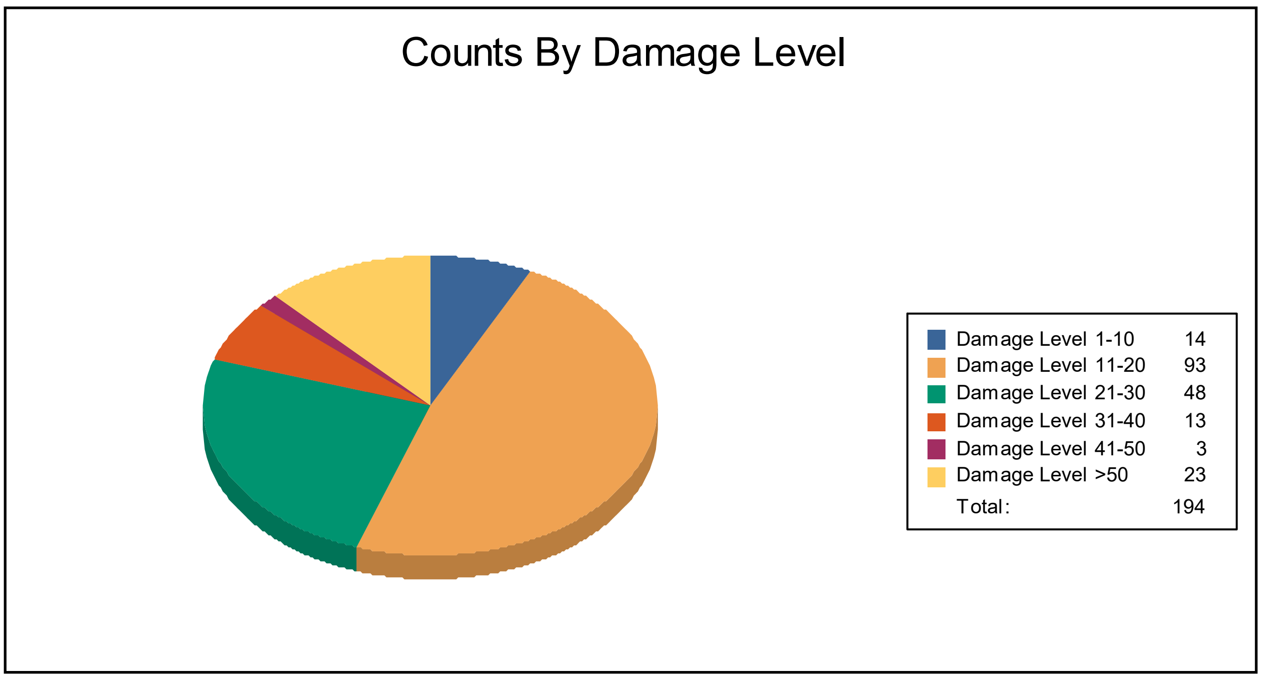


Table 3: Expected Building Damage by Occupancy

Occupancy	1-10 Count	1-10 (%)	11-20 Count	11-20 (%)	21-30 Count	21-30 (%)	31-40 Count	31-40 (%)	41-50 Count	41-50 (%)	>50 Count	>50 (%)
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
Commercial	1	8	10	77	2	15	0	0	0	0	0	0
Education	0	0	0	0	0	0	0	0	0	0	0	0
Government	0	0	0	0	0	0	0	0	0	0	0	0
Industrial	0	0	0	0	0	0	1	100	0	0	0	0
Religion	1	33	2	67	0	0	0	0	0	0	0	0
Residential	12	7	81	46	46	26	12	7	3	2	23	13
Total	**14**		**93**		**48**		**13**		**3**		**23**	



HAZUS™

Table 4: Expected Building Damage by Building Type

Building Type	1-10		11-20		21-30		31-40		41-50		>50	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	0	0	0	0	0	0	0	0	0	0	0	0
ManufHousing	0	0	0	0	0	0	0	0	0	0	0	0
Masonry	0	0	3	100	0	0	0	0	0	0	0	0
Steel	0	0	2	100	0	0	0	0	0	0	0	0
Wood	13	7	88	47	48	26	12	6	3	2	23	12

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 0 hospital beds available for use. On the day of the scenario flood event, the model estimates that 0 hospital beds are available in the region.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	At Least Moderate	At Least Substantial	Loss of Use
Emergency Operation Centers	1	0	0	0
Fire Stations	4	1	0	1
Hospitals	0	0	0	0
Police Stations	3	0	0	0
Schools	10	0	0	0

If this report displays all zeros or is blank, two possibilities can explain this.

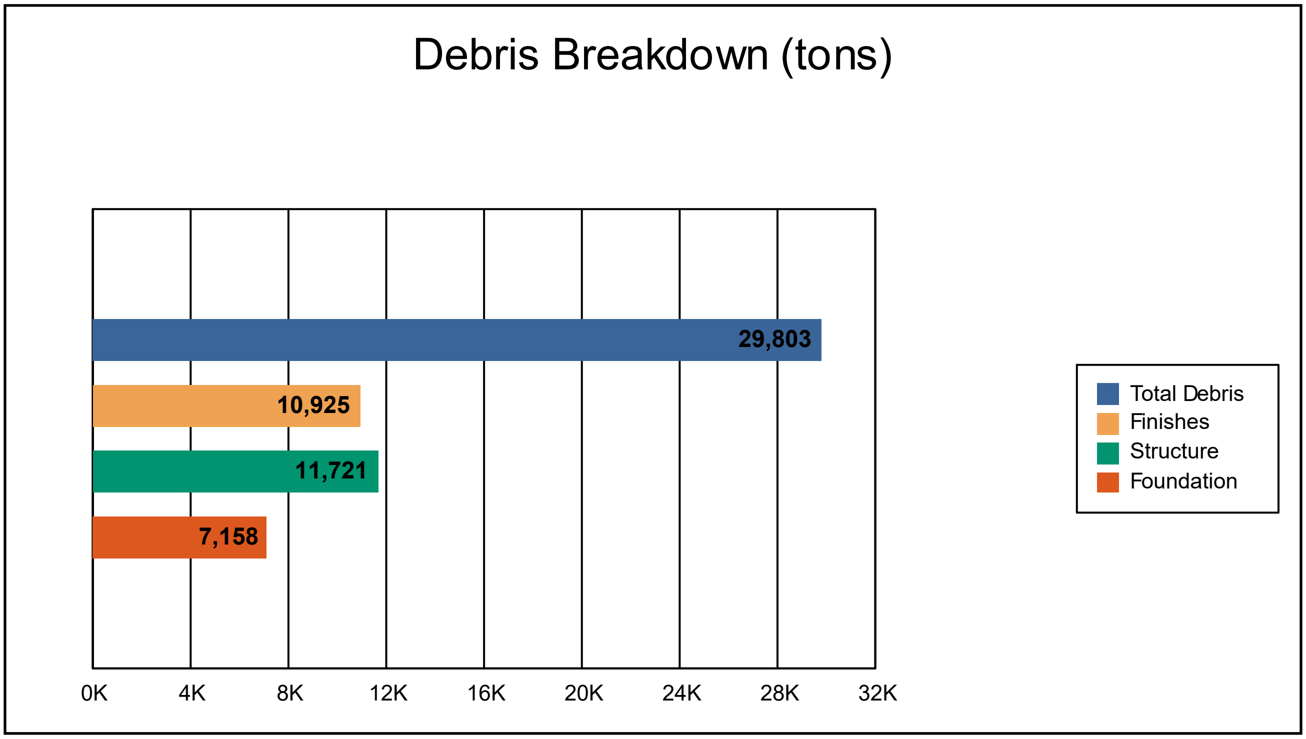
(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.

Induced Flood Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). This distinction is made because of the different types of material handling equipment required to handle the debris.

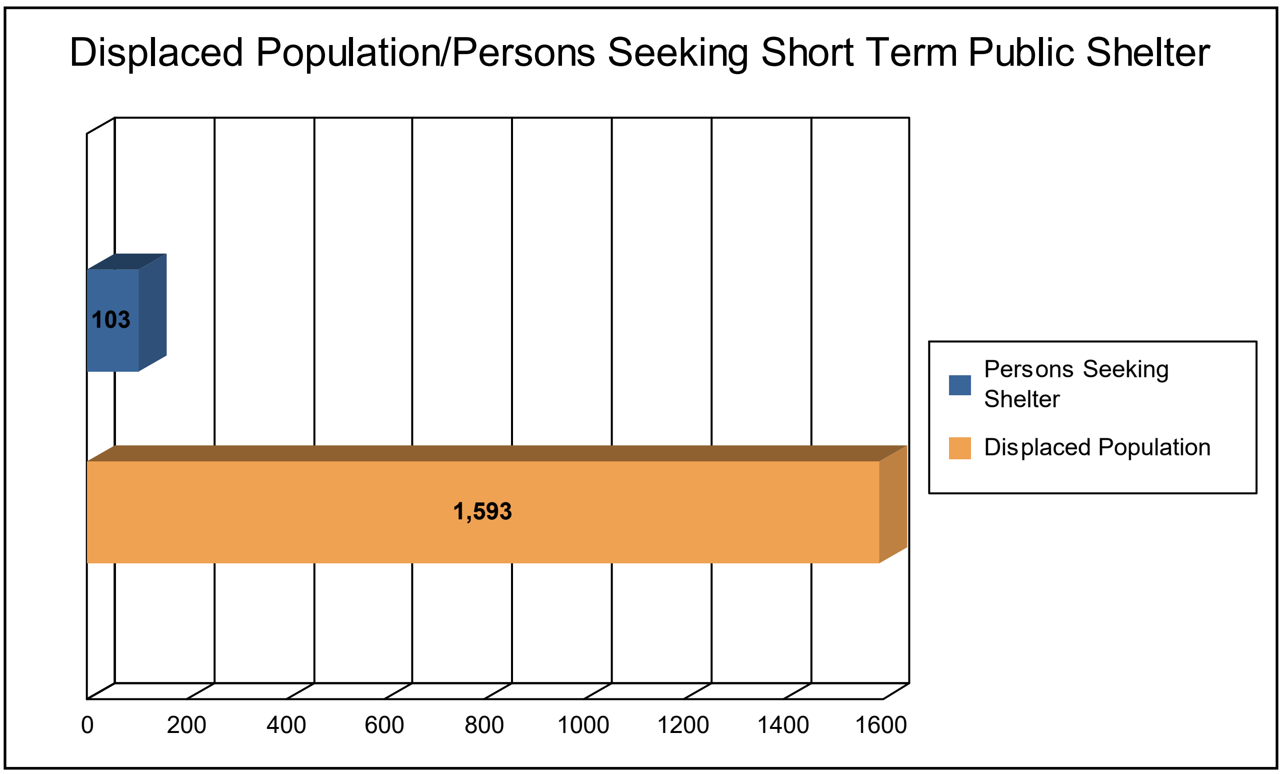


The model estimates that a total of 29,803 tons of debris will be generated. Of the total amount, Finishes comprises 37% of the total, Structure comprises 39% of the total, and Foundation comprises 24%. If the debris tonnage is converted into an estimated number of truckloads, it will require 1193 truckloads (@25 tons/truck) to remove the debris generated by the flood.

Social Impact

Shelter Requirements

Hazus estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. Hazus also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 531 households (or 1,593 of people) will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 103 people (out of a total population of 27,720) will seek temporary shelter in public shelters.



Economic Loss

The total economic loss estimated for the flood is 454.14 million dollars, which represents 35.04 % of the total replacement value of the scenario buildings.

Building-Related Losses

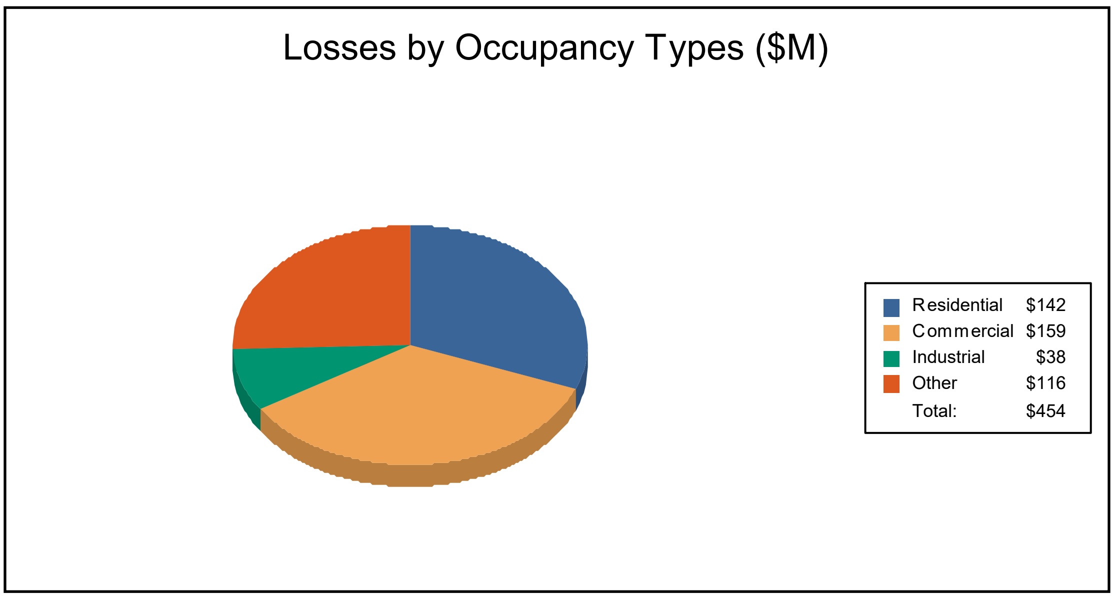
The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the flood. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the flood.

The total building-related losses were 239.93 million dollars. 47% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 31.22% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.

Table 6: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	60.16	16.33	8.09	2.96	87.54
	Content	56.70	42.34	23.59	16.86	139.49
	Inventory	0.00	9.16	3.73	0.02	12.90
	Subtotal	**116.86**	**67.83**	**35.40**	**19.84**	**239.93**
Business Interruption						
	Income	0.80	39.13	0.64	5.29	45.85
	Relocation	15.53	12.49	0.82	5.45	34.30
	Rental Income	6.71	8.58	0.24	1.79	17.31
	Wage	1.88	30.50	1.08	83.30	116.75
	Subtotal	**24.92**	**90.69**	**2.77**	**95.83**	**214.21**
ALL	**Total**	**141.77**	**158.52**	**38.18**	**115.68**	**454.14**



Appendix A: County Listing for the Region

Rhode Island

- Washington

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Rhode Island				
Washington	27,720	3,891,740	2,510,842	6,402,582
Total	**27,720**	**3,891,740**	**2,510,842**	**6,402,582**
Total Study Region	**27,720**	**3,891,740**	**2,510,842**	**6,402,582**

HAZUS™

Hazus: Flood Global Risk Report

Region Name: NK_Flood

Flood Scenario: 500-yr

Print Date: Thursday, June 20, 2024

Disclaimer:
Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Flood. These results can be improved by using enhanced inventory data and flood hazard information.

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The flood loss estimates provided in this report were based on a region that included 1 county(ies) from the following state(s):

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Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is approximately 9 square miles and contains 670 census blocks. The region contains over 11 thousand households and has a total population of 27,720 people. The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 11,243 buildings in the region with a total building replacement value (excluding contents) of 6,403 million dollars. Approximately 86.42% of the buildings (and 60.78% of the building value) are associated with residential housing.

HAZUS™

Building Inventory

General Building Stock

Hazus estimates that there are 11,243 buildings in the region which have an aggregate total replacement value of 6,403 million dollars. Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Scenario respectively. Appendix B provides a general distribution of the building value by State and County.

Table 1
Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure ($1000)	Percent of Total
Residential	3,891,740	60.8%
Commercial	1,632,649	25.5%
Industrial	479,800	7.5%
Agricultural	15,179	0.2%
Religion	72,894	1.1%
Government	103,071	1.6%
Education	207,249	3.2%
Total	**6,402,582**	**100%**

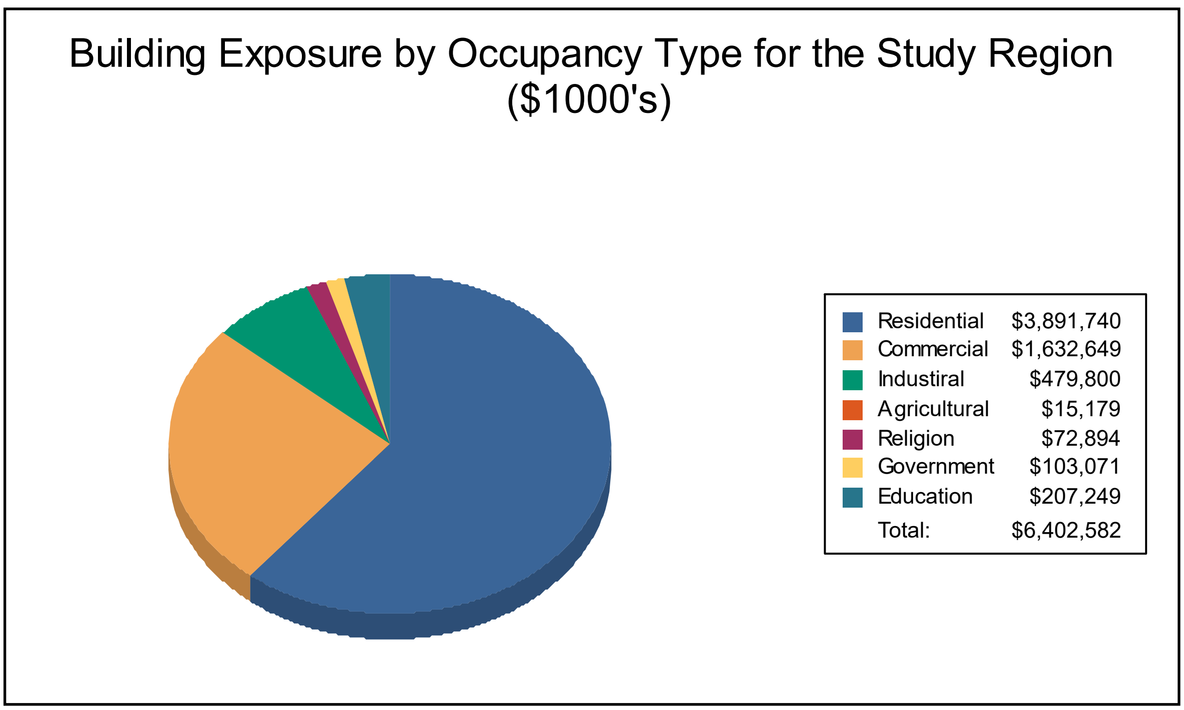
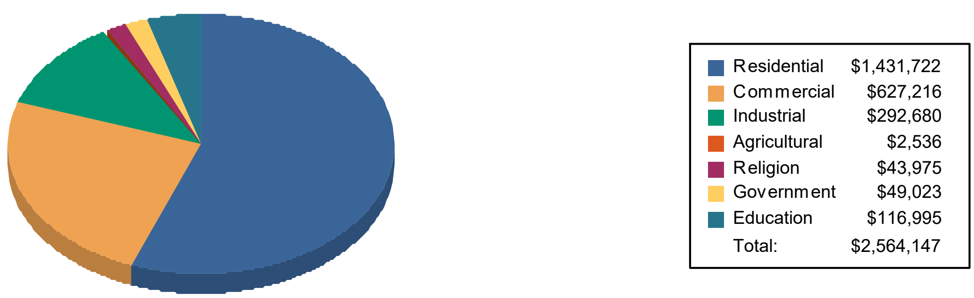


Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure ($1000)	Percent of Total
Residential	1,431,722	55.8%
Commercial	627,216	24.5%
Industrial	292,680	11.4%
Agricultural	2,536	0.1%
Religion	43,975	1.7%
Government	49,023	1.9%
Education	116,995	4.6%
Total	**2,564,147**	**100%**

Building Exposure by Occupancy Type for the Scenario ($1000's)



Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 10 schools, 4 fire stations, 3 police stations and 1 emergency operation center.

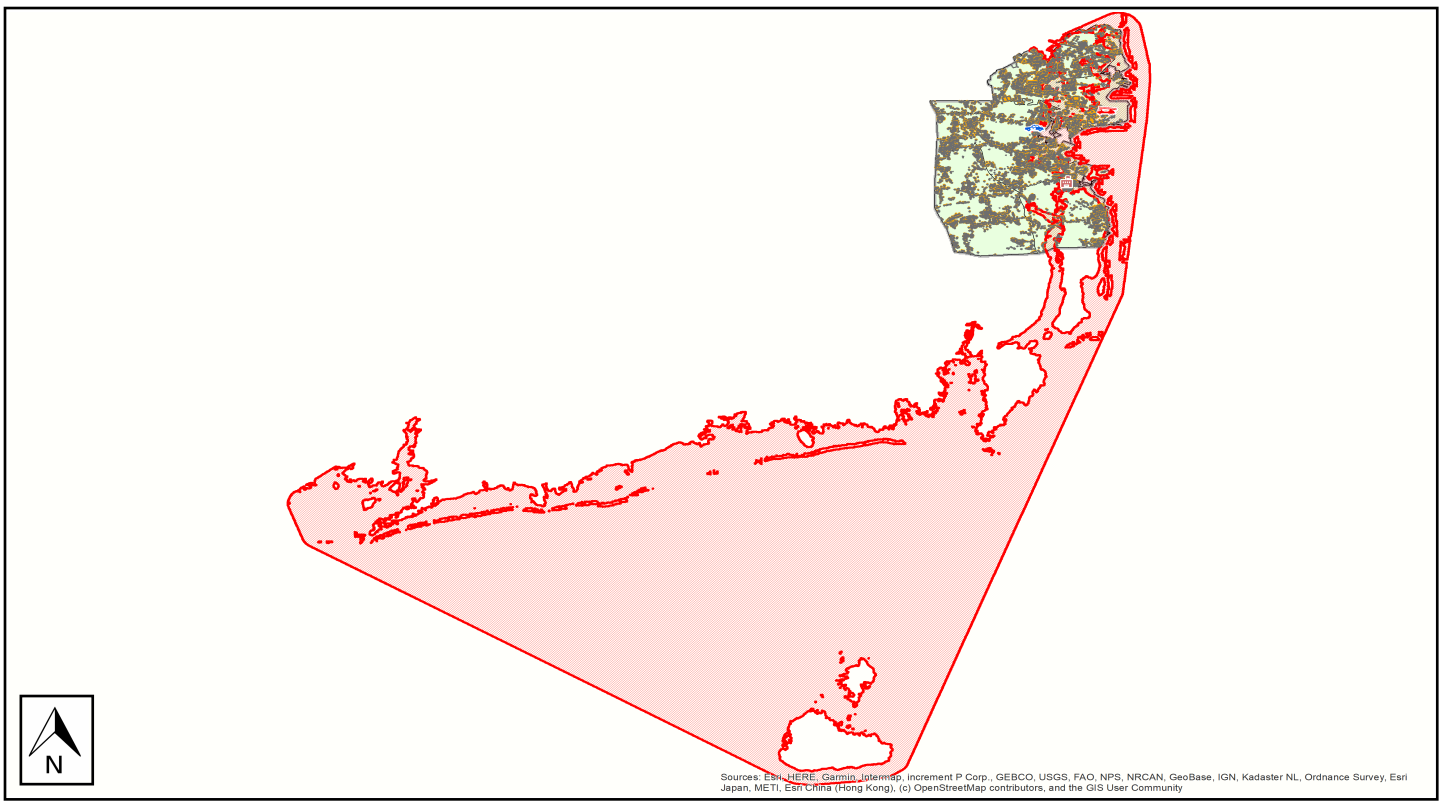
Flood Scenario Parameters

Hazus used the following set of information to define the flood parameters for the flood loss estimate provided in this report.

Study Region Name:	NK_Flood
Scenario Name:	500-yr
Return Period Analyzed:	100
Analysis Options Analyzed:	No What-Ifs

Study Region Overview Map

Illustrating scenario flood extent, as well as exposed essential facilities and total exposure



Building Damage

General Building Stock Damage

Hazus estimates that about 883 buildings will be at least moderately damaged. This is over 26% of the total number of buildings in the scenario. There are an estimated 385 buildings that will be completely destroyed. The definition of the 'damage states' is provided in the Hazus Flood Technical Manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

Total Economic Loss (1 dot = $300K) Overview Map

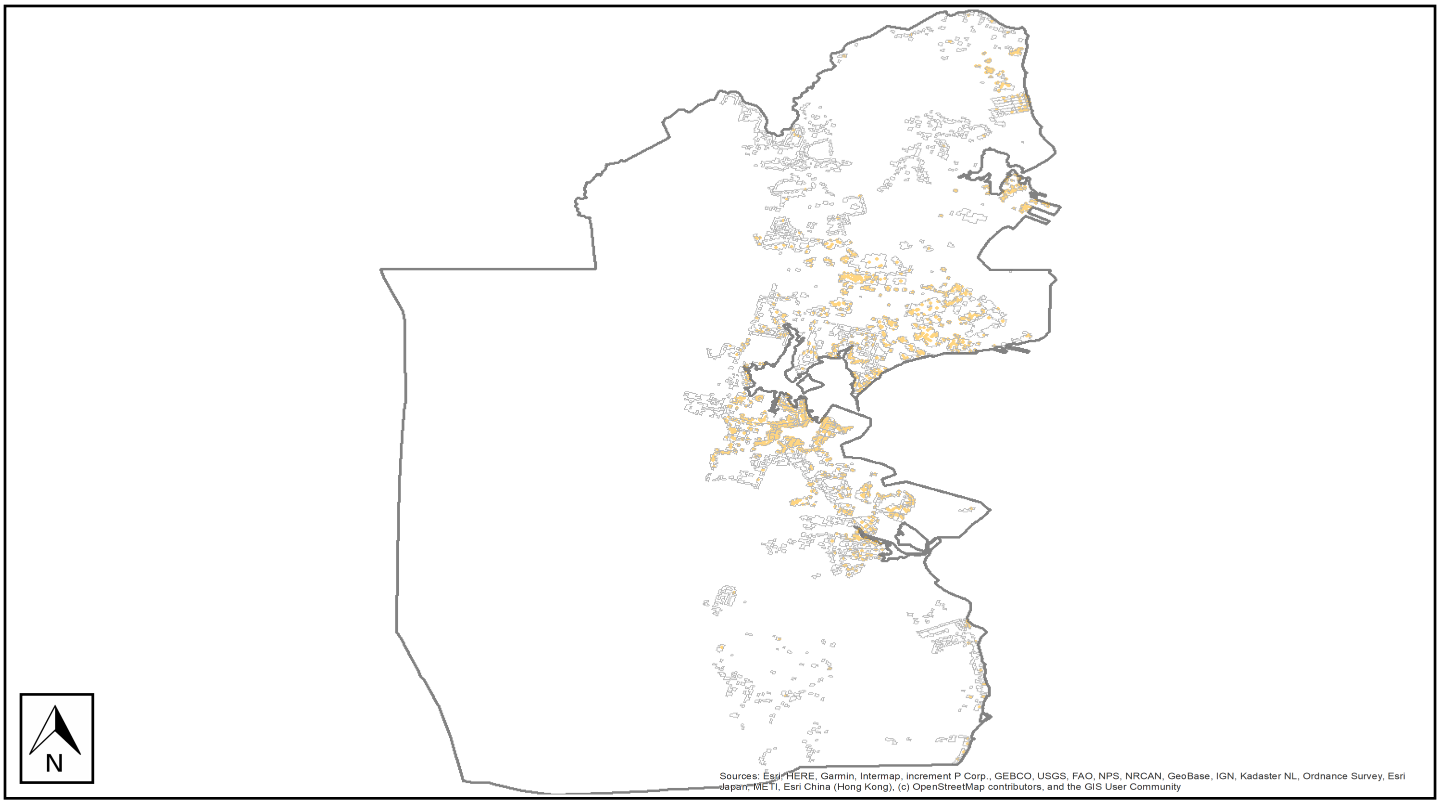


Table 3: Expected Building Damage by Occupancy

	1-10		11-20		21-30		31-40		41-50		>50	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	0	0	0	0	0	1	100	0	0	0	0
Commercial	0	0	1	3	0	0	0	0	0	0	33	97
Education	0	0	0	0	0	0	0	0	0	0	0	0
Government	1	100	0	0	0	0	0	0	0	0	0	0
Industrial	0	0	1	14	0	0	0	0	1	14	5	71
Religion	0	0	2	33	0	0	0	0	1	17	3	50
Residential	25	3	120	14	133	15	84	10	154	18	344	40
Total	**26**		**124**		**133**		**85**		**156**		**385**	

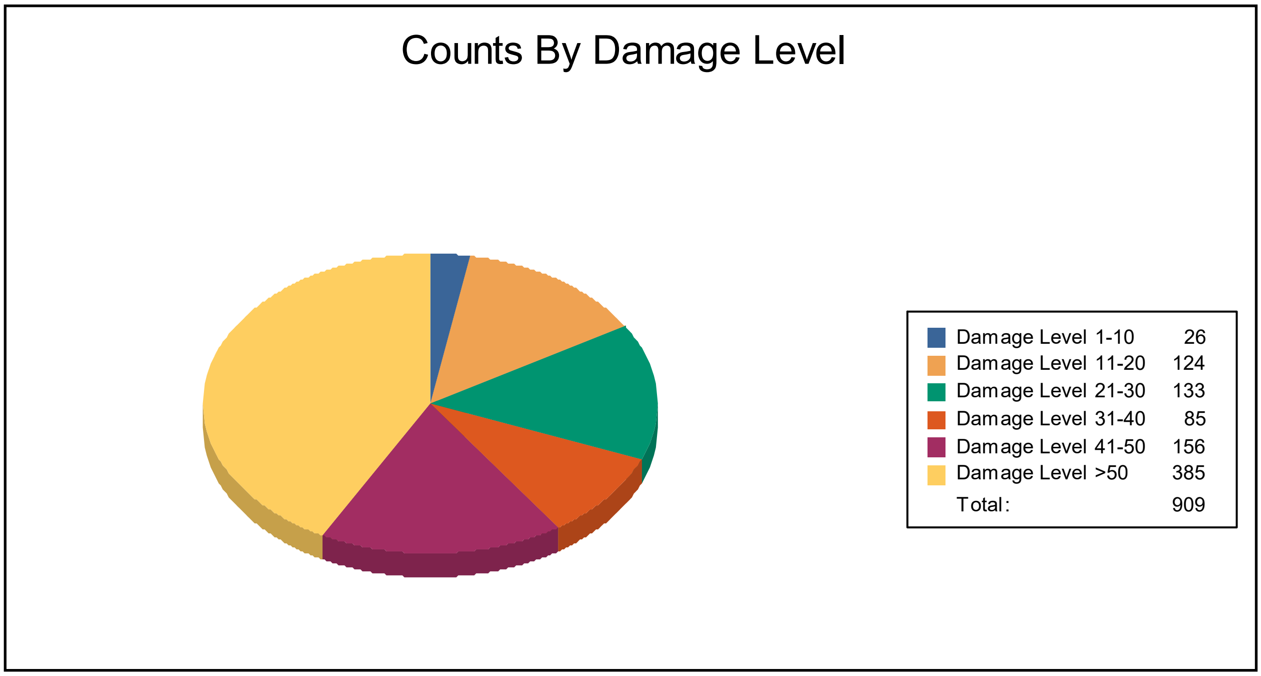


Table 4: Expected Building Damage by Building Type

Building Type	1-10		11-20		21-30		31-40		41-50		>50	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	0	0	0	0	0	0	0	0	0	0	0	0
ManufHousing	0	0	0	0	0	0	0	0	0	0	0	0
Masonry	0	0	0	0	2	22	1	11	1	11	5	56
Steel	1	10	0	0	0	0	0	0	2	20	7	70
Wood	25	3	123	14	131	15	84	10	151	17	366	42

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 0 hospital beds available for use. On the day of the scenario flood event, the model estimates that 0 hospital beds are available in the region.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	At Least Moderate	At Least Substantial	Loss of Use
Emergency Operation Centers	1	0	0	0
Fire Stations	4	0	1	1
Hospitals	0	0	0	0
Police Stations	3	1	0	0
Schools	10	1	0	1

If this report displays all zeros or is blank, two possibilities can explain this.

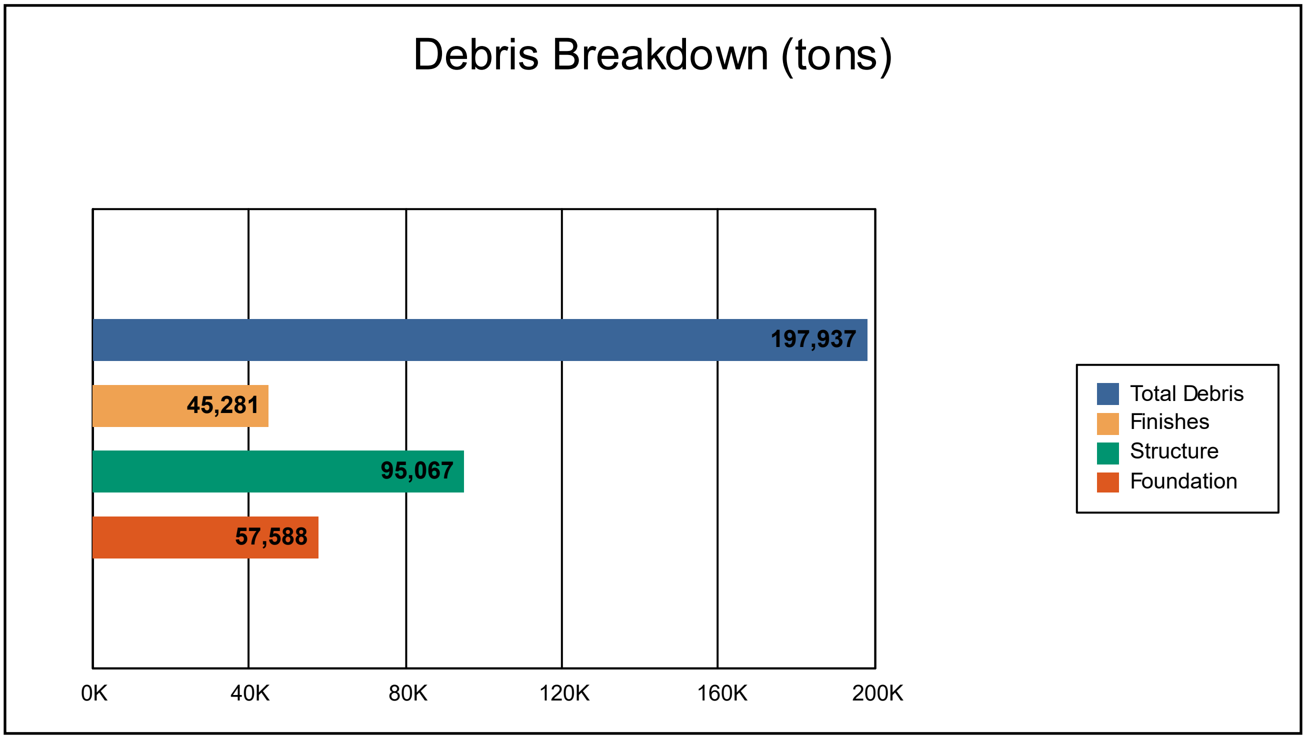
(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.

Induced Flood Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). This distinction is made because of the different types of material handling equipment required to handle the debris.

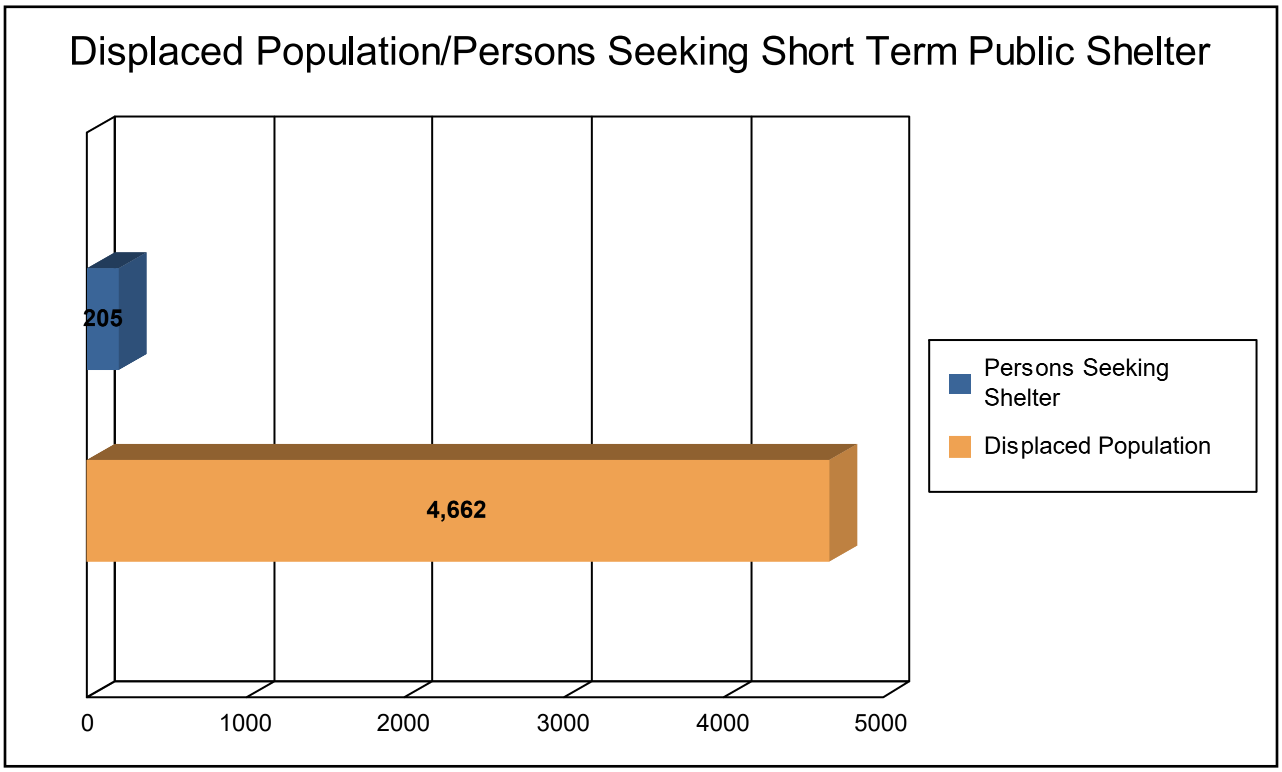


The model estimates that a total of 197,937 tons of debris will be generated. Of the total amount, Finishes comprises 23% of the total, Structure comprises 48% of the total, and Foundation comprises 29%. If the debris tonnage is converted into an estimated number of truckloads, it will require 7918 truckloads (@25 tons/truck) to remove the debris generated by the flood.

Social Impact

Shelter Requirements

Hazus estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. Hazus also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 1,554 households (or 4,662 of people) will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 205 people (out of a total population of 27,720) will seek temporary shelter in public shelters.



Economic Loss

The total economic loss estimated for the flood is 1,793.73 million dollars, which represents 69.95 % of the total replacement value of the scenario buildings.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the flood. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the flood.

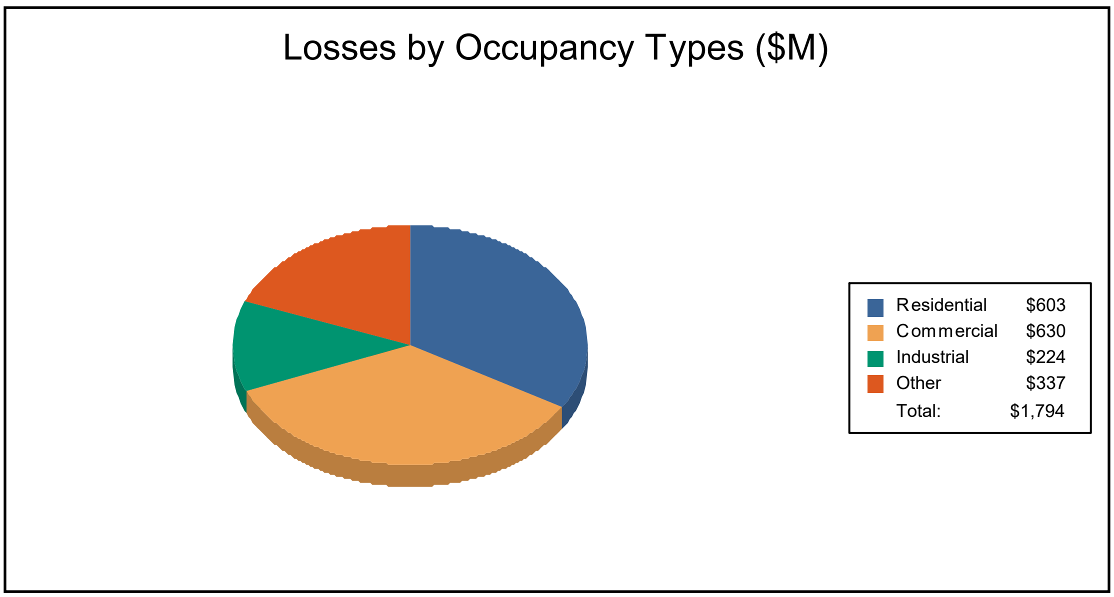
The total building-related losses were 1,195.15 million dollars. 33% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 33.62% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.

HAZUS™

Table 6: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	290.91	109.30	57.36	29.68	487.25
	Content	232.24	203.76	135.16	76.93	648.09
	Inventory	0.00	41.23	18.28	0.30	59.81
	Subtotal	**523.15**	**354.29**	**210.80**	**106.91**	**1,195.15**
Business Interruption						
	Income	3.58	106.87	2.66	22.10	135.20
	Relocation	46.58	35.11	4.59	16.67	102.95
	Rental Income	21.41	25.16	1.01	3.83	51.41
	Wage	8.42	108.54	4.47	187.59	309.02
	Subtotal	**79.99**	**275.68**	**12.73**	**230.18**	**598.58**
ALL	**Total**	**603.14**	**629.97**	**223.53**	**337.10**	**1,793.73**



Appendix A: County Listing for the Region

Rhode Island

- Washington

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars) Residential	Non-Residential	Total
Rhode Island				
Washington	27,720	3,891,740	2,510,842	6,402,582
Total	**27,720**	**3,891,740**	**2,510,842**	**6,402,582**
Total Study Region	**27,720**	**3,891,740**	**2,510,842**	**6,402,582**

Hazus: Hurricane Global Risk Report

Region Name: NK_Hurricane

Hurricane Scenario: Probabilistic 100-year Return Period

Print Date: Wednesday, June 19, 2024

Table of Contents

General Description of the Region

Hazus is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of Hazus is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Rhode Island

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 43.63 square miles and contains 7 census tracts. There are over 11 thousand households in the region and a total population of 27,732 people. The distribution of population by State and County is provided in Appendix B.

There are an estimated 11 thousand buildings in the region with a total building replacement value (excluding contents) of 6,403 million dollars. Approximately 86% of the buildings (and 61% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 11,243 buildings in the region which have an aggregate total replacement value of Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provi distribution of the building value by State and County.

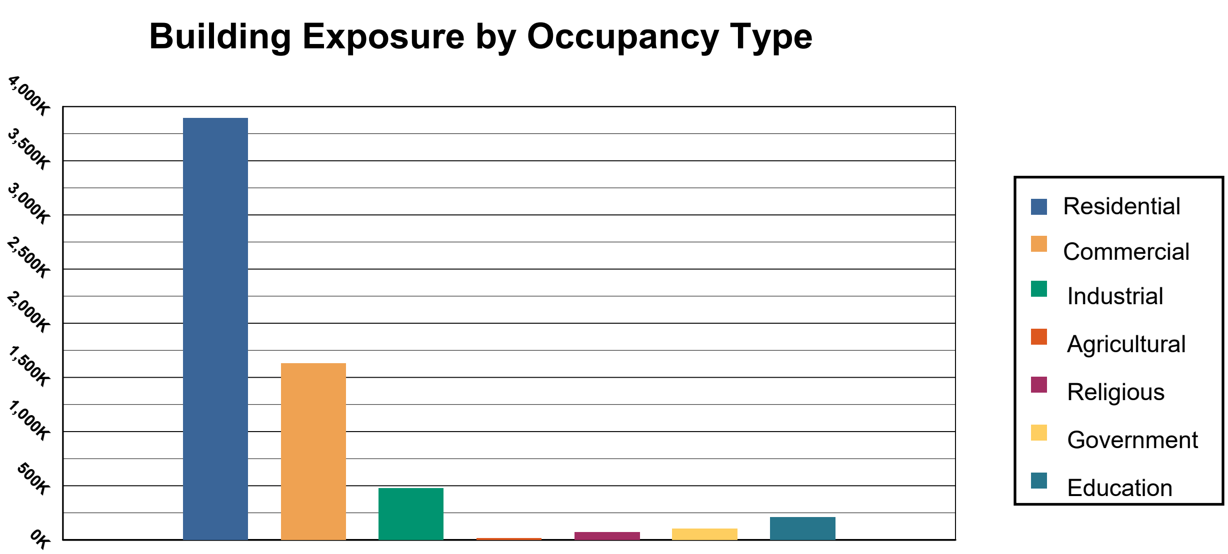


Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure ($1000)	Percent of Tot
Residential	3,892,161	60.78%
Commercial	1,632,886	25.50%
Industrial	479,857	7.49%
Agricultural	15,190	0.24%
Religious	72,912	1.14%
Government	103,090	1.61%
Education	207,258	3.24%
Total	**6,403,354**	**100.00%**

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 10 schools, 4 fire stations, 3 police stations and 1 emergency operation facilities.

Hurricane Scenario

Hazus used the following set of information to define the hurricane parameters for the hurricane loss estimate provided in this report.

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 307 buildings will be at least moderately damaged. This is over 3% of the total number of buildings in the region. There are an estimated 19 buildings that will be completely destroyed. The definition of the 'damage states' is provided in the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

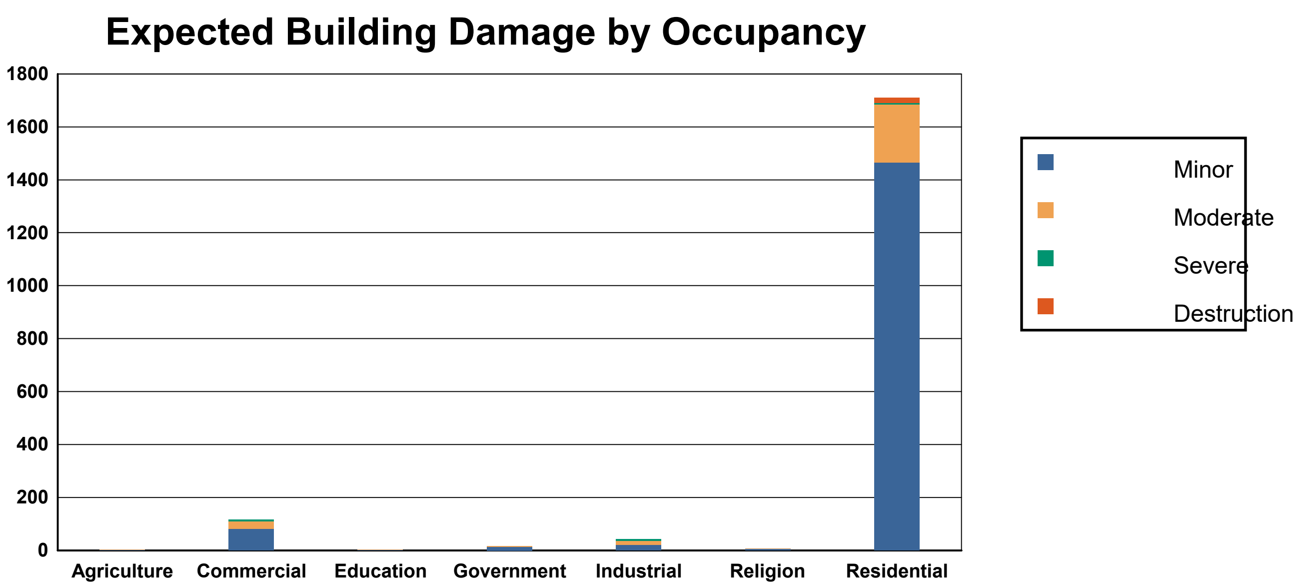


Table 2: Expected Building Damage by Occupancy : 100 - year Event

	None		Minor		Moderate		Severe		Destruction	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	30	89.90	2	7.05	1	2.04	0	0.93	0	0.07
Commercial	906	88.66	82	8.02	27	2.61	7	0.71	0	0.00
Education	18	83.53	2	10.87	1	5.49	0	0.11	0	0.00
Government	111	87.93	12	9.73	3	2.21	0	0.12	0	0.00
Industrial	210	83.09	21	8.42	15	5.93	6	2.51	0	0.05
Religion	64	89.76	6	8.19	1	1.89	0	0.16	0	0.00
Residential	8,006	82.40	1,466	15.08	218	2.25	8	0.08	19	0.19
Total	**9,345**		**1,592**		**266**		**22**		**19**	

Table 3: Expected Building Damage by Building Type : 100 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	45	87.43	5	10.21	1	2.23	0	0.13	0	0.00
Masonry	458	84.99	63	11.77	14	2.69	2	0.45	1	0.10
MH	36	94.06	1	3.33	1	1.70	0	0.04	0	0.87
Steel	446	79.79	56	10.11	44	7.91	12	2.19	0	0.00
Wood	8,526	84.81	1,336	13.29	168	1.67	9	0.09	14	0.14

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use by patients already in the hospital and those injured by the hurricane. After one week, none of the beds will be in service. By 30 days, none will be operational.

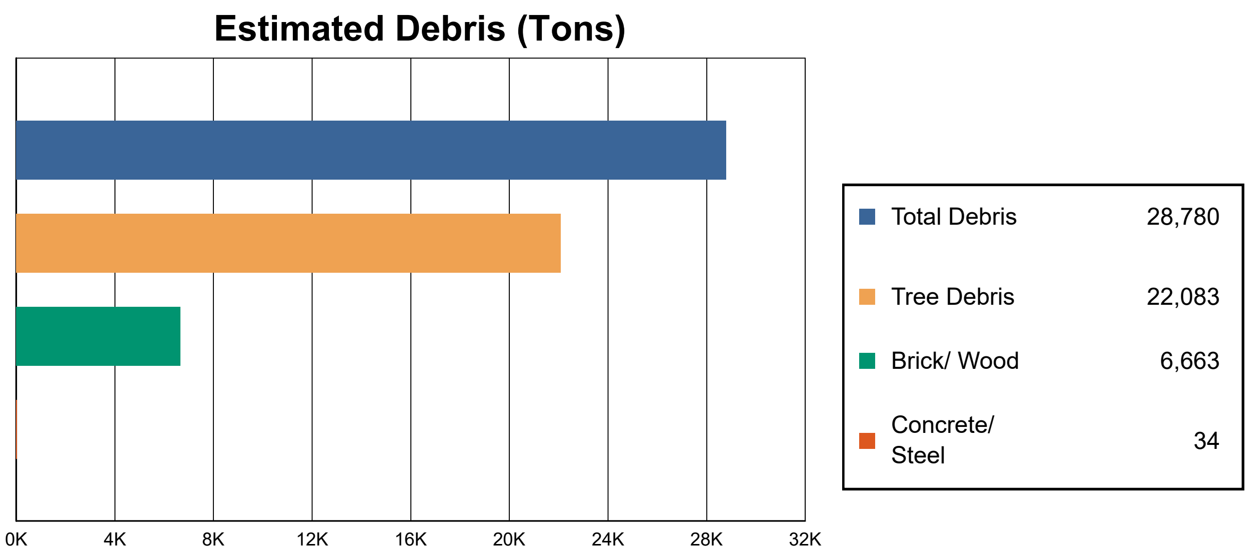
Thematic Map of Essential Facilities

Table 4: Expected Damage to Essential Facilities

		# Facilities		
Classification	**Total**	**Probability of at Least Moderate Damage > 50%**	**Probability of Complete Damage > 50%**	**Expected Loss of Use < 1 day**
EOCs	1	0	0	1
Fire Stations	4	0	0	4
Police Stations	3	0	0	3
Schools	10	0	0	8

Induced Hurricane Damage

Debris Generation

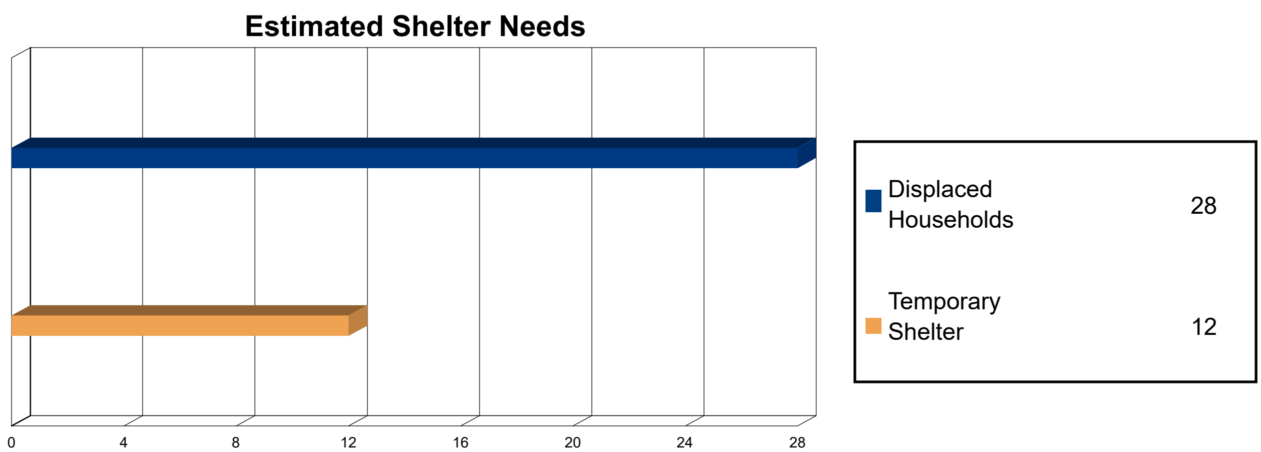


Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 28,780 tons of debris will be generated. Of the total amount, 13,143 tons (46%) is Other Tree Debris. Of the remaining 15,637 tons, Brick/Wood comprises 43% of the total, Reinforced Concrete/Steel comprises of 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 268 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 8,940 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement



Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 28 households to be displaced due to the hurricane. Of these, 12 people (out of a total population of 27,732) will seek temporary shelter in public shelters.

Economic Loss

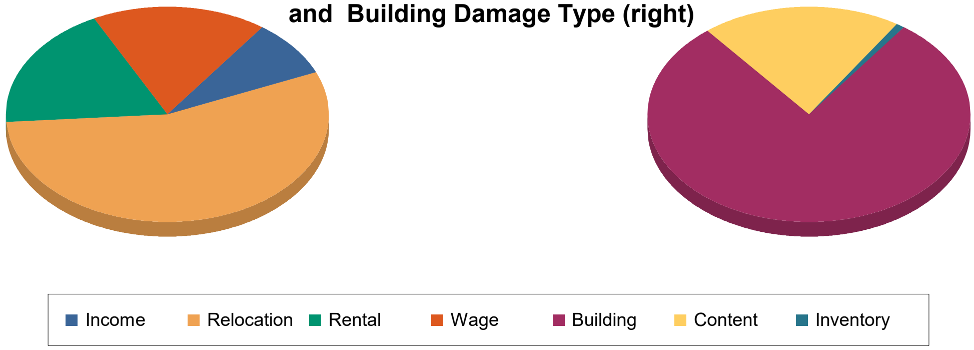
The total economic loss estimated for the hurricane is 92.7 million dollars, which represents 1.45 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 93 million dollars. 8% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 74% of the total loss. Table 5 below provides a summary of the losses associated with the building damage.

Loss by Business Interruption Type (left)
and Building Damage Type (right)



Loss Type by General Occupancy

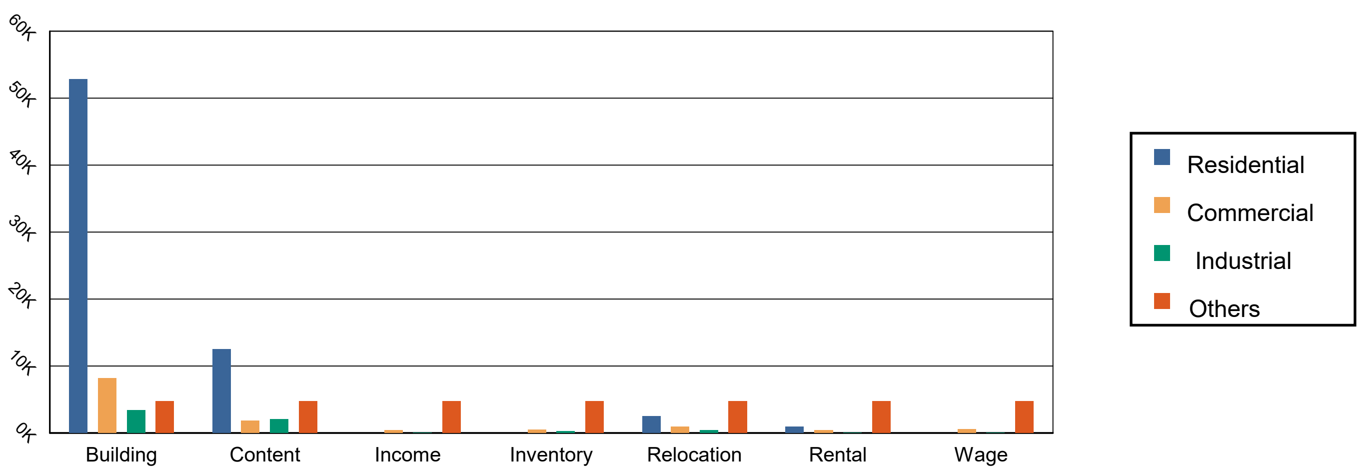


Table 5: Building-Related Economic Loss Estimates

(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Property Damage						
	Building	52,837.66	8,142.29	3,410.18	2,796.77	67,186.90
	Content	12,543.40	1,822.74	2,063.13	600.08	17,029.36
	Inventory	0.00	482.79	252.10	24.57	759.46
	Subtotal	**65,381.06**	**10,447.82**	**5,725.41**	**3,421.42**	**84,975.72**
Business Interruption Loss						
	Income	0.00	457.37	39.84	168.87	666.07
	Relocation	2,523.77	970.60	395.24	390.89	4,280.51
	Rental	973.73	378.31	36.57	35.11	1,423.71
	Wage	0.00	520.65	66.36	771.64	1,358.65
	Subtotal	**3,497.50**	**2,326.93**	**538.00**	**1,366.51**	**7,728.94**

Total

Total	**68,878.56**	**12,774.75**	**6,263.42**	**4,787.94**	**92,704.66**

Appendix A: County Listing for the Region

Rhode Island
- Washington

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars) Residential	Non-Residential	Total
Rhode Island				
Washington	27,732	3,892,161	2,511,193	6,403,354
Total	**27,732**	**3,892,161**	**2,511,193**	**6,403,354**
Study Region Total	**27,732**	**3,892,161**	**2,511,193**	**6,403,354**

Hazus: Hurricane Global Risk Report

Region Name: NK_Hurricane

Hurricane Scenario: Probabilistic 500-year Return Period

Print Date: Wednesday, June 19, 2024

Disclaimer:
Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Hurricane. These results can be improved by using enhanced inventory data.

Table of Contents

General Description of the Region

Hazus is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of Hazus is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Rhode Island

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 43.63 square miles and contains 7 census tracts. There are over 11 thousand households in the region and a total population of 27,732 people. The distribution of population by State and County is provided in Appendix B.

There are an estimated 11 thousand buildings in the region with a total building replacement value (excluding contents) of 6,403 million dollars. Approximately 86% of the buildings (and 61% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 11,243 buildings in the region which have an aggregate total replacement value of Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provi distribution of the building value by State and County.

Building Exposure by Occupancy Type

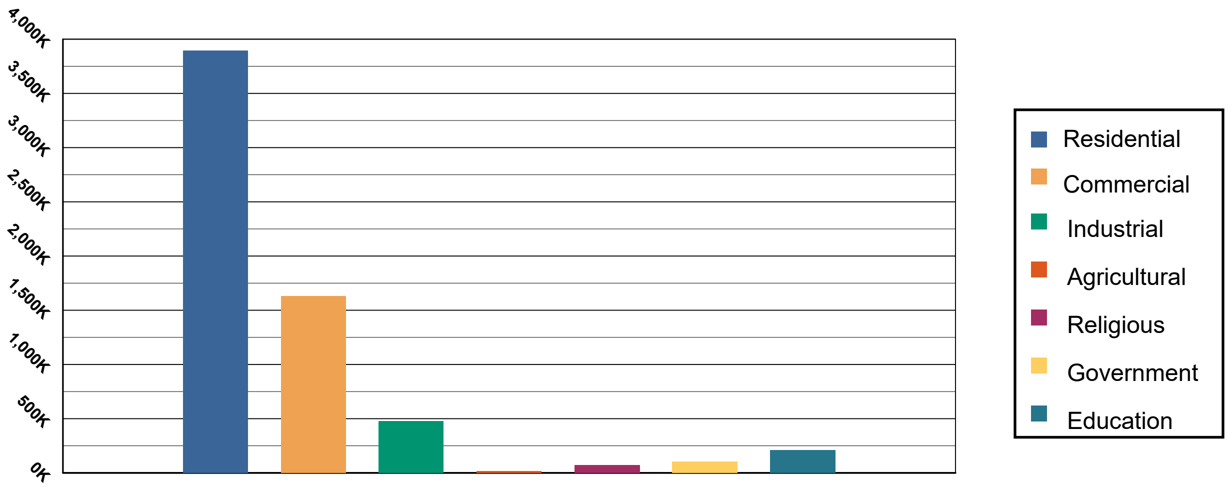


Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure ($1000)	Percent of Tot
Residential	3,892,161	60.78%
Commercial	1,632,886	25.50%
Industrial	479,857	7.49%
Agricultural	15,190	0.24%
Religious	72,912	1.14%
Government	103,090	1.61%
Education	207,258	3.24%
Total	**6,403,354**	**100.00%**

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 10 schools, 4 fire stations, 3 police stations and 1 emergency operation facilities.

Hurricane Scenario

Hazus used the following set of information to define the hurricane parameters for the hurricane loss estimate provided in this report.

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 1,565 buildings will be at least moderately damaged. This is over 14% of the total number of buildings in the region. There are an estimated 273 buildings that will be completely destroyed. The definition of the 'damage states' is provided in the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

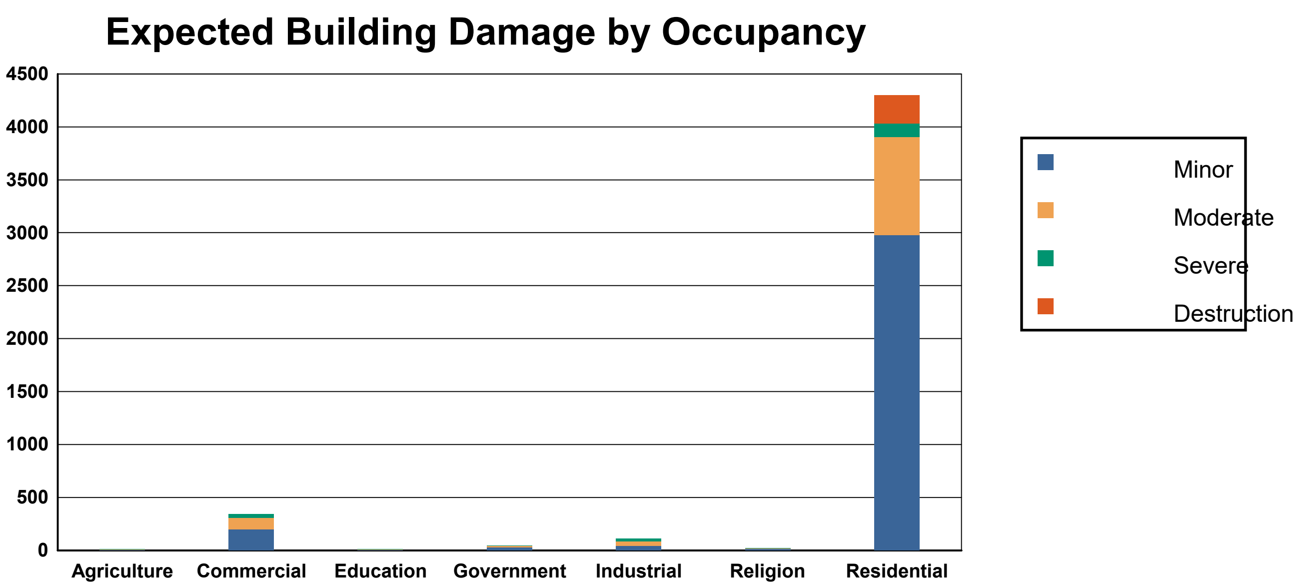


Table 2: Expected Building Damage by Occupancy : 500 - year Event

	None		Minor		Moderate		Severe		Destruction	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	23	70.21	6	18.56	2	6.95	1	3.74	0	0.53
Commercial	678	66.38	201	19.62	105	10.26	38	3.67	1	0.07
Education	13	57.57	5	21.05	4	18.93	1	2.45	0	0.01
Government	78	61.74	28	22.07	17	13.46	3	2.72	0	0.00
Industrial	142	55.94	43	17.09	40	15.75	27	10.78	1	0.44
Religion	49	68.93	14	20.42	6	9.03	1	1.62	0	0.00
Residential	5,418	55.76	2,981	30.68	922	9.49	124	1.28	271	2.79
Total	**6,400**		**3,278**		**1,097**		**196**		**273**	

Table 3: Expected Building Damage by Building Type : 500 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	31	59.23	12	22.50	8	14.81	2	3.47	0	0.00
Masonry	309	57.28	128	23.80	73	13.63	21	3.97	7	1.32
MH	28	73.15	4	10.09	4	9.69	0	0.72	2	6.35
Steel	281	50.21	101	18.00	120	21.54	57	10.13	1	0.12
Wood	6,056	60.24	2,883	28.67	785	7.81	109	1.08	221	2.20

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use by patients already in the hospital and those injured by the hurricane. After one week, none of the beds will be in service. By 30 days, none will be operational.

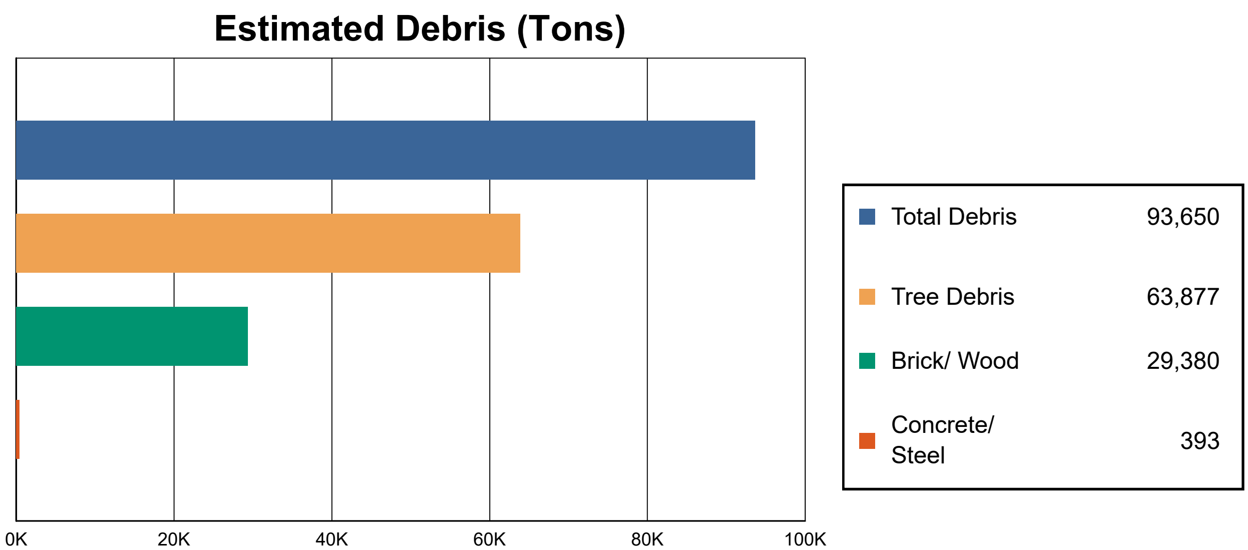
Thematic Map of Essential Facilities

Table 4: Expected Damage to Essential Facilities

		# Facilities		
Classification	**Total**	**Probability of at Least Moderate Damage > 50%**	**Probability of Complete Damage > 50%**	**Expected Loss of Use < 1 day**
EOCs	1	0	0	1
Fire Stations	4	0	0	4
Police Stations	3	0	0	3
Schools	10	1	0	0

Induced Hurricane Damage

Debris Generation

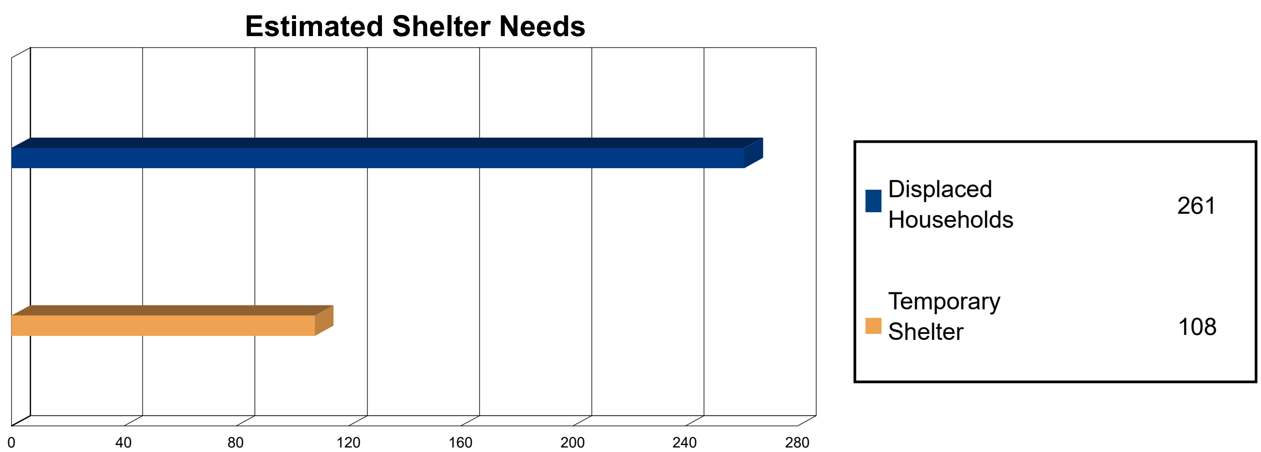


Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 93,650 tons of debris will be generated. Of the total amount, 38,362 tons (41%) is Other Tree Debris. Of the remaining 55,288 tons, Brick/Wood comprises 53% of the total, Reinforced Concrete/Steel comprises of 1% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 1191 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 25,515 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement



Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 261 households to be displaced due to the hurricane. Of these, 108 people (out of a total population of 27,732) will seek temporary shelter in public shelters.

Economic Loss

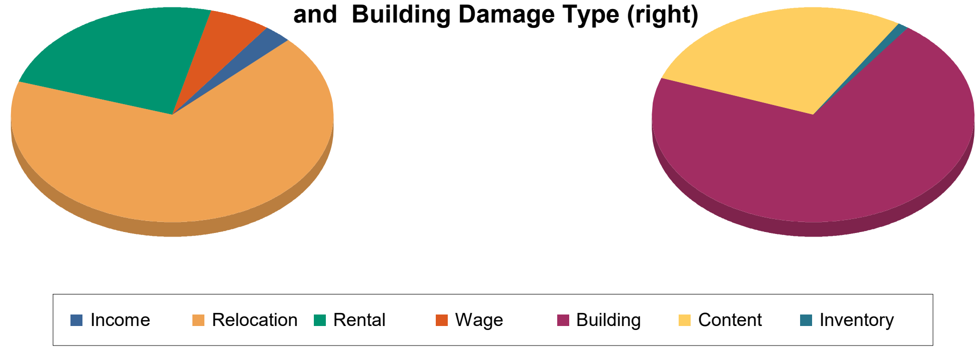
The total economic loss estimated for the hurricane is 490.7 million dollars, which represents 7.66 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 491 million dollars. 10% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 76% of the total loss. Table 5 below provides a summary of the losses associated with the building damage.

Loss by Business Interruption Type (left) and Building Damage Type (right)



Loss Type by General Occupancy

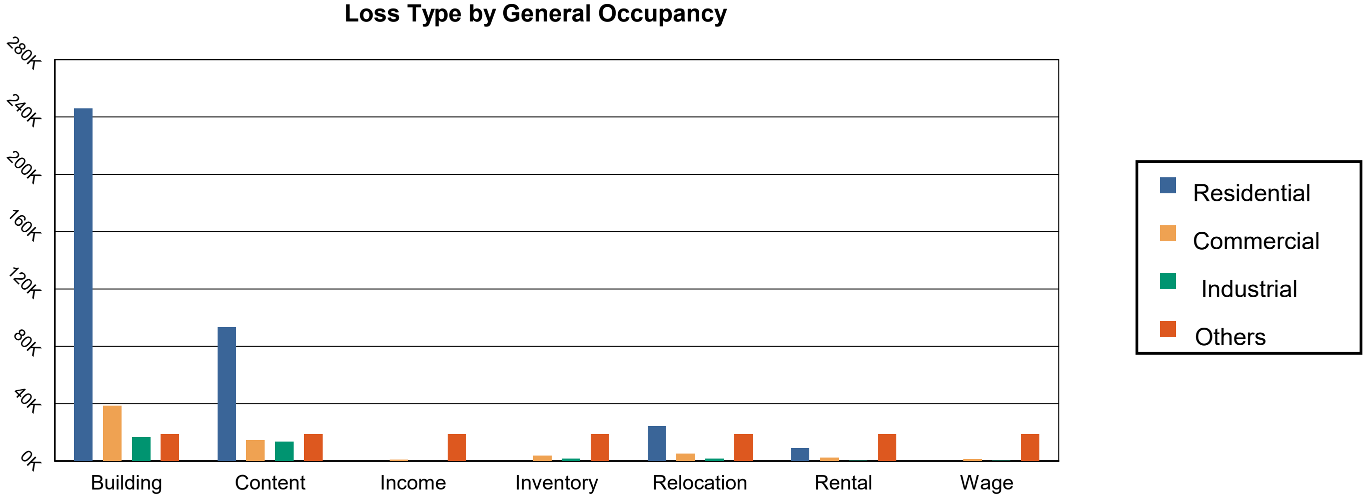


Table 5: Building-Related Economic Loss Estimates

(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Property Damage						
	Building	245,845.00	38,500.57	16,641.27	10,882.66	311,869.49
	Content	93,155.69	14,533.55	13,488.20	4,000.67	125,178.11
	Inventory	0.00	3,709.07	1,606.84	141.14	5,457.05
	Subtotal	**339,000.69**	**56,743.19**	**31,736.31**	**15,024.46**	**442,504.65**
Business Interruption Loss						
	Income	6.37	997.12	141.83	237.76	1,383.08
	Relocation	24,210.10	4,927.82	1,503.26	1,736.13	32,377.32
	Rental	8,876.18	2,304.30	195.08	208.67	11,584.24
	Wage	14.99	1,240.48	234.95	1,392.72	2,883.14
	Subtotal	**33,107.65**	**9,469.73**	**2,075.12**	**3,575.28**	**48,227.78**

Total

Total	**372,108.34**	**66,212.91**	**33,811.43**	**18,599.74**	**490,732.43**

Appendix A: County Listing for the Region

Rhode Island

- Washington

Appendix B: Regional Population and Building Value Data

		Building Value (thousands of dollars)		
	Population	Residential	Non-Residential	Total
Rhode Island				
Washington	27,732	3,892,161	2,511,193	6,403,354
Total	**27,732**	**3,892,161**	**2,511,193**	**6,403,354**
Study Region Total	**27,732**	**3,892,161**	**2,511,193**	**6,403,354**

Hazus: Earthquake Global Risk Report

Region Name: NK_Earthquake

Earthquake Scenario: 1,000-yr

Print Date: June 20, 2024

Disclaimer:
Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific earthquake. These results can be improved by using enhanced inventory, geotechnical, and observed ground motion data.

Table of Contents

General Description of the Region

Hazus-MH is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences. The primary purpose of Hazus is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The earthquake loss estimates provided in this report was based on a region that includes 1 county(ies) from the following state(s):

Rhode Island

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 45.10 square miles and contains 7 census tracts. There are over 11 thousand households in the region which has a total population of 27,732 peopleF. The distribution of population by Total Region and County is provided in Appendix B.

There are an estimated 11 thousand buildings in the region with a total building replacement value (excluding contents) of 6,403 (millions of dollars). Approximately 86.00 % of the buildings (and 61.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 2,538 and 200 (millions of dollars) , respectively.

Building and Lifeline Inventory

Building Inventory

Hazus estimates that there are 11 thousand buildings in the region which have an aggregate total replacement value of 6,403 (millions of dollars) . Appendix B provides a general distribution of the building value by Total Region and County.

In terms of building construction types found in the region, wood frame construction makes up 89% of the building inventory. The remaining percentage is distributed between the other general building types.

Critical Facility Inventory

Hazus breaks critical facilities into two (2) groups: essential facilities and high potential loss facilities (HPL). Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

For essential facilities, there are 0 hospitals in the region with a total bed capacity of beds. There are 10 schools, 4 fire stations, 3 police stations and 1 emergency operation facilities. With respect to high potential loss facilities (HPL), there are no dams identified within the inventory. The inventory also includes no hazardous material sites, no military installations and no nuclear power plants.

Transportation and Utility Lifeline Inventory

Within Hazus, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data are provided in Tables 1 and 2.

The total value of the lifeline inventory is over 2,738.00 (millions of dollars). This inventory includes over 82.64 miles of highways, 35 bridges, 559.86 miles of pipes.

Table 1: Transportation System Lifeline Inventory

System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	35	114.2671
	Segments	46	742.6466
	Tunnels	0	0.0000
		Subtotal	**856.9137**
Railways	Bridges	3	15.2100
	Facilities	0	0.0000
	Segments	71	1598.1867
	Tunnels	0	0.0000
		Subtotal	**1613.3967**
Light Rail	Bridges	0	0.0000
	Facilities	0	0.0000
	Segments	0	0.0000
	Tunnels	0	0.0000
		Subtotal	**0.0000**
Bus	Facilities	0	0.0000
		Subtotal	**0.0000**
Ferry	Facilities	1	1.3310
		Subtotal	**1.3310**
Port	Facilities	10	33.9649
		Subtotal	**33.9649**
Airport	Facilities	1	13.3560
	Runways	2	19.8860
		Subtotal	**33.2420**
		Total	**2,538.80**

Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	9.0161
	Facilities	0	0.0000
	Pipelines	0	0.0000
		Subtotal	**9.0161**
Waste Water	Distribution Lines	NA	5.4097
	Facilities	1	153.2154
	Pipelines	0	0.0000
		Subtotal	**158.6251**
Natural Gas	Distribution Lines	NA	3.6064
	Facilities	0	0.0000
	Pipelines	0	0.0000
		Subtotal	**3.6064**
Oil Systems	Facilities	0	0.0000
	Pipelines	0	0.0000
		Subtotal	**0.0000**
Electrical Power	Facilities	1	29.2608
		Subtotal	**29.2608**
Communication	Facilities	0	0.0000
		Subtotal	**0.0000**
		Total	**200.50**

Earthquake Scenario

Hazus uses the following set of information to define the earthquake parameters used for the earthquake loss estimate provided in this report.

Scenario Name	1,000-yr
Type of Earthquake	Probabilistic
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	1,000.00
Longitude of Epicenter	NA
Latitude of Epicenter	NA
Earthquake Magnitude	5.00
Depth (km)	NA
Rupture Length (Km)	NA
Rupture Orientation (degrees)	NA
Attenuation Function	NA

Direct Earthquake Damage

Building Damage

Hazus estimates that about 24 buildings will be at least moderately damaged. This is over 0.00 % of the buildings in the region. There are an estimated 0 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 below summarizes the expected damage by general building type.

Damage Categories by General Occupancy Type

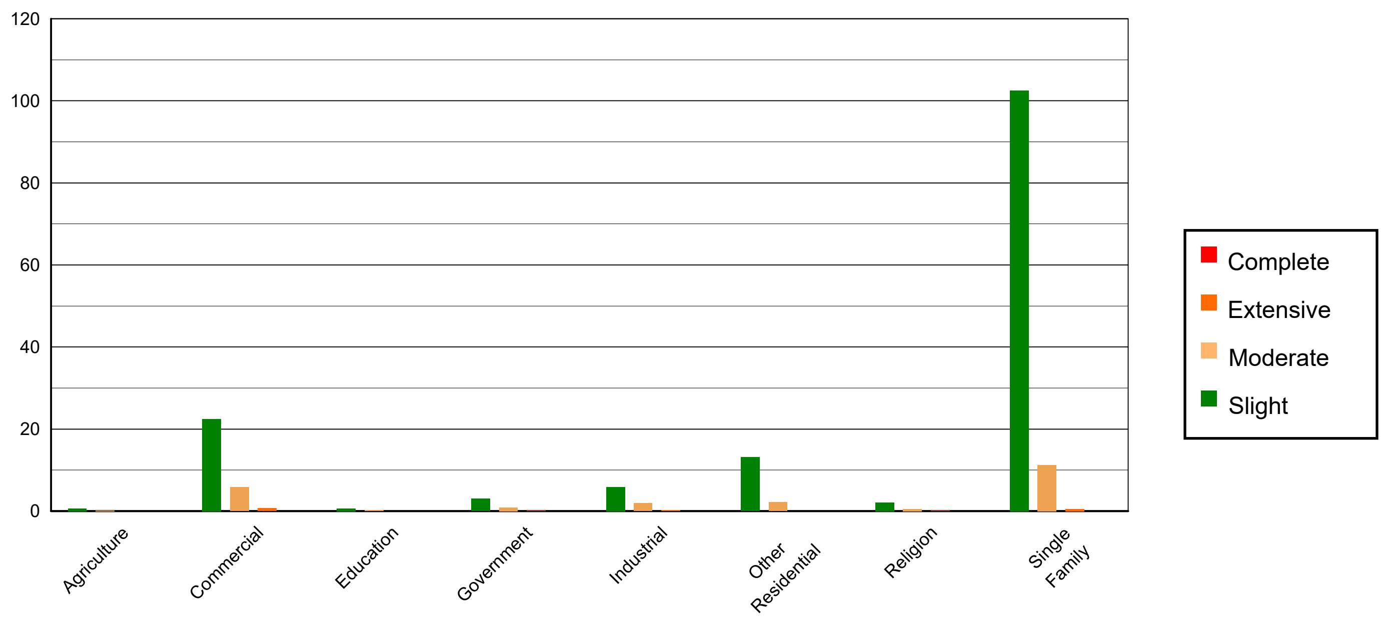


Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	32.26	0.29	0.60	0.40	0.13	0.56	0.01	0.86	0.00	1.04
Commercial	992.98	8.97	22.44	14.92	5.84	25.40	0.69	41.22	0.04	43.80
Education	21.11	0.19	0.65	0.43	0.21	0.91	0.03	1.63	0.00	1.96
Government	122.00	1.10	3.04	2.02	0.87	3.77	0.09	5.47	0.00	5.11
Industrial	244.92	2.21	5.93	3.94	1.94	8.42	0.20	12.18	0.01	6.94
Other Residential	904.66	8.17	13.12	8.72	2.18	9.49	0.04	2.43	0.00	2.29
Religion	68.23	0.62	2.12	1.41	0.58	2.51	0.07	4.20	0.00	4.97
Single Family	8681.64	78.44	102.53	68.16	11.26	48.94	0.54	32.02	0.03	33.90
Total	**11,068**		**150**		**23**		**2**		**0**	

Table 4: Expected Building Damage by Building Type (All Design Levels)

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Wood	9932.96	89.75	110.09	73.18	8.70	37.80	0.00	0.00	0.00	0.00
Steel	544.50	4.92	10.71	7.12	3.08	13.38	0.21	12.51	0.00	0.00
Concrete	34.57	0.31	0.60	0.40	0.15	0.63	0.00	0.21	0.00	0.00
Precast	16.11	0.15	0.49	0.33	0.30	1.28	0.05	2.97	0.00	0.00
RM	2.98	0.03	0.03	0.02	0.01	0.04	0.00	0.03	0.00	0.00
URM	502.73	4.54	25.52	16.96	9.72	42.26	1.40	83.60	0.10	100.00
MH	33.94	0.31	2.99	1.99	1.06	4.61	0.01	0.68	0.00	0.00
Total	**11,068**		**150**		**23**		**2**		**0**	

*Note:

RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had hospital beds available for use. On the day of the earthquake, the model estimates that only hospital beds (%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, % of the beds will be back in service. By 30 days, % will be operational.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	**Total**	**At Least Moderate Damage > 50%**	**Complete Damage > 50%**	**With Functionality > 50% on day 1**
Hospitals	0	0	0	0
Schools	10	0	0	10
EOCs	1	0	0	1
PoliceStations	3	0	0	3
FireStations	4	0	0	4

Transportation Lifeline Damage

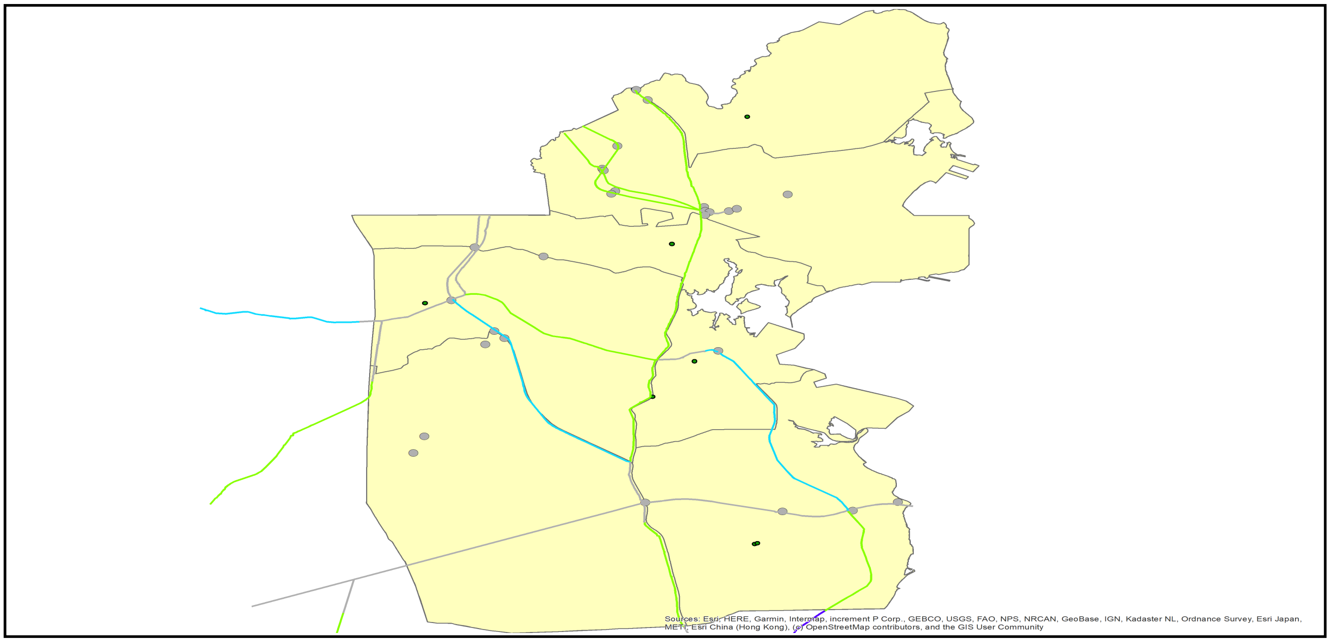


Table 6: Expected Damage to the Transportation Systems

System	Component	Number of Locations_				
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 %	
					After Day 1	After Day 7
Highway	Segments	46	0	0	46	46
	Bridges	35	0	0	35	35
	Tunnels	0	0	0	0	0
Railways	Segments	71	0	0	71	71
	Bridges	3	0	0	3	3
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Light Rail	Segments	0	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Bus	Facilities	0	0	0	0	0
Ferry	Facilities	1	0	0	1	1
Port	Facilities	10	0	0	10	10
Airport	Facilities	1	0	0	1	1
	Runways	2	0	0	2	2

Table 6 provides damage estimates for the transportation system.

Note: Roadway segments, railroad tracks and light rail tracks are assumed to be damaged by ground failure only. If ground failure maps are not provided, damage estimates to these components will not be computed.

Tables 7-9 provide information on the damage to the utility lifeline systems. Table 7 provides damage to the utility system facilities. Table 8 provides estimates on the number of leaks and breaks by the pipelines of the utility systems. For electric power and potable water, Hazus performs a simplified system performance analysis. Table 9 provides a summary of the system performance information.

Table 7 : Expected Utility System Facility Damage

System	# of Locations				
	Total #	With at Least Moderate Damage	With Complete Damage	with Functionality > 50 %	
				After Day 1	After Day 7
Potable Water	0	0	0	0	0
Waste Water	1	0	0	1	1
Natural Gas	0	0	0	0	0
Oil Systems	0	0	0	0	0
Electrical Power	1	0	0	1	1
Communication	0	0	0	0	0

Table 8 : Expected Utility System Pipeline Damage (Site Specific)

System	Total Pipelines Length (miles)	Number of Leaks	Number of Breaks
Potable Water	280	1	0
Waste Water	168	0	0
Natural Gas	112	0	0
Oil	0	0	0

Table 9: Expected Potable Water and Electric Power System Performance

	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	11,409	0	0	0	0	0
Electric Power		0	0	0	0	0

Induced Earthquake Damage

Fire Following Earthquake

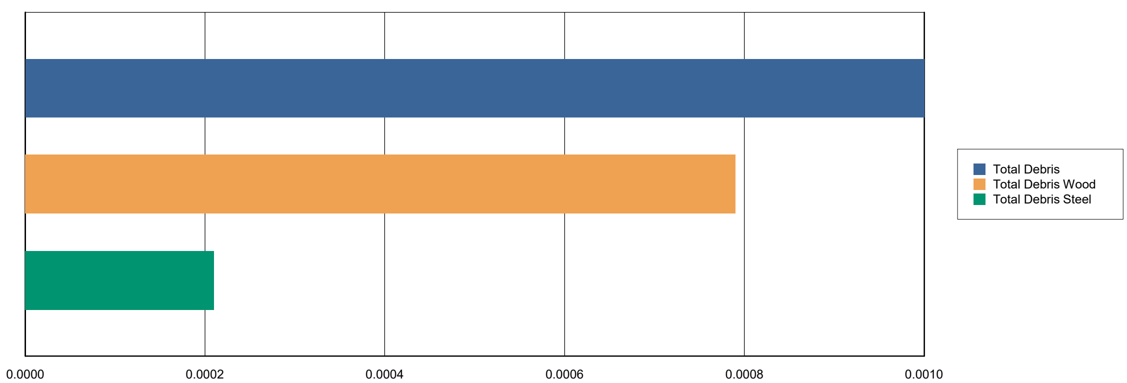
Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. Hazus uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there will be 0 ignitions that will burn about 0.00 sq. mi 0.00 % of the region's total area.) The model also estimates that the fires will displace about 0 people and burn about 0 (millions of dollars) of building value.

Debris Generation

Hazus estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 1,000 tons of debris will be generated. Of the total amount, Brick/Wood comprises 79.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 40 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Earthquake Debris (millions of tons)



Brick/ Wood	Reinforced Concrete/Steel	Total Debris	Truck Load
0.00	0.00	0.00	40 (@25 tons/truck)

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the earthquake. Of these, 0 people (out of a total population of 27,732) will seek temporary shelter in public shelters.

Displaced Households/ Persons Seeking Short Term Public Shelter

Displaced households as a result of the earthquake	Persons seeking temporary public shelter
0	0

Casualties

Hazus estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

- Severity Level 1: Injuries will require medical attention but hospitalization is not needed.
- Severity Level 2: Injuries will require hospitalization but are not considered life-threatening
- Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.
- Severity Level 4: Victims are killed by the earthquake.

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

Table 10 provides a summary of the casualties estimated for this earthquake

Table 10: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	0.01	0.00	0.00	0.00
	Commuting	0.00	0.00	0.00	0.00
	Educational	0.00	0.00	0.00	0.00
	Hotels	0.00	0.00	0.00	0.00
	Industrial	0.03	0.00	0.00	0.00
	Other-Residential	0.07	0.01	0.00	0.00
	Single Family	0.26	0.02	0.00	0.00
	Total	**0**	**0**	**0**	**0**
2 PM	Commercial	0.57	0.06	0.00	0.01
	Commuting	0.00	0.00	0.00	0.00
	Educational	0.16	0.02	0.00	0.00
	Hotels	0.00	0.00	0.00	0.00
	Industrial	0.22	0.02	0.00	0.00
	Other-Residential	0.02	0.00	0.00	0.00
	Single Family	0.08	0.01	0.00	0.00
	Total	**1**	**0**	**0**	**0**
5 PM	Commercial	0.38	0.04	0.00	0.01
	Commuting	0.00	0.00	0.00	0.00
	Educational	0.00	0.00	0.00	0.00
	Hotels	0.00	0.00	0.00	0.00
	Industrial	0.13	0.01	0.00	0.00
	Other-Residential	0.03	0.00	0.00	0.00
	Single Family	0.10	0.01	0.00	0.00
	Total	**1**	**0**	**0**	**0**

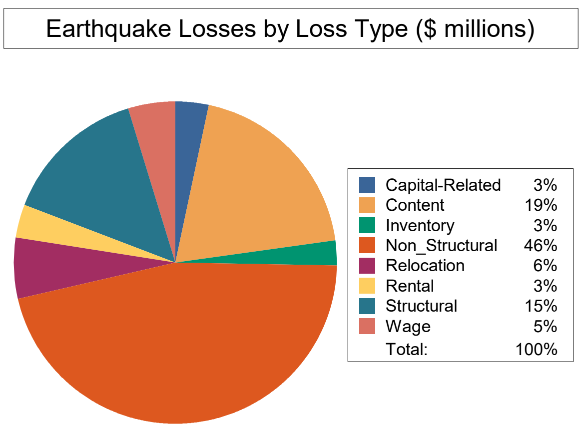
Economic Loss

The total economic loss estimated for the earthquake is 10.24 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

The total building-related losses were 8.09 (millions of dollars); 17 % of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 40 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.



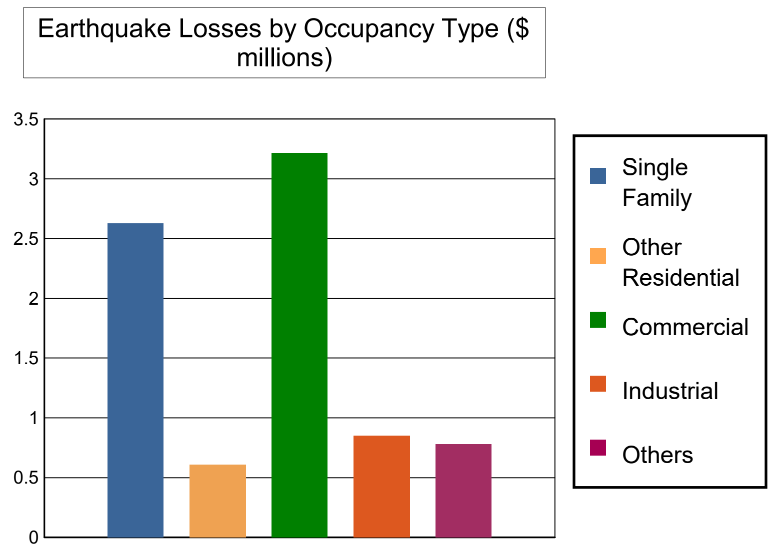


Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.0000	0.0692	0.2532	0.0143	0.0431	0.3798
	Capital-Related	0.0000	0.0294	0.2254	0.0086	0.0072	0.2706
	Rental	0.0287	0.0347	0.1712	0.0106	0.0182	0.2634
	Relocation	0.0886	0.0118	0.2296	0.0510	0.1020	0.4830
	Subtotal	**0.1173**	**0.1451**	**0.8794**	**0.0845**	**0.1705**	**1.3968**
Capital Stock Losses							
	Structural	0.3224	0.0572	0.5333	0.1330	0.1330	1.1789
	Non_Structural	1.6575	0.3227	1.0626	0.3621	0.3224	3.7273
	Content	0.5284	0.0845	0.5682	0.2361	0.1501	1.5673
	Inventory	0.0000	0.0000	0.1755	0.0365	0.0046	0.2166
	Subtotal	**2.5083**	**0.4644**	**2.3396**	**0.7677**	**0.6101**	**6.6901**
	Total	**2.63**	**0.61**	**3.22**	**0.85**	**0.78**	**8.09**

Transportation and Utility Lifeline Losses

For the transportation and utility lifeline systems, Hazus computes the direct repair cost for each component only. There are no losses computed by Hazus for business interruption due to lifeline outages. Tables 12 & 13 provide a detailed breakdown in the expected lifeline losses.

Table 12: Transportation System Economic Losses
(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	742.6466	0.0000	0.00
	Bridges	114.2671	0.0000	0.00
	Tunnels	0.0000	0.0000	0.00
	Subtotal	**856.9137**	**0.0000**	
Railways	Segments	1598.1867	0.0000	0.00
	Bridges	15.2100	0.0000	0.00
	Tunnels	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Subtotal	**1613.3967**	**0.0000**	
Light Rail	Segments	0.0000	0.0000	0.00
	Bridges	0.0000	0.0000	0.00
	Tunnels	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Bus	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Ferry	Facilities	1.3310	0.0000	0.00
	Subtotal	**1.3310**	**0.0000**	
Port	Facilities	33.9649	0.8007	2.36
	Subtotal	**33.9649**	**0.8007**	
Airport	Facilities	13.3560	0.3195	2.39
	Runways	19.8860	0.0000	0.00
	Subtotal	**33.2420**	**0.3195**	
	Total	**2,538.85**	**1.12**	

Table 13: Utility System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Distribution Lines	9.0161	0.0027	0.03
	Subtotal	**9.0161**	**0.0027**	
Waste Water	Pipelines	0.0000	0.0000	0.00
	Facilities	153.2154	0.5225	0.34
	Distribution Lines	5.4097	0.0014	0.03
	Subtotal	**158.6251**	**0.5239**	
Natural Gas	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Distribution Lines	3.6064	0.0005	0.01
	Subtotal	**3.6064**	**0.0005**	
Oil Systems	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Electrical Power	Facilities	29.2608	0.5026	1.72
	Subtotal	**29.2608**	**0.5026**	
Communication	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
	Total	**200.51**	**1.03**	

Appendix A: County Listing for the Region

Washington,RI

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Rhode Island					
	Washington	27,732	3,892	2,511	6,403
Total Region		**27,732**	**3,892**	**2,511**	**6,403**

Hazus: Earthquake Global Risk Report

Region Name: NK_Earthquake

Earthquake Scenario: 2,500-yr

Print Date: June 20, 2024

Disclaimer:
Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific earthquake. These results can be improved by using enhanced inventory, geotechnical, and observed ground motion data.

Table of Contents

General Description of the Region

Hazus-MH is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences. The primary purpose of Hazus is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The earthquake loss estimates provided in this report was based on a region that includes 1 county(ies) from the following state(s):

Rhode Island

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 45.10 square miles and contains 7 census tracts. There are over 11 thousand households in the region which has a total population of 27,732 peopleF. The distribution of population by Total Region and County is provided in Appendix B.

There are an estimated 11 thousand buildings in the region with a total building replacement value (excluding contents) of 6,403 (millions of dollars). Approximately 86.00 % of the buildings (and 61.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 2,538 and 200 (millions of dollars) , respectively.

Building and Lifeline Inventory

Building Inventory

Hazus estimates that there are 11 thousand buildings in the region which have an aggregate total replacement value of 6,403 (millions of dollars) . Appendix B provides a general distribution of the building value by Total Region and County.

In terms of building construction types found in the region, wood frame construction makes up 89% of the building inventory. The remaining percentage is distributed between the other general building types.

Critical Facility Inventory

Hazus breaks critical facilities into two (2) groups: essential facilities and high potential loss facilities (HPL). Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

For essential facilities, there are 0 hospitals in the region with a total bed capacity of beds. There are 10 schools, 4 fire stations, 3 police stations and 1 emergency operation facilities. With respect to high potential loss facilities (HPL), there are no dams identified within the inventory. The inventory also includes no hazardous material sites, no military installations and no nuclear power plants.

Transportation and Utility Lifeline Inventory

Within Hazus, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data are provided in Tables 1 and 2.

The total value of the lifeline inventory is over 2,738.00 (millions of dollars). This inventory includes over 82.64 miles of highways, 35 bridges, 559.86 miles of pipes.

Table 1: Transportation System Lifeline Inventory

System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	35	114.2671
	Segments	46	742.6466
	Tunnels	0	0.0000
		Subtotal	**856.9137**
Railways	Bridges	3	15.2100
	Facilities	0	0.0000
	Segments	71	1598.1867
	Tunnels	0	0.0000
		Subtotal	**1613.3967**
Light Rail	Bridges	0	0.0000
	Facilities	0	0.0000
	Segments	0	0.0000
	Tunnels	0	0.0000
		Subtotal	**0.0000**
Bus	Facilities	0	0.0000
		Subtotal	**0.0000**
Ferry	Facilities	1	1.3310
		Subtotal	**1.3310**
Port	Facilities	10	33.9649
		Subtotal	**33.9649**
Airport	Facilities	1	13.3560
	Runways	2	19.8860
		Subtotal	**33.2420**
		Total	**2,538.80**

Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	9.0161
	Facilities	0	0.0000
	Pipelines	0	0.0000
		Subtotal	**9.0161**
Waste Water	Distribution Lines	NA	5.4097
	Facilities	1	153.2154
	Pipelines	0	0.0000
		Subtotal	**158.6251**
Natural Gas	Distribution Lines	NA	3.6064
	Facilities	0	0.0000
	Pipelines	0	0.0000
		Subtotal	**3.6064**
Oil Systems	Facilities	0	0.0000
	Pipelines	0	0.0000
		Subtotal	**0.0000**
Electrical Power	Facilities	1	29.2608
		Subtotal	**29.2608**
Communication	Facilities	0	0.0000
		Subtotal	**0.0000**
		Total	**200.50**

Earthquake Scenario

Hazus uses the following set of information to define the earthquake parameters used for the earthquake loss estimate provided in this report.

Scenario Name	2,500-yr
Type of Earthquake	Probabilistic
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	2,500.00
Longitude of Epicenter	NA
Latitude of Epicenter	NA
Earthquake Magnitude	5.00
Depth (km)	NA
Rupture Length (Km)	NA
Rupture Orientation (degrees)	NA
Attenuation Function	NA

Direct Earthquake Damage

Building Damage

Hazus estimates that about 97 buildings will be at least moderately damaged. This is over 1.00 % of the buildings in the region. There are an estimated 0 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 below summarizes the expected damage by general building type.

Damage Categories by General Occupancy Type

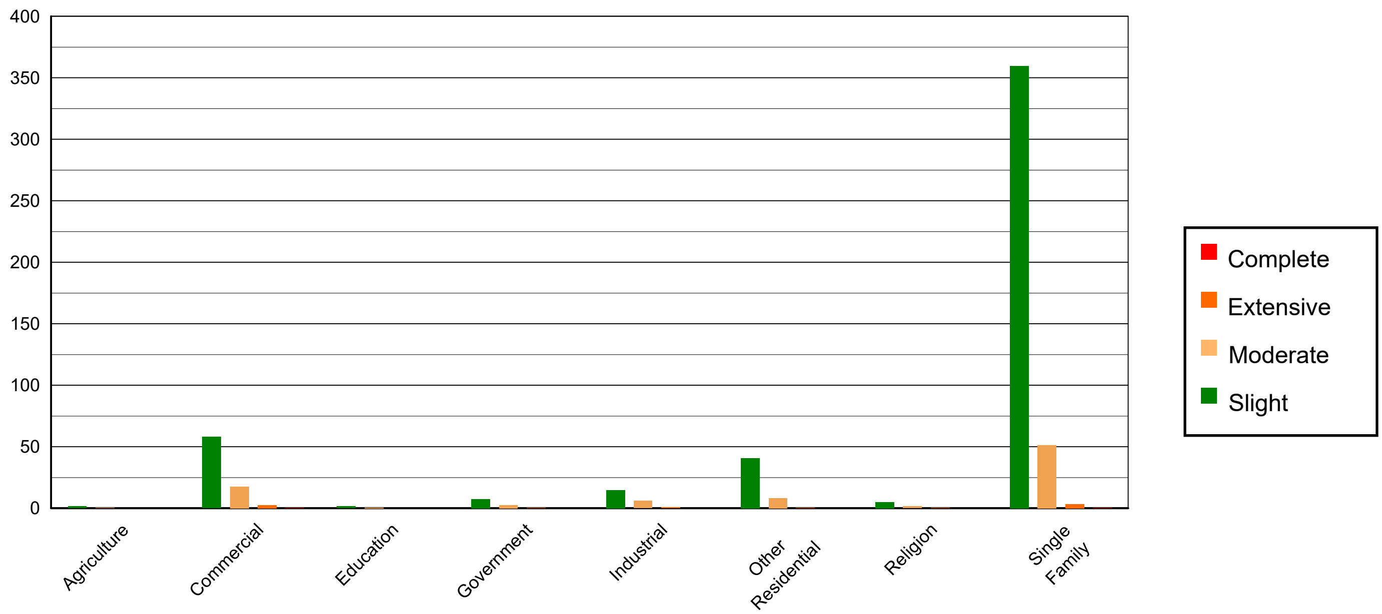


Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	30.85	0.29	1.68	0.34	0.41	0.46	0.05	0.70	0.00	0.90
Commercial	943.56	8.85	57.95	11.85	17.71	19.94	2.55	32.42	0.23	41.55
Education	19.83	0.19	1.48	0.30	0.58	0.65	0.09	1.21	0.01	1.71
Government	115.47	1.08	7.42	1.52	2.73	3.08	0.36	4.52	0.03	5.32
Industrial	231.27	2.17	14.76	3.02	6.07	6.84	0.86	10.91	0.04	7.33
Other Residential	870.48	8.17	40.83	8.35	8.32	9.37	0.36	4.51	0.01	2.03
Religion	64.04	0.60	5.06	1.03	1.63	1.84	0.25	3.12	0.03	4.62
Single Family	8381.40	78.65	359.71	73.58	51.33	57.82	3.36	42.62	0.20	36.53
Total	**10,657**		**489**		**89**		**8**		**1**	

Table 4: Expected Building Damage by Building Type (All Design Levels)

	None		Slight		Moderate		Extensive		Complete	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Wood	9602.32	90.10	399.67	81.75	48.07	54.14	1.68	21.32	0.00	0.00
Steel	519.05	4.87	27.35	5.59	11.01	12.40	1.09	13.78	0.01	1.36
Concrete	32.93	0.31	1.73	0.35	0.63	0.71	0.03	0.43	0.00	0.03
Precast	14.92	0.14	1.07	0.22	0.79	0.89	0.18	2.27	0.00	0.25
RM	2.89	0.03	0.09	0.02	0.04	0.04	0.00	0.03	0.00	0.00
URM	455.47	4.27	53.38	10.92	25.29	28.49	4.79	60.86	0.54	98.36
MH	29.33	0.28	5.60	1.15	2.96	3.33	0.10	1.30	0.00	0.00
Total	**10,657**		**489**		**89**		**8**		**1**	

*Note:
RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had hospital beds available for use. On the day of the earthquake, the model estimates that only hospital beds (%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, % of the beds will be back in service. By 30 days, % will be operational.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	**Total**	**At Least Moderate Damage > 50%**	**Complete Damage > 50%**	**With Functionality > 50% on day 1**
Hospitals	0	0	0	0
Schools	10	0	0	10
EOCs	1	0	0	1
PoliceStations	3	0	0	3
FireStations	4	0	0	4

Transportation Lifeline Damage

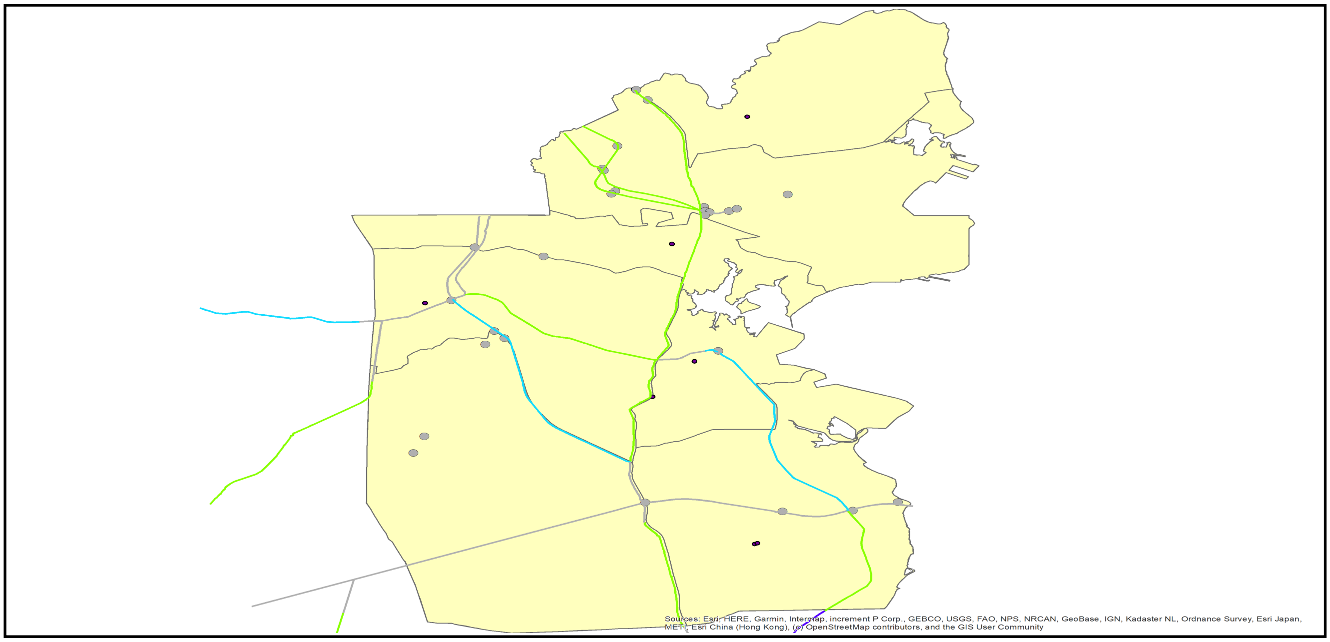


Table 6: Expected Damage to the Transportation Systems

System	Component	Number of Locations_				
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 %	
					After Day 1	After Day 7
Highway	Segments	46	0	0	46	46
	Bridges	35	0	0	35	35
	Tunnels	0	0	0	0	0
Railways	Segments	71	0	0	71	71
	Bridges	3	0	0	3	3
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Light Rail	Segments	0	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Bus	Facilities	0	0	0	0	0
Ferry	Facilities	1	0	0	1	1
Port	Facilities	10	0	0	10	10
Airport	Facilities	1	0	0	1	1
	Runways	2	0	0	2	2

Table 6 provides damage estimates for the transportation system.

Note: Roadway segments, railroad tracks and light rail tracks are assumed to be damaged by ground failure only. If ground failure maps are not provided, damage estimates to these components will not be computed.

Tables 7-9 provide information on the damage to the utility lifeline systems. Table 7 provides damage to the utility system facilities. Table 8 provides estimates on the number of leaks and breaks by the pipelines of the utility systems. For electric power and potable water, Hazus performs a simplified system performance analysis. Table 9 provides a summary of the system performance information.

Table 7 : Expected Utility System Facility Damage

System	# of Locations				
	Total #	With at Least Moderate Damage	With Complete Damage	with Functionality > 50 %	
				After Day 1	After Day 7
Potable Water	0	0	0	0	0
Waste Water	1	0	0	1	1
Natural Gas	0	0	0	0	0
Oil Systems	0	0	0	0	0
Electrical Power	1	0	0	1	1
Communication	0	0	0	0	0

Table 8 : Expected Utility System Pipeline Damage (Site Specific)

System	Total Pipelines Length (miles)	Number of Leaks	Number of Breaks
Potable Water	280	2	1
Waste Water	168	1	0
Natural Gas	112	0	0
Oil	0	0	0

Table 9: Expected Potable Water and Electric Power System Performance

	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	11,409	0	0	0	0	0
Electric Power		0	0	0	0	0

Induced Earthquake Damage

Fire Following Earthquake

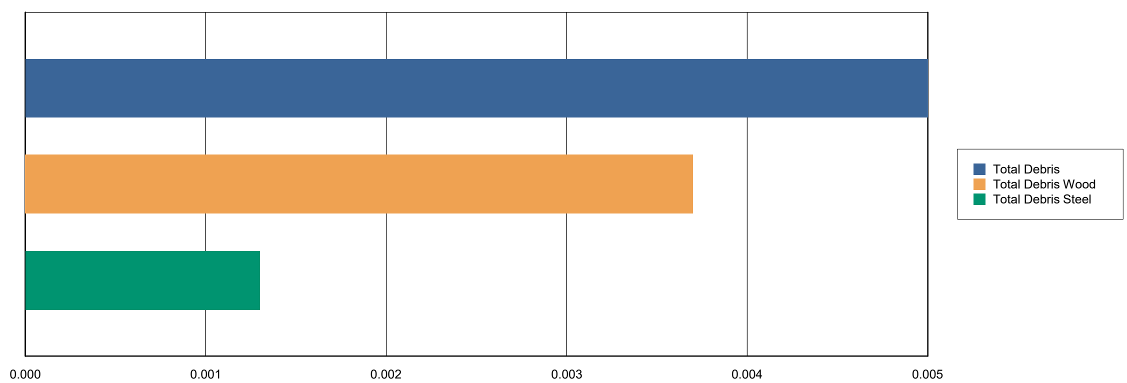
Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. Hazus uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there will be 0 ignitions that will burn about 0.00 sq. mi 0.00 % of the region's total area.) The model also estimates that the fires will displace about 0 people and burn about 0 (millions of dollars) of building value.

Debris Generation

Hazus estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 5,000 tons of debris will be generated. Of the total amount, Brick/Wood comprises 74.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 200 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Earthquake Debris (millions of tons)



Brick/ Wood	Reinforced Concrete/Steel	Total Debris	Truck Load
0.00	0.00	0.01	200 (@25 tons/truck)

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the earthquake. Of these, 0 people (out of a total population of 27,732) will seek temporary shelter in public shelters.

Displaced Households/ Persons Seeking Short Term Public Shelter

Displaced households as a result of the earthquake	Persons seeking temporary public shelter
0	0

Casualties

Hazus estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

- · Severity Level 1: Injuries will require medical attention but hospitalization is not needed.
- · Severity Level 2: Injuries will require hospitalization but are not considered life-threatening
- · Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.
- · Severity Level 4: Victims are killed by the earthquake.

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

Table 10 provides a summary of the casualties estimated for this earthquake

Table 10: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	0.03	0.00	0.00	0.00
	Commuting	0.00	0.00	0.00	0.00
	Educational	0.00	0.00	0.00	0.00
	Hotels	0.00	0.00	0.00	0.00
	Industrial	0.10	0.01	0.00	0.00
	Other-Residential	0.27	0.02	0.00	0.00
	Single Family	1.02	0.08	0.01	0.01
	Total	**1**	**0**	**0**	**0**
2 PM	Commercial	1.91	0.25	0.02	0.04
	Commuting	0.00	0.00	0.00	0.00
	Educational	0.55	0.07	0.01	0.01
	Hotels	0.00	0.00	0.00	0.00
	Industrial	0.71	0.09	0.01	0.01
	Other-Residential	0.08	0.01	0.00	0.00
	Single Family	0.31	0.03	0.00	0.00
	Total	**4**	**0**	**0**	**0**
5 PM	Commercial	1.28	0.17	0.01	0.03
	Commuting	0.00	0.00	0.00	0.00
	Educational	0.00	0.00	0.00	0.00
	Hotels	0.00	0.00	0.00	0.00
	Industrial	0.44	0.06	0.00	0.01
	Other-Residential	0.10	0.01	0.00	0.00
	Single Family	0.39	0.03	0.00	0.00
	Total	**2**	**0**	**0**	**0**

Economic Loss

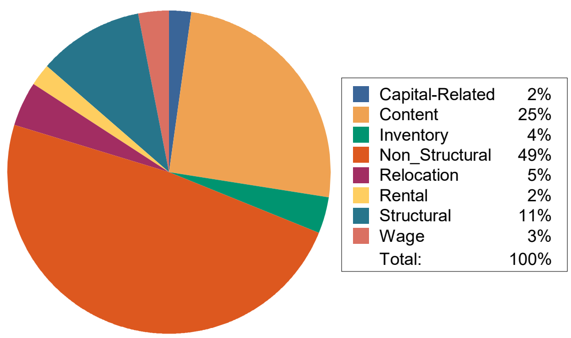
The total economic loss estimated for the earthquake is 47.97 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

The total building-related losses were 38.31 (millions of dollars); 12 % of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 42 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Earthquake Losses by Loss Type ($ millions)



Earthquake Losses by Occupancy Type ($ millions)

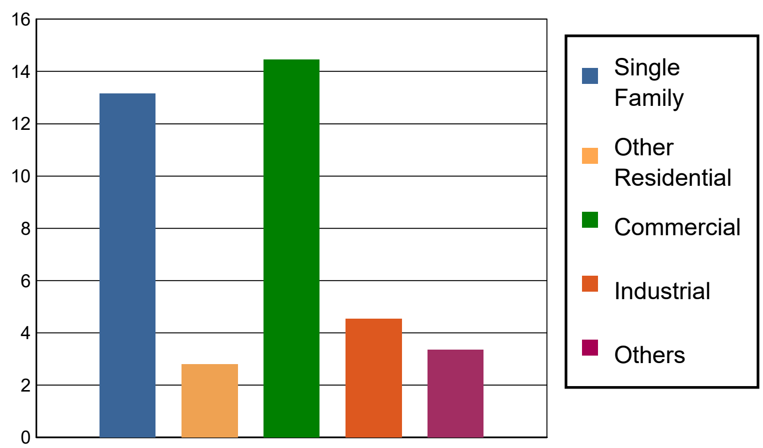


Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.0000	0.2182	0.7961	0.0470	0.1229	1.1842
	Capital-Related	0.0000	0.0929	0.6945	0.0282	0.0212	0.8368
	Rental	0.1292	0.1222	0.5239	0.0343	0.0575	0.8671
	Relocation	0.4240	0.0523	0.7457	0.1727	0.3300	1.7247
	Subtotal	**0.5532**	**0.4856**	**2.7602**	**0.2822**	**0.5316**	**4.6128**
Capital Stock Losses							
	Structural	1.3129	0.1941	1.6863	0.4269	0.4090	4.0292
	Non_Structural	8.0747	1.6118	5.3694	2.0832	1.4803	18.6194
	Content	3.2260	0.5133	3.5492	1.5100	0.8979	9.6964
	Inventory	0.0000	0.0000	1.0915	0.2328	0.0304	1.3547
	Subtotal	**12.6136**	**2.3192**	**11.6964**	**4.2529**	**2.8176**	**33.6997**
	Total	**13.17**	**2.80**	**14.46**	**4.54**	**3.35**	**38.31**

Transportation and Utility Lifeline Losses

For the transportation and utility lifeline systems, Hazus computes the direct repair cost for each component only. There are no losses computed by Hazus for business interruption due to lifeline outages. Tables 12 & 13 provide a detailed breakdown in the expected lifeline losses.

Table 12: Transportation System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	742.6466	0.0000	0.00
	Bridges	114.2671	0.0002	0.00
	Tunnels	0.0000	0.0000	0.00
	Subtotal	**856.9137**	**0.0002**	
Railways	Segments	1598.1867	0.0000	0.00
	Bridges	15.2100	0.0000	0.00
	Tunnels	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Subtotal	**1613.3967**	**0.0000**	
Light Rail	Segments	0.0000	0.0000	0.00
	Bridges	0.0000	0.0000	0.00
	Tunnels	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Bus	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Ferry	Facilities	1.3310	0.0000	0.00
	Subtotal	**1.3310**	**0.0000**	
Port	Facilities	33.9649	2.3171	6.82
	Subtotal	**33.9649**	**2.3171**	
Airport	Facilities	13.3560	0.9160	6.86
	Runways	19.8860	0.0000	0.00
	Subtotal	**33.2420**	**0.9160**	
	Total	**2,538.85**	**3.23**	

Table 13: Utility System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Distribution Lines	9.0161	0.0101	0.11
	Subtotal	**9.0161**	**0.0101**	
Waste Water	Pipelines	0.0000	0.0000	0.00
	Facilities	153.2154	3.3547	2.19
	Distribution Lines	5.4097	0.0051	0.09
	Subtotal	**158.6251**	**3.3598**	
Natural Gas	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Distribution Lines	3.6064	0.0017	0.05
	Subtotal	**3.6064**	**0.0017**	
Oil Systems	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Electrical Power	Facilities	29.2608	3.0499	10.42
	Subtotal	**29.2608**	**3.0499**	
Communication	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
	Total	**200.51**	**6.42**	

Appendix A: County Listing for the Region

Washington,RI

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Rhode Island					
	Washington	27,732	3,892	2,511	6,403
Total Region		**27,732**	**3,892**	**2,511**	**6,403**

ATTACHMENT 12: EXISTING HAZARD MITIGATION CAPABILITIES

Attachment 12 - Table 1 in the following pages summarizes the updated 2019 plan existing natural hazard mitigation actions, goals, and capabilities currently in place in North Kingstown. This table also shows the most up-to-date status of each of the 2019 actions, goals, and capabilities. As discussed in **Section 5** of the plan, this list was used as a catalyst for preparing the future mitigation capabilities for 2024 and over the next five years, shown in **Section 5 Table 4**.

Codes for Table 1 (following pages):

Responsible Agencies	
BO = Building Official	
AMC = Asset Management Commission	CRMC = RI Coastal Resources Management Council
FD = Finance Department	DEM = RI Department Environmental Management
RIDOT = RI Department of Transportation	EMA = Emergency Management Agency
DPW = Dept. of Public Works	PC = Planning Commission
EDAB = Economic Development Advisory Board	ZB = Zoning Board
FEMA = Fed. Emer. Mgmt. Agency	PD = Police Department
FD = Fire Department	PRC = Parks and Recreation
FM = Fire Marshall	TE = Town Engineer
HC = Harbor Commission	TW = Tree Warden
HDC = Historic District Commission	USACE = US Army Corp. of Engineers
HUD = Dept. of Housing & Urban Development	NOAA = National Ocean. & Atmospheric Administration
	RIANG = Rhode Island Air National Guard

Potential Funding Sources
BFP = Bridge Formula Program
CIP = Capital Improvement Program
CDBG-DR = Community Development Block Grant (Disaster Recovery)
EMGP = Emergency Management Performance Grant
FMA = Flood Mitigation Assistance
HMGP = Hazard Mitigation Grant Program
OBs = Operating Budgets
OPs = Other Programs
OSCAR = Ocean State Climate Adaptation and Resilience Fund
Pre-Disaster Mitigation (PDM) Grant Program
RTP = Regional Transportation Program
Silver Jackets (FEMA/USACE)
STIP = Statewide Transportation Improvement Project
UCF - Urban and Community Forestry Grant Program

Attachment 12 - Table 1: Update to Mitigation Measures from 2019 North Kingstown Hazard Mitigation Prioritized Action Plan

EXISTING MITIGATION STRATEGIES/ CAPABILITIES	STATUS	COSTS	PRIORITY	RESPONSIBLE AGENCIES	POSSIBLE FUNDING SOURCE
GENERAL MULTIPLE HAZARDS					
1: (Action 1.4 of 2019 Plan): **Identify the "design life" of critical facilities at the time of construction** and maintain data to allow for clear planning horizons to be defined for the development of phasing plans for implementation and prioritizing funding from federal and state grants and through the municipal CIP by utilizing the STORMTOOLS mapping program to reduce future risk.	As new municipal facilities are planned and constructed, the design life will be incorporated into the plan. As new residential applications are received for new construction or substantial improvements in the SFHA, more emphasis will be placed on utilizing the STORMTOOLS program to help property owners determine what the best design life for these structures should be. This will continue to be a focus for all coastal applications.	Medium	High	Building Department & DPW	CIP
2: **Comprehensive Land Use Policy** (Action 1.5 from 2019 Plan): **Create policy to direct development away from areas subject to erosion and flooding from gale-force winds, storm surge, and sea level rise.**	As in previous years, no major land development projects have taken place within the SFHA or areas prone to erosion and flooding. While few in number, there have been some single-family homes that have been constructed or reconstructed within these areas. However, they have been built to meet flood zone standards and as required installed erosion controls or other best management practices as necessary. The town continues to protect lands subject to flooding and erosion to direct development away from these hazardous areas.	Low	Medium	Planning Department, Building Department & DPW	FEMA, HUD
3: **Keep up-to-date database** including inventory of town assets in the town's comprehensive GIS database including asset categories outlined in this 2024 HMP Update. (Action 1.7 of 2019 Plan):	The town continues to maintain the GIS databases as noted in previous updates. The town has a digital repository of all elevation certificates (ECs) by year. As part of the yearly CRS recertification, the building permits issued in the SFHA are tabulated. The building permit software program has specific language related to the SFHA to better track the type of activity in the SFHA each year. In addition, the town maintains a database of the open space parcels. The protected open space parcels within the SFHA are also housed in a digital format and updated as new parcels are added. As new open space is protected it is added to the database.	Low	High	Planning Department, Building Department & DPW	CIP, US DOT Promoting Resilient Operations for Transformative, Efficient, and Cost-Saving Transportation (PROTECT) Discretionary Grant Program

EXISTING MITIGATION STRATEGIES/ CAPABILITIES	STATUS	COSTS	PRIORITY	RESPONSIBLE AGENCIES	POSSIBLE FUNDING SOURCE
4: PUBLIC SAFETY: **Evacuation Planning**. (Action 1.8 of 2019 Plan): Plan and Raise awareness via the municipal web site and CodeRED for the Safe Evacuation of Tourist, Residents & Business Owners during Hazard Events.	CodeRed® Emergency Telephone Calling System is still utilized as needed by the town. More information on CodeRed is available on the Police Department's web page along with links to the FIRM and evacuation route mapping. Planning staff also added CodeRed and a link to the evacuation map to the flood information page. The flood information page also has a link to the RIEMA web site where the evacuation maps and other helpful information on preparedness and response can be found.	Medium	Medium	Department of Public Works & Planning Dept.	FEMA, EMPG
5: **Update town-wide evacuation routes** (Action 3.1 and 3.3 from 2019 Plan): Identify all evacuation routes serving coastal hazard areas that will be inundated with future sea level rise scenarios. Identify strategies for upgrades to the segments identified for evacuation routes and coordination with Neighboring towns. Publish and make these available to educate and raise awareness to those citizens impacted. See State Evacuation Plan for the town.	The town uses the inundation mapping completed by URI that identifies various inundation scenarios including a 1', 3', and 5' sea level rise and how those scenarios will impact not only evacuation routes but also local infrastructure as well as private property. The town also added a link to STORMTOOLS to our flood information page. The town has and will continue to coordinate with neighboring towns to ensure that evacuation routes are compatible.	Low	High	Planning Department, Police Department, Schools, and Day-Care Centers	FEMA
6: **Street Tree Maintenance Plan**: (Action 3.2 from 2019 Plan): **Continue to maintain viable evacuation routes through the implementation of the town's Tree Maintenance Plan which prioritizes maintaining those** trees running along evacuation routes and roads offering single access to coastal and flood prone neighborhoods and encourage routine inspections for trees that are a potential storm threat.	The town has a tree maintenance program for all local roads. The state continues to maintain trees along state roadways as part of their tree maintenance program. Many evacuation routes run along these state roadways. The town will continue to work with the state to ensure that the trees along these roadways are pruned and maintained as needed to ensure a clear and clear pathway along the evacuation routes. The North Kingstown Tree Board is also planning an update to our existing street tree inventory. Health of the trees and need for trimming are some of the characteristics that will be inventoried in the update.	Low to Medium	High	Department of Public Works	RI DEM, UCF

EXISTING MITIGATION STRATEGIES/ CAPABILITIES	STATUS	COSTS	PRIORITY	RESPONSIBLE AGENCIES	POSSIBLE FUNDING SOURCE
8: **Emergency Shelter**. (Action 3.4 of 2019 Plan): Evaluate shelter sites (existing and potential) on an annual basis.	The town will continue to ensure that there are shelters available as needed in an emergency. The Town of North Kingstown, The Town of Narragansett, and the Town of South Kingstown utilize the South Kingstown High School as a regional shelter. The North Kingstown Emergency Operations Plan (EOP) addresses the need for shelter both locally and regionally. The EOP was updated in 2021.	Medium to High	Medium	Department of Public Works	CIP
9: **Recovery and Reconstruction Plan**: (Action 3.6 from 2019 Plan): The town will research feasibility of a recovery and reconstruction ordinance that will expedite rebuilding after a natural hazard event.	The town has not yet adopted a recovery and reconstruction ordinance. The town continues to administer expedited review of building permits after a natural hazard event. The CRMC has procedures and protocols in place to prioritize applications for reconstruction post-storm event as well.	Low to Medium	High	Building Dept. & Planning/Zoning Dept.	FEMA BRIC, EMPG
10: **Maintain and upgrade municipal facilities within the SFHA** and develop a cooperative strategy for municipal officials/facilities. **(**Action 4.2 and 4.3 from 2019 Plan).	The municipal offices building, schools, and library are located outside of the SFHA. The Senior Center and Cold Spring Community Center are located within the SFHA. However, the Senior Center was built to flood standards. There are no plans to retrofit the community center. However, the need to construct a new community center has been discussed. Any new community center will either be located outside the SFHA or constructed to flood zone standards. The town also completed renovations to the existing bathroom facilities at the town beach. The town departments have good working relationships and coordinate regularly on a variety of issues. These departments will continue to work together to protect municipal facilities. The town's Technical Review Committee (TRC) provides good opportunity for such coordination. The 2024 update to the hazard mitigation plan was recently on the TRC agenda to notify departments of the need for their input on the update. Strategizing on our municipal facilities can be another discussion item for the TRC. The Asset Management Commission is also another resource that could serve as a host for these discussions.	Low	Medium	Department of Public Works, Building Dept. & Planning Dept.	FEMA HMGP and PDM

EXISTING MITIGATION STRATEGIES/ CAPABILITIES	STATUS	COSTS	PRIORITY	RESPONSIBLE AGENCIES	POSSIBLE FUNDING SOURCE
11: (Action 5.2 from 2019 Plan): **Promote OWTS upgrades** in accordance with the Cesspool Phase-out Act, 2007 through potential grants and determine feasibility of sewering neighborhoods and commercial centers in SFHA with storm surge and sea level rise impacts.	The town continues to adhere to the cesspool phase out act through the building permit process. Since 2007, any property with a cesspool within 200 feet of the coastal feature must be upgraded to an engineered onsite wastewater treatment system (OWTS). This act was amended in 2015 to require that if a property subject to sale or transfer has a cesspool, that cesspool must be removed from service within one year of the closing date. In addition, the town has installed sewers along the Route 1 corridor and within a portion of Wickford village. In addition, the town received grant funding from the SNEP and USEPA to upgrade decentralized wastewater systems to improve coastal water quality and mitigate pollution from traditional septic systems outside of the Wickford village area. The town will provide funding to 30 properties across four coastal neighborhoods to upgrade their cesspools and conventional OWTS to innovative, nitrogen reducing systems.	Medium	High	DEM, Department of Public Works, Planning Dept. & Building Dept.	NA
12: (Action 5.7 from 2019 Plan): Move **utility lines underground** for public safety by prioritizing lines in coastal areas and requiring that all utilities for new residential development to be installed underground.	The town continues to require underground utilities in new subdivisions. The town engaged with National Grid (now would be RI Energy) in the past to discuss the potential for either undergrounding utilities or moving the utilities to one side of the road along the Post Road Corridor. There are no plans to underground or relocate the utility lines at this time.	Medium	Medium	Department of Public Works, RIDOT	FEMA PDM
13: (Action 5.9 from 2019 Plan) Continue to implement the **Storm Preparedness Plan** to mitigate the effect of storms on boats, marina, infrastructure, and docks and by preparing harbor and shoreline areas for storm events.	The town continues to implement the Storm Preparedness Plan that has been prepared as part of the Harbor Management Plan. The HMP was amended and adopted locally in 2017 and by the RI Coastal Resources Management Council in November 2020. The plan has a goal to prevent the loss of life and property by properly preparing harbor and shoreline areas for storm events; having a completed and enforceable response and recovery plan; working in cooperation with harbor and shoreline users to ensure that a coordinated approach is applied to hazard mitigation; integrating harbor hazard mitigation activities with other,	Medium	Medium	Harbor Commission	HMGP, PDM

EXISTING MITIGATION STRATEGIES/ CAPABILITIES	STATUS	COSTS	PRIORITY	RESPONSIBLE AGENCIES	POSSIBLE FUNDING SOURCE
	ongoing, local hazard mitigation programs; and identifying and completing long-term actions to redirect, interact with, or avoid the hazard.				
14: (Action 6.1 from 2019 Plan) Work with the Quonset Development Corporation to **ensure new and existing development at Quonset Point meets State Building Code** requirements.	The Quonset Development Corporation (QDC) continues to solely review all building permit applications for activities within the park. The town participates in the monthly technical review committee meeting with QDC and is made aware of proposed development in the park.	Medium	Medium	State Building Official	CIP
15: (Action 6.2 from 2019 Plan): **Coordinate closely with RI Airport Corporation and the Army National Guard to mitigate the potential for airport flood damage**.	The town participated in the preparation of the Quonset Airport Master Plan. The seawall was assessed as part of the master plan. Recommendations for repair were also included. This should help to protect the airport from flood damage. The town will work with the RIANG as the master plan is implemented and updated in the future. RIAC completed a Strategic Business Plan in 2022 on which the town had an opportunity to comment. One of the comments given was our support for the seawall improvements.	Medium	Medium	Department of Public Works, RIDOT	HMGP, PDM
16: (Action 6.3 from 2019 Plan): **Actively involve flood prone businesses** in Quonset Point in the outreach process to inform of natural hazards, primarily hurricanes and protection of their property and employees.	The Quonset Development Corporation coordinates outreach and communication with the tenants inside the park. They will continue to be charged with this task.	Medium	Medium	Department of Public Works, RIDOT	HMGP, PDM
17: (Action 8.2 from 2019 Plan): **Implement climate adaptation recommendations in the Comprehensive Plan** based on the findings of the strategies at the local level to help North Kingstown make informed decisions and build an increased resilience to coastal hazards and climate change.	Incorporation of HMP actions into the comprehensive plan is an important step in getting these strategies implemented. Preserving open space in the SFHA is one of these actions and will continue to be a focus of the town's efforts. Notifying property owners of their risk (e.g., through additional outreach activity, social media, website, etc.) is also an action the town will target in 2024.	Medium	Medium	Planning Department	HMGP, PDM

EXISTING MITIGATION STRATEGIES/ CAPABILITIES	STATUS	COSTS	PRIORITY	RESPONSIBLE AGENCIES	POSSIBLE FUNDING SOURCE
18: (Action 8.3 from 2019 Plan): Implement projects using the **TIP and CIP funds**.	During the preparation of the TIP and CIP, resiliency to storm surge events and projected sea level rise scenarios are being considered. The projects listed on the TIP for Federal Fiscal Year 2023-2031 are for bridge repairs, resurfacing, drainage improvements, safety, and sidewalks. Some of the listed projects, including the Wickford Village Sidewalk and Resiliency Enhancements as well as the Curbing and Sidewalks along West Main Street, including drainage improvements, will address mitigation and resiliency.	Medium	Medium	Planning Department	TIP, CIP
19: (Action 8.4 from 2019 Plan): Continue to **coordinate with state agencies and educational institutions** to identify new or innovative hazard mitigation strategies that have been successfully implemented in other locations to address emerging problems.	The town has a long-standing relationship with the Statewide Planning Program, RI Department of Environmental Management and the RI Department of Transportation as well as with the University of Rhode Island and the RI School of Design in addressing emerging problems such as sea level rise, climate adaptation and green infrastructure. The town is implementing a project that was an outcome of an effort by the CRMC and Save the Bay on shoreline adaptation. We have designed and received the permits for the project at the end of the Roger Williams Drive right of way to incorporate green infrastructure as a means of addressing stormwater management. The town anticipates constructing the improvements in early 2024. The town also participated in a project with Envision Resilience who is partnering with Syracuse University on a student project to reimagine at-risk sites in Wickford and provide solutions that are adaptive in the face of sea level rise. The town can refer to the findings of this project for ideas on making Wickford more resilient. We will continue to foster these relationships and develop innovative strategies to address these issues into the future.	Medium	Medium	Planning Department, Building Department	TIP, Statewide Planning Program
FLOOD HAZARDS					
20: (Action 1.1 of 2019 Plan). **Land Acquisition** (Near-term): **Open Space Acquisition of lands within SFHA areas** with a priority on the protection	The town continues to look for opportunities to protect land in the SFHA. The town is currently considering the acquisition of property in the northern section of town that is partially in the SFHA.	Medium to High	High	Department of Planning and Development Partnerships:	FEMA HMGP

EXISTING MITIGATION STRATEGIES/ CAPABILITIES	STATUS	COSTS	PRIORITY	RESPONSIBLE AGENCIES	POSSIBLE FUNDING SOURCE
of open space landward of sensitive features to help create a buffer to storm surge drainage and erosion.				North Kingstown Land Conservancy, Narrow River Land Trust, Town Council, Conservation Commission, and RIDEM, CRMC Coastal and Estuary Habitat Restoration Program/Trust, Natural Resource Conservation Service (NRCS)	
21: (Action 1.2 from 2019 Plan): Continue to **enforce Building Code Compliance for land uses and structures in SFHA and those prone to other potential hazards** to residents in accordance with updated legislation, ordinances, and State Building Code requirements as part of the building permitting process to reduce risk to structures and facilities.	The town continues to enforce building code compliance for land uses and structures in SFHA and those prone to hazards consistent with state building code. The town continues to adhere to the new definition for building height adopted in 2020. That definition addresses the base flood elevation as well as freeboard.	Varying	High	Building Department	FEMA FMA
22: (Action 1.3 and 2.2 of 2019 Plan): **Educate, promote awareness, and provide information via direct mailings** to schools and day-care facilities located in the flood zone, to homeowners of the benefit of	The town continues to provide information on our web site that provides property owners with information related to protecting people and property from hazards, insuring your property, and building responsibly. The town also created a hazard mitigation page with links to the local plan as well as the state hazard mitigation plan. Informational brochures are	Low	High	Planning Department & Building Department	FEMA PDA, EMPG, NOAA

EXISTING MITIGATION STRATEGIES/ CAPABILITIES	STATUS	COSTS	PRIORITY	RESPONSIBLE AGENCIES	POSSIBLE FUNDING SOURCE
elevating or otherwise storm-proofing coastal structures to reduce losses and protect public health, safety, and welfare through mailings and through the town's website.	also available in the Building and Planning Departments as well as the North Kingstown Free Library. These brochures are updated and supplemented as needed. The town also distributes information about where residents can access information about flooding and the impacts of flooding in one of the quarterly "Puddle" publications that is distributed in the water bills that are mailed to all water customers. This has been the most efficient way to send direct communication to residents across town. The Planning Department also had a table and display at the Wickford Art festival to provide information and resources to attendees. This included mapping of the SFHA and evacuation maps. The North Kingstown Department of Senior/Human services distributes information about flooding and hurricane preparedness to their clients and will continue this in 2024. There are currently no childcare providers or schools located in the flood zone nor are any proposed.				
23: (Action 1.6 from 2019 Plan): **Utilize the municipal web site and direct mailings as outreach to North Kingstown's Historic District (HD) property owners and residents in Wickford located within the SFHA to educate and assist these homeowners with the long-term management** of their property to balance the preservation of the structure's historic integrity with protection of the property from future flood damage.	The Planning Department continues to work with property owners in the historic district through the Historic District Commission (HDC) application process to assist them in balancing preservation of historic integrity and protecting their property from flood damage. A large majority of the district is in the SFHA. The town has a link to the Floodplain Management Bulletin for Historic Structures on the flooding page of the municipal website. The town also developed a draft standard operating procedure for reviewing properties in both the historic district and the SFHA.	Medium	High	Planning Department, Building Department & DPW, Historic District Commission	CIP, FMA
24: (Action 2.1 of 2019 Plan): **Complete an assessment of municipal structures** located in SFHA	**2023 CRS Status Action 2.1**: No new municipal structures have been constructed in the SFHA. There are no schools located in the SFHA. The North Kingstown Senior Services building is located in the SFHA however it was built to flood standards.	Medium	Medium	Building Dept. & Planning Dept.	FEMA FMA

EXISTING MITIGATION STRATEGIES/ CAPABILITIES	STATUS	COSTS	PRIORITY	RESPONSIBLE AGENCIES	POSSIBLE FUNDING SOURCE
that are utilized by vulnerable populations.	The historic town hall building was recently renovated however it is located outside of the SFHA. Improvements are proposed to the current municipal office building however it too is located outside of the SFHA.				
25: (Action 4.1 from 2019 Plan): **Maintain a database with record of flood impacts** on municipal properties and structures to better plan for improvements and protect the town's assets.	The town will develop a database to record flood impacts to municipal properties and structures. This is a long-term goal of the HMP, and the town will begin the process of developing this database in the next 2-3 years.	Medium	Medium	Building Depart. & Planning Depart.	FEMA FMA, CIP
26: Evaluate "**green infrastructure**" (Action 5.1 from 2019 Plan): **Evaluate "green infrastructure" solutions that could be applied to increase stormwater infiltration and reduce runoff.**	The town is using the results of the Green and Resilient Infrastructure Implementation Project (GRIP) to implement projects with green infrastructure (GI) components, including: Finalized the design for the Wickford Waterfront Project and received permits from the regulatory agencies; Preparing to publish a request for proposals to select a contractor to install improvements including the GI and resilient components. The town is also working with CRMC and Save the Bay on a shoreline adaptation project (end of Roger Williams Drive right of way) to incorporate GI. The town has finalized the design and received permits for this project and construction is anticipated in the Spring 2024.	Medium	Medium	Department of Public Works, Planning Dept. & Building Dept.	EPA, NOAA, DEM
27: (Action 5.4 of 2019 Plan): **Inspect municipally owned bridges** and work with the RIDOT via the State Transportation Improvement Program to inspect state-owned bridges for structural integrity to determine their individual vulnerability to damage in a hazard event. Records will be maintained to allow for the prioritization of funds for bridges which may have to be retrofitted to prevent failure.	The town will continue to inspect municipally owned bridges and work with the RIDOT on inspection and needed repairs to local bridges on state roads. The RIDOT TIP includes several NK bridge reconstruction projects. The Gilbert Stuart and Silver Spring bridges are the most recently rehabilitated bridges in North Kingstown. The Potowomut, Stony Lane, Sandhill, Hamilton Mill, and Babbit Farm are on the TIP for current funding as well. The bridge on Brown Street in Wickford Bridge is listed in the TIP for improvement starting in 2028 to address transportation and resiliency needs.	Medium	Medium	Department of Public Works, RIDOT	BFP

EXISTING MITIGATION STRATEGIES/ CAPABILITIES	STATUS	COSTS	PRIORITY	RESPONSIBLE AGENCIES	POSSIBLE FUNDING SOURCE
28: (Action 5.5 from 2019 Plan): **Create an emergency response plan in the event of bridge collapse**. Hussey Bridge, Brown Street Bridge, Babbit Farm Bridge over Cocumscussoc Brook and the Hamilton Mill Bridge on Boston Neck.	The town updated the Emergency Operations Plan (EOP) in 2021. The EOP will be followed during an event such as a bridge collapse. The EOP also addresses damage assessment and calls for a public infrastructure team that will be utilized to document damage to infrastructure including bridges. The Department of Public Works will also work with the RIDOT as needed to achieve the timely shut down of gas lines in state owned bridges.	Medium	Medium	Department of Public Works, RIDOT	BFP, PDM
29: (Action 5.8 from 2019 Plan) **Retrofit flood prone homes** located within the historic district and other historical buildings and structures in town. As ownership changes and improvements are proposed to these structures, over time properties will be upgraded to meet flood standards. Historic homeowners should be directed to resources that will assist them in a self-inspection of their properties to determine how vulnerable their structures are to storm damage.	**2023 CRS Status Action 5.8**: The Planning Department continues to work with property owners in the historic district through the Historic District Commission application process as well as meetings in our department to assist them in balancing preservation of historic integrity and protecting their property from flood damage. The property owners within the historic district are directed to resources available on the town's web site as well as information available in our offices to assist them in assessing their property's vulnerability and ensuring the structures are being built to flood standard. This includes the mapping completed by the University of Rhode Island, RI Sea Grant and the Coastal Resources Center. The Building Official's office also provides information to homeowners in the historic district on the code requirements for structures in the flood zone. In 2023, the town also met with representative of the Army Corps of Engineers to discuss their coastal storm risk management feasibility study. The Wickford Historic District is one of their study areas. The project is aimed at helping reduce future flooding risks and understanding how mitigation measures impact historic properties. The study is ongoing.	Low	Medium	Planning Department & Building Department	PDM, FMA
30: (Action 5.10 from 2019 Plan) **Maintain town** beaches and work with CRMC to re-nourish local beaches to help prevent erosion and protect coastal properties. The town	There has not been extensive work completed on the maintenance and re-nourishment of the local beaches or the establishment of new beaches. The town will coordinate with CRMC on this effort.	Medium to High	Medium	Department of Public Works, CRMS & Planning Department	USACE

EXISTING MITIGATION STRATEGIES/ CAPABILITIES	STATUS	COSTS	PRIORITY	RESPONSIBLE AGENCIES	POSSIBLE FUNDING SOURCE
should also research the possibility of establishment of new beaches.					
31: **Continue participating in FEMA's Community Rating System (CRS)** program that results in reducing the cost of NFIP premiums while improving coastal flood resiliency. (Action 7.1 from 2019 Plan): Update CRS application and earn a class 7 rating.	The town has an opportunity to elevate in CRS rating every year and at the 5-year verification visit. The town is due for a 5-year cycle verification in 2024.	Low	Medium	Planning Dept, Building Official, Department of Public Works	FEMA
32: (Action 8.1 from 2019 Plan) **Inform citizens and business owners of impacts from storm surges and rising sea levels** through the municipal web site, local information sessions and dissemination of information at the town hall, libraries, and chamber of commerce.	**2023 CRS Status Action 8.1**: We will continue to utilize the town's web site as well as the library to better inform residents and business owners regarding storm surge and sea level rise as well as evacuation routes into and out of neighborhoods. The web site is updated as needed, adding new information and maps related to the hazard mitigation plan and CRS. The town will also continue to provide informational brochures on these subjects in our Planning, Public Works, and Building Official departments, Chamber of Commerce, and Senior Services building. The town will look to adopt new outreach activities as well such as surveys, community signage and outreach to vulnerable neighborhoods and businesses. The town also partnered with USGS to install a new tide gauge in Wickford Harbor. The gauge records the water level every ten minutes. Data for this gauge is available on the USGS website. A link to this data will be added to the town's web site to provide easy access to such information such as current temperature and height.	Medium	Medium	Planning Dept., URICRC & RISG, RIDOT, Building Dept. & DPW	FEMA, NOAA, USACE
CLIMATE RELATED HAZARDS: DROUGHT, WIDLFIRE, & EXTREME HEAT					
33: (Action 5.6 from 2019 Plan): **Continue to Protect the town water supply** from contamination and drought through the increased monitoring, a town-wide study of	The town continues to implement the regulations outlined in our groundwater recharge and wellhead protection overlay district. This provides protection for our town water supply from contamination associated with certain land uses. The groundwater ordinance was updated in 2022 to address such	Medium	High	Water Department, Department of Public Works, RIDOT	HUD, USDA, EPA, Clean Water State Revolving Fund (CWSRF)

EXISTING MITIGATION STRATEGIES/ CAPABILITIES	STATUS	COSTS	PRIORITY	RESPONSIBLE AGENCIES	POSSIBLE FUNDING SOURCE
ground and surface water capacity, and review of activities allowed in Groundwater Overlay Areas and through the Purchase of Development Rights (PDR) and Transfer of Development Rights (TDR) to direct development outside of the GW Overlay zones.	things as density and land uses allowed the groundwater area. The town is currently considering the acquisition of a parcel in the northern portion of town within the wellhead protection area. The town also adheres to an odd-even watering schedule to address excessive lawn watering.				
34: (Action 5.11 from 2019 Plan): **Perform actions to provide adequate access** to forested parcels and a local source of water.	As needed in periods of dry weather, the larger forested areas across town will be monitored. Access to these areas will be ensured. The EOP references emergency fire powers as it relates to forest fires under R.I. Gen. Laws Section 2-12-15. In addition, outdoor burning of any kind is not permitted in spring (April/May) due to the high risk of brush fires. Burn permits are typically not issued during these months.	Medium	Medium	Department of Public Works, Planning Department, Fire Dept., Water Dept.	Land and Water Conservation Fund (LWCF), EPA
SECONDARY HAZARDS: DAM FAILURE					
35: (Action 5.3 from 2019 Plan): **Continue to monitor, update, and evaluate town owned and private dams in accordance with Emergency Action Plan (EAP)** with a view to implementing preventative actions in the event of a dam failure. This should be reviewed with an update occurring annually.	The Silver Spring dam (RIDEM-owned) was repaired in 2022-2023. The Slocum Road Upper Dam was inspected in 2020, and the RIDEM issued a notice to the owners in August 2021. The owners are actively working to resolve the issue. In December 2023, the town also partnered with Save the Bay to submit a pre-proposal application to the Rhode Island Coastal and Estuary Habitat Restoration Fund to examine dam removal alternatives at the Rodman Mill Dam (High Hazard). The application was selected to advance to the full application stage. The Department of Public Works will continue to help monitor dams to prevent dam failure.	Low	High	Department of Public Works, RIDEM, Water Department	RI DEM