Middletown Comprehensive Community Plan
Appendix 2:

2025 Aquidneck Island Regional Hazard Mitigation and Flood Management Plan

Town of Portsmouth, Rhode Island
Town of Middletown, Rhode Island
City of Newport, Rhode Island

PREPARED BY

vhb

1 Cedar Street
Suite 400
Providence, RI 02903
401-272-8100

October 2025

RESOLUTION NO. XXXX-XX

A RESOLUTION OF THE TOWN COUNCIL OF THE TOWN OF PORTSMOUTH AUTHORIZING THE ADOPTION OF THE 2025 AQUIDNECK ISLAND REGIONAL HAZARD MITIGATION AND FLOOD MANAGEMENT PLAN

WHEREAS, the Town of Portsmouth recognizes exposure to natural hazards that increase the risk to life, property, environment, within the community; and

WHEREAS; pro-active mitigation of known hazards before a disaster event can reduce or eliminate long-term risk to life and property; and

WHEREAS, The Disaster Mitigation Act of 2000 (Public Law 106-390) established new requirements for pre- and post- disaster hazard mitigation programs; and

WHEREAS; the 2025 Plan identifies mitigation goals and actions to reduce or eliminate long-term risk to people and property in Portsmouth from impacts of future hazards and disasters; and

WHEREAS, adoption by the Town Council demonstrates its commitment to hazard mitigation and achieving goals outlined in the 2025 Aquidneck Island Regional Hazard Mitigation and Flood Management Plan.

NOW, THEREFORE, BE IT RESOLVED that the Town of Portsmouth

1) Adopts in its entirety, the 2025 Aquidneck Island Regional Hazard Mitigation and Flood Management Plan ("the Plan") and resolves to execute the actions identified in the Plan that pertain to this jurisdiction.
2) Will use the adopted and approved portions of the Plan to guide pre- and post-disaster mitigation of the hazards identified.
3) Will coordinate the strategies identified in the Plan with other planning programs and mechanisms under its jurisdictional authority.
4) Will continue its support of the Hazard Mitigation Committee as described within the Plan.
5) Will help to promote and support the mitigation successes of all participants in this Plan.
6) Will incorporate mitigation planning as an integral component of government and partner operations.
7) Will provide an update of the Plan every five years.

PASSED AND ADOPTED on [insert date]

____

Keith E. Hamilton, Town Council President, Town of Portsmouth

ATTEST: ______________________

Jennifer M. West, CMC, Town Clerk, Town of Portsmouth

RESOLUTION NO. XXXX-XX

A RESOLUTION OF THE TOWN COUNCIL OF THE TOWN OF MIDDLETOWN AUTHORIZING THE ADOPTION OF THE 2025 AQUIDNECK ISLAND REGIONAL HAZARD MITIGATION AND FLOOD MANAGEMENT PLAN

WHEREAS, the Town of Middletown recognizes exposure to natural hazards that increase the risk to life, property, environment, within the community; and

WHEREAS; pro-active mitigation of known hazards before a disaster event can reduce or eliminate long-term risk to life and property; and

WHEREAS, The Disaster Mitigation Act of 2000 (Public Law 106-390) established new requirements for pre- and post- disaster hazard mitigation programs; and

WHEREAS; the 2025 Plan identifies mitigation goals and actions to reduce or eliminate long-term risk to people and property in Middletown from impacts of future hazards and disasters; and

WHEREAS, adoption by the Town Council demonstrates its commitment to hazard mitigation and achieving goals outlined in the 2025 Aquidneck Island Regional Hazard Mitigation and Flood Management Plan.

NOW, THEREFORE, BE IT RESOLVED that the Town of Middletown

1) Adopts in its entirety, the 2025 Aquidneck Island Regional Hazard Mitigation and Flood Management Plan ("the Plan") and resolves to execute the actions identified in the Plan that pertain to this jurisdiction.
2) Will use the adopted and approved portions of the Plan to guide pre- and post-disaster mitigation of the hazards identified.
3) Will coordinate the strategies identified in the Plan with other planning programs and mechanisms under its jurisdictional authority.
4) Will continue its support of the Hazard Mitigation Committee as described within the Plan.
5) Will help to promote and support the mitigation successes of all participants in this Plan.
6) Will incorporate mitigation planning as an integral component of government and partner operations.
7) Will provide an update of the Plan every five years.

PASSED AND ADOPTED on [insert date]

____

Paul M. Rodrigues, Town Council President, Town of Middletown

ATTEST: ______________________

Wendy J. Marshall, MMC, Town Clerk, Town of Middletown

RESOLUTION NO. XXXX-XX

A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF NEWPORT AUTHORIZING THE ADOPTION OF THE 2025 AQUIDNECK ISLAND REGIONAL HAZARD MITIGATION AND FLOOD MANAGEMENT PLAN

WHEREAS, the City of Newport recognizes exposure to natural hazards that increase the risk to life, property, environment, within the community; and

WHEREAS; pro-active mitigation of known hazards before a disaster event can reduce or eliminate long-term risk to life and property; and

WHEREAS, The Disaster Mitigation Act of 2000 (Public Law 106-390) established new requirements for pre- and post- disaster hazard mitigation programs; and

WHEREAS; the 2025 Plan identifies mitigation goals and actions to reduce or eliminate long-term risk to people and property in Newport from impacts of future hazards and disasters; and

WHEREAS, adoption by the City Council demonstrates its commitment to hazard mitigation and achieving goals outlined in the 2025 Aquidneck Island Regional Hazard Mitigation and Flood Management Plan.

NOW, THEREFORE, BE IT RESOLVED that the City of Newport

1) Adopts in its entirety, the 2025 Aquidneck Island Regional Hazard Mitigation and Flood Management Plan (“the Plan”) and resolves to execute the actions identified in the Plan that pertain to this jurisdiction.
2) Will use the adopted and approved portions of the Plan to guide pre- and post-disaster mitigation of the hazards identified.
3) Will coordinate the strategies identified in the Plan with other planning programs and mechanisms under its jurisdictional authority.
4) Will continue its support of the Hazard Mitigation Committee as described within the Plan.
5) Will help to promote and support the mitigation successes of all participants in this Plan.
6) Will incorporate mitigation planning as an integral component of government and partner operations.
7) Will provide an update of the Plan every five years.

PASSED AND ADOPTED on [insert date]

____

Charles M. Holder, Chair and Mayor, City of Newport

ATTEST: ________________________

Laura Swistak, CMC, Town Clerk, City of Newport

Table of Contents

List of Tables

List of Figures

Executive Summary

Aquidneck Island is an island region in Rhode Island made up of the Towns of Portsmouth and Middletown and the City of Newport. Serving as the lead entity, the Town of Portsmouth received a Federal Emergency Management Agency (FEMA) Building Resilient Infrastructure and Communities (BRIC) award to develop a regional, multi-jurisdictional natural hazard mitigation plan for all three island municipalities. Vanasse Hangen Brustlin, Inc. (VHB), a third-party consultant, was hired by the Town of Portsmouth to lead this effort.

This Regional Hazard Mitigation and Flood Management Plan (RHMP) is a product of the Regional Hazard Mitigation Committee (RHMC or Committee). It has been approved by the governing bodies of each participating municipality, the Rhode Island Emergency Management Agency, and FEMA in accordance with the Disaster Mitigation Act of 2000.

VHB, Aquidneck Island Land Trust, residents, and municipal officials from each community contributed to this planning effort. VHB prepared this RHMP, building upon the prior Hazard Mitigation Plans from each municipality.

This RHMP was constructed using input from municipal and private stakeholders and the public.

The purpose of this plan is to:

1. Identify natural hazards and vulnerability that will affect Aquidneck Island and its nearly 60,000 residents
2. Identify community assets that may be vulnerable to these hazards
3. Highlight current capabilities to reduce risks from natural hazards
4. Propose a series of mitigation actions that reduce the loss of life and property, economic disruptions, and the cost of post-disaster recovery

Public input and the RHMC's overview of past natural hazard occurrences verify that the region is vulnerable to diverse events including hurricanes, Nor'easters, sea level rise, high winds, flooding, and severe winter weather. Our risk assessment (see Chapter 4) confirms that the region has much to lose from these events. Vulnerabilities identified in the risk assessment include:

- Flood-prone areas, streets, or infrastructure
- Drainage systems
- Bridges
- Wastewater systems
- Water supply systems
- Other services/utilities
- Communication equipment
- Dams
- Critical municipal hazard response facilities
- Populations
- Businesses
- Schools
- Public buildings
- Recreation facilities
- Natural and historic resources

To address these risks, this RHMP puts forth a clear mission—to protect public health and safety and create sustainable economic growth by limiting losses to lives, public and private property, and natural resources/systems—along with a distinct set of goals to guide us and 10 regional mitigation actions to achieve those goals.

This planning process establishes funding priorities for municipalities on Aquidneck Island. Historically, the formal adoption and implementation of this plan has allowed municipalities to participate in several programs offered by FEMA. At this time, many grant programs are being revised, new guidance should be reviewed when available. On average, natural hazard mitigation saves taxpayers $6 for every $1 spent on federally funded mitigation activities.

Moving forward, this plan serves not only as a roadmap for mitigation investment but also as a shared commitment among Aquidneck Island's cultural, economic, and natural assets. Continued collaboration, proactive planning, and targeted funding will be essential to reduce risk and ensure a safer, more sustainable future for all communities across Aquidneck Island.

1

Introduction

Hazard Mitigation and Its Benefits

Natural hazard mitigation planning consists of a series of actions taken to identify specific assets that are vulnerable to natural hazards within a region and seeks to permanently reduce or eliminate the long-term risk to human life and property. It coordinates available resources and identifies community policies, actions, and tools for implementation that will reduce risk and the potential for future losses region-wide. The process of natural hazard mitigation planning sets clear goals, identifies appropriate actions, and produces effective mitigation strategies that can be updated and revised to keep the plan current.

States and communities across the country are realizing that responding to natural disasters without working to minimize their potential effect is not an adequate long-term solution. Conversely, proactive planning that characterizes the hazard, assesses the community's vulnerability, and designs appropriate land-use policies and building code requirements is a more effective and fiscally sound approach to achieving public safety goals related to natural hazards.

Definitions

A **Natural Hazard** is an extreme natural event. **Natural Disasters** occur when these extreme natural events come into contact with people and property.

Natural hazard mitigation is any sustained action taken to permanently reduce or eliminate long-term risk to people and their property from the effects of natural hazards.

Natural Hazard mitigation planning is a process undertaken by a community to analyze the risk from natural disasters, coordinate available resources, and implement actions to minimize the damage to property and injury or loss of life before disaster occurs.

Federal Funding

Federal legislation authorizes funding mechanisms for disaster relief, recovery, and hazard mitigation planning. The legislation includes the following:

The Disaster Mitigation Act of 2000 (DMA) amended the Robert T. Stafford Emergency Assistance Act to create the authority on mitigation planning and the Pre-Disaster Mitigation (PDM) grant program. The DMA allows states and tribes with an increased commitment to mitigation to achieve an "Enhanced" status, which provides additional funding. In 2020, the PDM program was replaced by BRIC, which provides annual funding for proactive, capability-enhancing hazard mitigation projects nationwide.

Section 322 of the DMA specifically addresses mitigation planning at the state and municipal levels of government. It identifies new requirements that allow Hazard Mitigation Grant Program (HMGP) funds to be used for planning activities. As a result of this Act, **states and local jurisdictions must now have a FEMA-approved natural hazard mitigation plan in place prior to receiving pre- and post-disaster HMGP funds**. In the event of a natural disaster, municipalities that do not have an approved natural hazard mitigation plan will not be eligible to receive HMGP funding.

The Water Infrastructure Improvements for the Nation Act of 2016 added a new dam safety grant program. The program requires applicants to have a mitigation plan that includes all dam risks.

The **Disaster Recovery Reform Act** of 2018 acknowledges the need for collaborative disaster response and recovery across the whole community. The Disaster Recovery Reform Act created the BRIC grant program to replace and simplify the PDM program and added new requirements for the national post-disaster HMGP or other annual funding opportunities.

Collaborative Hazard Mitigation

Hazard mitigation can bring together a collaborative network of stakeholders whose interests might be affected by hazard losses. Collaborating to develop risk reduction actions, stakeholders can pool skills, expertise, and experience to achieve a common goal. Such collaboration helps the region ensure that mitigation projects are informed by a broad range of community perspectives, leading to solutions that are more equitable, better tailored to local needs, and grounded in shared priorities.

Social and Economic Benefits

Proactive hazard mitigation planning focused on sustainability can help minimize the social and economic hardships that have resulted from previous natural disasters. These social and economic hardships include loss of life/injuries, destruction of property, interruption of jobs, damage to businesses, and loss of historically significant structures and facilities.

Mission Statement and Goals

The Aquidneck Island communities of Portsmouth, Middletown, and Newport will work together to protect public health and safety and create sustainable economic growth by limiting losses to lives, public and private property, and natural resources/systems.

Goals

This mitigation strategy is adopted by Aquidneck Island communities to present actions that help protect its citizens, visitors, businesses, and property from the effects of various natural hazards. It is the intent of the Aquidneck Island communities to:

1. Protect public health, safety, and welfare
2. Reduce property damage caused by hazard impacts
3. Minimize social dislocation and distress
4. Reduce economic losses and minimize disruption to local businesses
5. Protect ongoing operations of critical infrastructure
6. Reduce dependence on and need for disaster assistance funding after disasters
7. Expedite disaster recovery mitigation efforts
8. Provide an ongoing forum for the education and awareness of natural hazard mitigation issues, programs, policies, and projects

Background

Aquidneck Island is located in the eastern section of Rhode Island in Newport County. It refers to the geographic area occupied by the three adjoining municipalities of Portsmouth, Middletown, and Newport and includes Prudence Island and hog island, as well as the uninhabited Patience Island and Hope Island, as shown in **Figure 1**. The island occupies 37.8 square miles of land and is surrounded by Narragansett Bay on the western side, Rhode Island Sound to the South, and the Sakonnet River to the east. The island is connected to the mainland by Mount Hope Bridge (north), Claiborne Pell/Newport Bridge (southwest), and Sakonnet River Bridge (east).

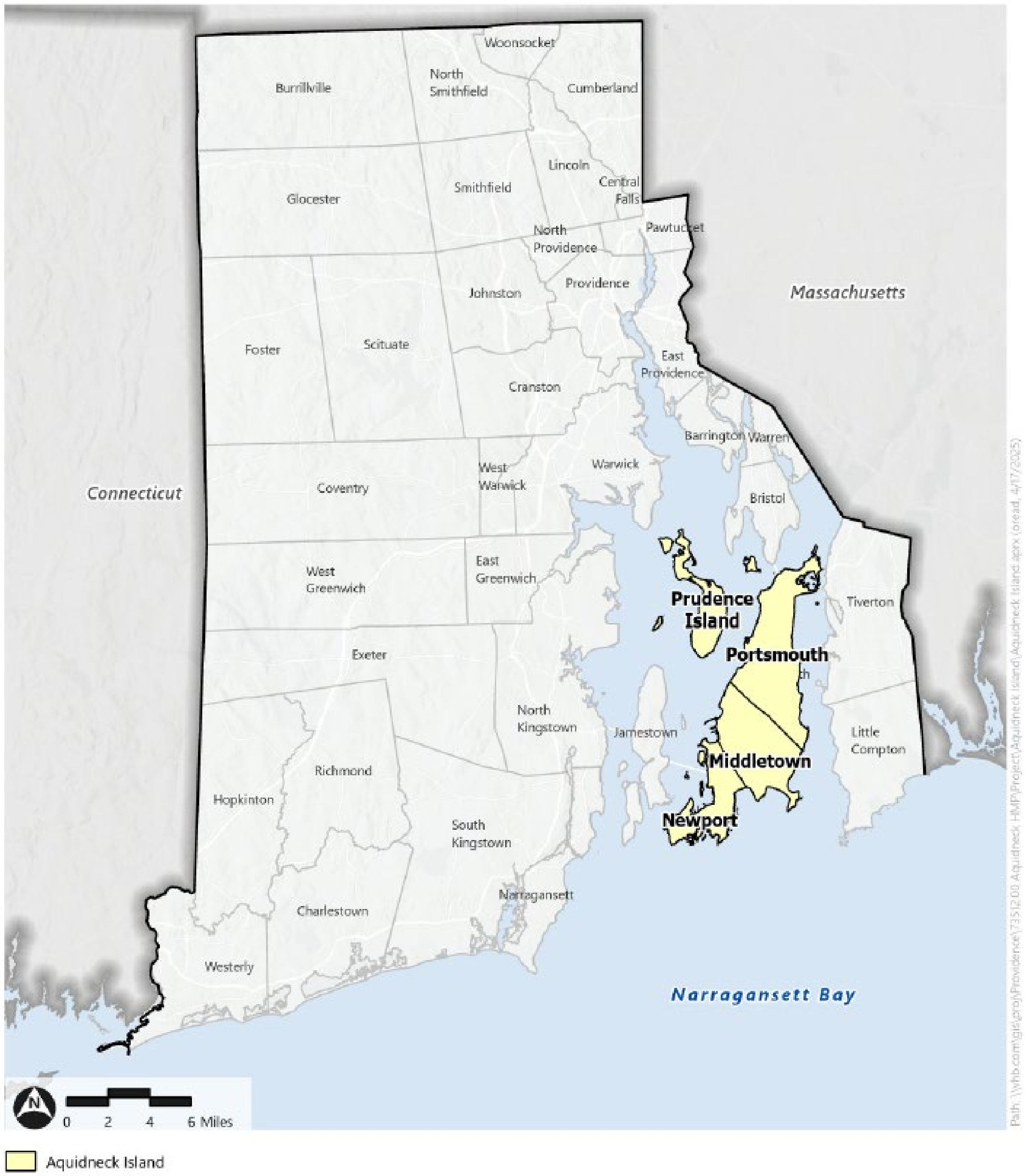
Aquidneck Island has an estimated year-round population of 58,752.[1] During the summer months, the population in Newport alone increases to 100,000. Newport is the state's principal tourist center and resort community, attracting millions of visitors from all over to enjoy events, view the mansions, sail, see the sights, and dine.

Middletown, located between Portsmouth and Newport, is known for its beaches and other natural areas and recreational opportunities, including the Sachuest Point National Wildlife Refuge, the Norman Bird Sanctuary, and several Aquidneck Land Trust properties and trails. Middletown is also home to the Naval Undersea Warfare Center at the United States Naval Station Newport.

The Town of Portsmouth, known for historic attractions, residential neighborhoods, and a thriving business park, includes Prudence Island, the third largest island in Narraganset Bay, and three smaller islands: Patience Island, Hope Island, and Hog Island.

1 United States Census Bureau QuickFacts data.

Figure 1 Locus Map—Aquidneck Island



Source: RIGIS

Select Demographics

Aquidneck Island's three municipalities exhibit both shared and distinct demographic characteristics. Newport has the largest population and largest percentage of historic homes on the island. Portsmouth and Middletown are generally more affluent and have similar population sizes. See **Table 1** and **Table 2** below for additional demographic details.[2]

Table 1 Demographic Overview

	Portsmouth	Middletown	Newport	Rhode Island
Total Population	17,447	16,588	24,717	1,112,308
Aged 65+ (%)	4,322 (24% of total)	22%	21%	19%
Race (%)	White (89%) Asian (1%) Black (1%) American Indian and Pacific Islander (0.3%) Hispanic or Latino (6%) Two or More Races (9%)	White (82%) Asian (2%) Black (4%) American Indian and Pacific Islander (0.2%) Hispanic or Latino (7%) Two or More Races (8%)	White (76%) Asian (3.0%) Black (8%) American Indian and Pacific Islander (0.5%) Hispanic or Latino (11%) Two or More Races (9%)	White (80%) Asian (4%) Black (9%) American Indian and Pacific Islander (1.5%) Hispanic or Latino (18%) Two or More Races (3%)
Median Household Income	$119,500	$128,510	$83,562	$86,372
Percent of Population in Poverty[3]	4.4%	10.0%	15.1%	10.8%
Number of Housing Units	8,375	8,225	13,527	483,132
Housing Units Built Before 1939	1,353 (16% of total)	1,194 (14.5% of total)	5,810 (43% of total)	142,275 (26% of total)

Table 2 Demographic Changes on Aquidneck Island

	2010	2020	% Change
Housing Units (total)	28,985	30,193	+3.3%
Population	58,211	60,109	+3.1%
Percent of Homes Owner-Occupied	56%	60%	+4.0%

Certain populations throughout Aquidneck Island are more vulnerable to the impacts of natural hazard events and climate change than others. Factors increasing this vulnerability include age, socioeconomic status, minority status, and health or disabilities. According to the Rhode Island Department of Environmental Management (RIDEM) Environmental Justice Mapper,[4] there are five

2 Demographic information was derived from the United States Census Bureau QuickFacts data.

3 In 2021, the poverty threshold for a single individual under the age of 65 in Rhode Island was $13,380 per year, while for a family of four with two children, it was set at $27,300 per year.

4 Environmental Justice | Rhode Island Department of Environmental Management

census tracts on Aquidneck Island. Census tracts 402 and 403.3 in Middletown, and Census tracts 405, 406, and 412 in Newport meet one or more of the criteria for Environmental Justice communities according to RIDEM:

- Annual median household income is not more than 65 percent of the statewide annual median household income
- Minority population is equal to or greater than 40 percent of the population
- 25 percent or more of the households lack English language proficiency
- Minorities comprise 25 percent or more of the population and the annual median household income of the municipality in the proposed area does not exceed 150 percent of the statewide annual median household income

Both the City of Newport and the Town of Middletown are among the 13 Rhode Island-designated disadvantaged communities where some residents are unable to adequately meet household energy needs. [5]

Economic Conditions

Aquidneck Island's economic success is largely dependent on tourism, restaurants, museums, and retail. The region's rich waterfront history is showcased in exhibits, and tours.

Key industries on Aquidneck Island include professional and technical services, accommodation and food services, healthcare, and manufacturing.[6]

In June 2024, the average unemployment rate (not seasonally adjusted) in Aquidneck Island was 3.4 percent on average, which is slightly lower than the state average of 4.3 percent during the same period. Unemployment rates statewide have been improving since the average of 15.8 percent in the second quarter of 2020 (COVID pandemic).[7]

Government

Aquidneck Island has no island-wide government; any policy changes or updates to land use ordinances must be done at the local level. Portsmouth, Middletown, and Newport have similar governance structures (see **Table 3**). Each Council will adopt this Regional Hazard Mitigation and Flood Management Plan separately.

5 Rhode Island Office of Energy Resources, Energy Justice https://energy.ri.gov/energy-justice

6 State of Rhode Island Department of Labor and Training, Employment & Wages by Industry, 2023. https://dlt.ri.gov/labor-market-information/data-center/employment-wages-industry-qcew

7 State of Rhode Island Department of Labor and Training, Unemployment Rate/Labor Force Statistics Unemployment Rate/Labor Force Statistics (LAUS) | RI Department of Labor & Training, accessed February 2023.

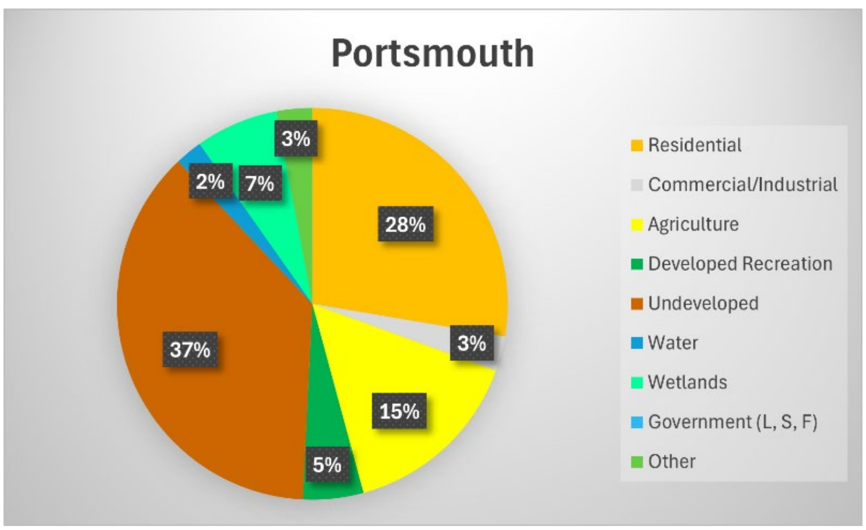
Table 3 Local Government Structure

	Portsmouth	Middletown	Newport
Council Type	Town Council	Town Council	City Council
# of Members	7	7	7
Leadership	Town Administrator, appointed	Town Administrator, appointed	City Manager, appointed Mayor, elected by City Council

Land Use Patterns

The land area of Aquidneck Island is 37.8 square miles and supports a mix of land uses connecting the communities. Residential and open space dominates the landscape, with pockets of commercial districts, farmland, and a United States Navy base. **Figure 2, Figure 3,** and **Figure 4** detail the land use breakdown for each municipality based on data from each Local Comprehensive Plan. Note that these breakdowns are from different years (Portsmouth 2022, Middletown 2015, Newport 2017) and may not reflect land use changes since those dates.

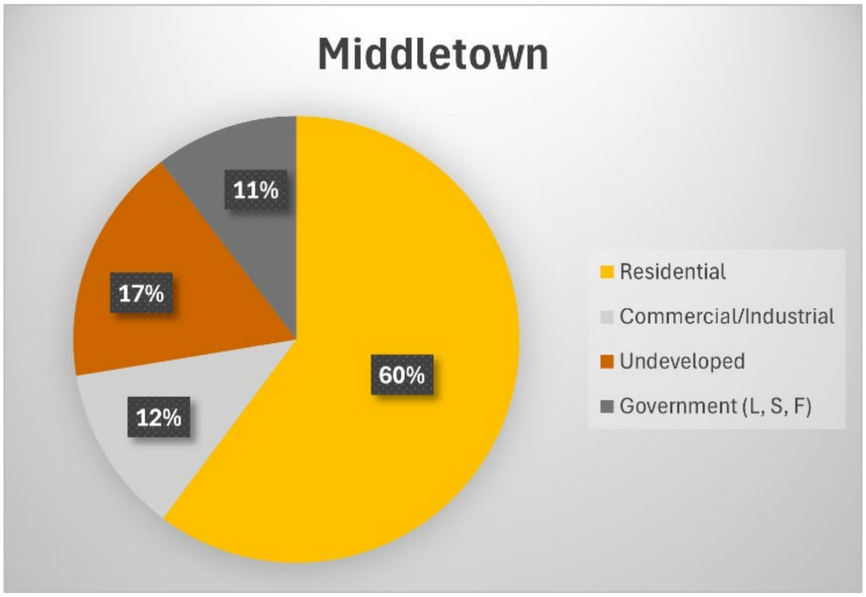
Figure 2 Portsmouth Land Use by Category



Source: Town of Portsmouth Local Comprehensive Plan, 2022.

As shown, most of the land in Portsmouth is residential or undeveloped, which accounts for 65 percent of land use in the community. Agriculture is the third largest land use category in Portsmouth. Commercial/Industrial land makes up just 3 percent of land.

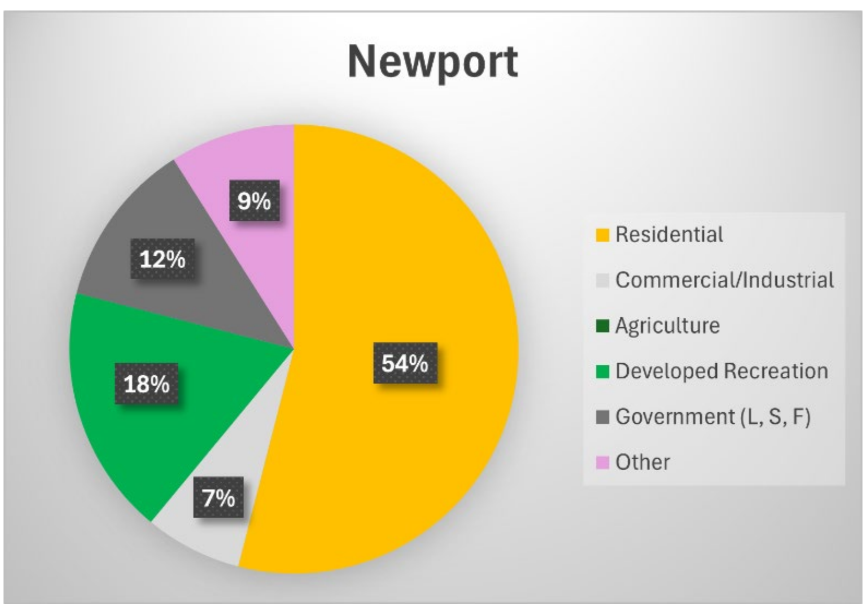
Figure 3 Middletown Land Use by Category



Source: Town of Middletown Comprehensive Plan, 2015.

In Middletown, residential land use dominates, accounting for 60 percent of total land use. Commercial/Industrial land is greater in Middletown than in Portsmouth, accounting for 12 percent of land use in the community. Undeveloped land makes up 17 percent of land use in Middletown, which is less than half of undeveloped land in Portsmouth.

Figure 4 Newport Land Use by Category



Source: City of Newport Comprehensive Land Use Plan, 2017.

Similarly to Portsmouth and Middletown, the predominant land use in Newport is residential, with over 54% of land cover dedicated to this purpose. Newport also has a significant amount of developed recreation space, accounting for 18 percent of land use, more than double the amount of commercial/industrial land in the City, which accounts for just 7 percent of land use. Like Middletown, over 10 percent of land use is dedicated to government, as Newport is home to a U.S. Naval Station.

As these figures illustrate, roughly 50 percent of the land across Aquidneck Island is devoted to residential uses. In Newport and Middletown, residential land use includes high, medium, and low density residential, while in Portsmouth, medium density residential dominates the landscape, with only small concentrations of high-density residential in the southern and northern areas of the town.

An additional 30 percent of land is characterized by agricultural use, open space, developed recreation, or wetlands. Portsmouth and Middletown have higher concentrations of agricultural land, while Newport contains more land dedicated to developed recreation. Commercial and industrial land uses are most prevalent in Middletown, followed by Newport and Portsmouth.

Roads and Bridges

Aquidneck Island's location strongly influences regional traffic flow on and off the island. Two main roads, State Route 138 (East Main Road) and State Route 114 (West Main Road), handle most of the north-south traffic on the island. Various locally owned roads and bridges connect the major routes and bring people to the coast and business centers.

The island is served by a network of small municipally owned bridges and five major bridges owned and operated by the Rhode Island Bridge and Turnpike Authority (RITBA) and the Rhode Island Department of Transportation (RIDOT):

- Claiborne Pell Newport Bridge, connecting Jamestown to Newport (RITBA)
- Jamestown Verrazzano Bridge, connecting Jamestown to mainland North Kingstown (RITBA)
- Mount Hope Bridge, connecting Portsmouth to mainland Bristol (RITBA)
- Sakonnet River Bridge, connecting Portsmouth to mainland Tiverton (RIDOT)
- Hurricane Escape Bridge (Cove Bridge) connecting Island Park to the Hummocks (RIDOT)

Dams

In 2022, RIDEM identified seven high hazard dams, one significant hazard dam, and seven low hazard dams on Aquidneck Island, as shown in **Table 4**. Should a significant hazard dam become a high hazard dam, the municipalities will consider mitigation actions to reduce long-term vulnerabilities.

The City of Newport owns and operates most of the dams on the island, which impound water for regional water supply purposes. Regardless of the dams' ownership, Portsmouth and Middletown are responsible for the emergency response plans required by RIDEM for the dams located within their municipalities.

Owners of high and significant hazard dams are required to file a dam Emergency Action Plan (EAP). While this responsibility generally falls to the owner, in practice, the lead for developing or updating these plans may be determined based on the jurisdiction in which the dam is located. For example, although some dams within Portsmouth's boundaries are owned by the City of Newport, Portsmouth has taken the lead in updating their EAPs due to its jurisdictional authority. This approach may not apply to privately owned dams, where the owner typically takes full responsibility for planning. As of 2024, RIDEM's Dam Safety Program has renewed coordination with island municipalities to confirm that all high and significant hazard dams have current EAPs.

Definitions

High Hazard Dam—failure or maloperation will result in probable loss of human life

Significant Hazard Dam—failure or maloperation will result in no probable loss of human life but can cause major economic loss or disruption of lifeline facilities or can have other detrimental impacts to the public's health, safety, or welfare

Low Hazard Dam—failure or maloperation will result in no probable loss of human life and low economic losses

Table 4 Dams on Aquidneck Island

Dam Name	RIDEM Dam Number	Hazard Classification	Location	Owner	EAP On File?
Lawton Valley Reservoir	395	High	Portsmouth	City of Newport	No
Sisson Pond	580	High	Portsmouth	City of Newport	No
St. Mary's Pond	581	High	Portsmouth	City of Newport	No
Gardiner Pond	583	High	Middletown	City of Newport	No
Nelson Pond	582	High	Middletown	City of Newport	2024 Draft
Easton Pond North	584	High	Middletown	City of Newport	2024 Draft
Easton Pond South	585	High	Middletown and Newport	City of Newport	No
Melville #1	761	Significant	Portsmouth	Town of Portsmouth	No
Various (4)	N/A	Low	Portsmouth	Various/Unknown	N/A
Various (3)	N/A	Low	Middletown	Various/Unknown	N/A
None Reported	N/A	Low	Newport	N/A	N/A

In support of the Dam Safety Program and in coordination with RIDEM, Aquidneck Island communities have maintained ongoing engagement with dam owners and state officials to better understand the condition, risks, and vulnerabilities associated with high hazard potential dams. Information shared by RIDEM and local dam owners, including annual inspection data and EAPs, has informed the development of this plan and the regional approach to hazard mitigation.

Dam failure poses a unique risk to Aquidneck Island's critical infrastructure and water supply. Most of the island's high hazard dams are associated with the Newport Water Division's reservoir system and are aging assets that require continued monitoring and upkeep. Recent inspections conducted by RIDEM and the Newport Water Division, supplemented by condition assessments from Pare Corporation, have flagged several issues related to vegetation overgrowth, spillway condition, and EAP compliance. While many structures are rated as "fair" and currently functioning as intended, they require ongoing maintenance to remain in good standing.

Limitations identified by RIDEM's 2023 Annual Report include unclear ownership of some high hazard dams, insufficient funding to repair privately owned dams, inadequate spillway capacities, and limited staff resources at the state level. These gaps pose challenges to dam safety and hazard preparedness. The potential consequences of dam failure, particularly from structures like Easton Pond South or Lawton Valley Reservoir, include risks to public safety, disruption of the regional water supply, and flooding of major transportation corridors such as Memorial Boulevard.

Each municipality has coordinated with RIDEM and dam owners to ensure that dam safety responsibilities are clearly assigned and that any deficiencies identified during inspections are being addressed. For example, the Town of Portsmouth has taken the lead on certain EAP updates despite not owning the dams within its borders. This collaborative approach supports readiness across jurisdictions.

The risk assessment presented in this plan accounts for the location, condition, and failure potential of each high hazard dam, and acknowledges that extreme rainfall and coastal storm events—both of which are projected to intensify due to climate change—may increase dam failure risk in the future. Continued monitoring, inter-agency coordination, and targeted mitigation strategies will be essential to protect life safety and critical infrastructure on the island.

Utilities

Sewerage

The Newport Water Pollution Control Division is responsible for providing wastewater treatment to the residents of Newport, Middletown, and the Naval Station in Newport. The Town of Portsmouth relies exclusively on individual on-site wastewater treatment systems for wastewater disposal. There is no municipal wastewater utility. Larger facilities or subdivisions do have private shared or cluster systems. There are no plans to install a publicly owned wastewater treatment system in Portsmouth.

The Newport Wastewater Treatment Facility, located about 1,000 feet from the shoreline, is vulnerable to partial inundation from the one-percent-annual-chance flood event (base flood).

Stormwater

Most stormwater and drainage infrastructure on the island drains into catchments, wetlands, or receiving waters. In Newport, some stormwater connections discharge to the city's Combined Sewer Overflows (CSOs) during heavy rainfall events. Each municipality is responsible for the maintenance of its own infrastructure.

Newport owns and operates two CSO facilities at Washington Street and Wellington Avenue, a pump station at Long Wharf, and a Water Pollution Control Plant in the North End. By the nature of their function, they are located in coastal areas susceptible to flooding. As heavy rainfall can stress the system, the city is working on disconnecting or removing private and public inflow sources to achieve a reduction in rainfall-derived flow.[8] Newport is currently implementing phased updates to its CSO facilities as part of its long-term control plan.

Much of the island is low-lying and vulnerable to sea level rise and storm surge. The nature of the topography puts stormwater infrastructure at risk of underperforming or failing during high tide or heavy rain events. While Portsmouth has some of the relatively higher elevations on the island, sloping from its north-south ridgeline towards the Sakonnet River and Narragansett Bay, these slopes can contribute to runoff, creating localized drainage issues downslope and placing strain on stormwater systems.

Fresh Water

The Newport Water Division operates and manages the source water reservoirs, treatment plants, storage tanks and drinking water distribution system throughout Newport, the Town of Middletown, and a small portion of the Town of Portsmouth. The Newport Water Division also sells water to the Portsmouth Water and Fire District and Naval Station Newport, each of which operates the distribution system within their jurisdictions.

Most of the drinking water on Aquidneck Island is sourced at various surface water reservoirs throughout Rhode Island. Of the nine total interconnected reservoirs controlled by Newport Water, seven are located on Aquidneck Island, one is in Tiverton, and one is located in Little Compton. During heavy rain events, or when one of the on-site wastewater treatment systems fails, the likelihood of drinking water contamination increases.

Energy

Rhode Island Energy is responsible for delivering natural gas and electricity throughout the island. While regional gas, electric, and sewer utilities are regularly maintained by the entities that own them, the municipalities maintain the public utility infrastructure that they own.

8 Collection System Capacity Assessment and System Master Plan, Prepared for City of Newport, November 2012. https://www.cityofnewport.com/CityOfNewport/media/City-Hall/Departments/Utilities/W%20P%20C/CSO-REPORTS/SystemMasterPlan-November2012.pdf

Communications

Municipal communication equipment and private cellular towers are located throughout the island. The primary telecommunications providers are Verizon, AT&T, T-Mobile, and Cox Communications, which maintain regional infrastructure on the island.

Water Resources

Water resources, including freshwater bodies, coastal waters, and wetlands are important environmental features of the region. Wetlands prevent flooding, purify the groundwater, and provide wildlife habitat.

The most significant natural water features on Aquidneck Island are listed in **Table 5**.

Table 5 Natural Water Resources

Name	Type	Features	Location
Island Park Cove	Saltwater	Body of water between Point Road and Route 24 in Portsmouth	Portsmouth
Barker Brook	Stream	Runs from the middle of Portsmouth under Route 24 to Narragansett Bay	Portsmouth
Bloody Brook	Stream	Connected to the eastern end of Barker Brook;	Portsmouth
Bailey Brook	Stream	Primary water source for North Easton/Green End Pond (public drinking water reservoir)	Middletown
Maidford River	River	Primary water source for the drinking water reservoirs Nelson Pond and Gardiner Pond	Middletown
Paradise Brook	River	Supplies water to Nelson Pond	Middletown
Lawton Valley Reservoir	Freshwater Pond	Drinking water reservoir	Portsmouth
Saint Mary's Pond	Freshwater Pond	Drinking water reservoir	Portsmouth
Sisson Pond	Freshwater Pond	Drinking water reservoir	Portsmouth
Gardiner Pond	Freshwater Pond	Drinking water reservoir; coastal	Middletown
Nelson Pond	Freshwater Pond	Drinking water reservoir; coastal	Middletown
North Easton Pond/Green End Pond	Freshwater Pond	Drinking water reservoir; coastal	Middletown and Newport
Easton Pond	Coastal Pond	Dual drinking water reservoir; coastal	Middletown and Newport
Almy Pond	Coastal Pond	Shallow pond in Newport's south end; one of the most impaired water bodies on Aquidneck Island	Newport
Lily Pond	Coastal Pond	Small pond in the residential area of Newport's south end	Newport

Almy Pond, one of the most impaired bodies of water on Aquidneck Island. Photo credit: City of Newport

Figure 8 illustrates water resources on Aquidneck Island. The map identifies rivers and streams, lakes and ponds, and United States Department of Agriculture (USDA) watersheds. USDA watersheds are geographic areas where all precipitation, such as rain or melted snow, drains into a common outlet like a river, stream, or ocean. Watersheds encompass the land that contributes water to a particular point. USDA monitors select watersheds to protect and improve watershed health.

Figure 8 Water Resources of Aquidneck Island

Aquidneck Island Regional Hazard Mitigation and Flood Management Plan | Rhode Island

Source: RIGIS

Forest and Open Space

Private, municipal, and state commitments have played a large role in the preservation of open space on Aquidneck Island. Aquidneck Island's open space and recreation areas enhance its character and provide for the passive and active recreational needs of residents.

There are not a lot of brushland, grassland, and open forest habitat areas on Aquidneck Island. Key open space areas are listed in **Table 6**.

Table 6 Open Space

Name	Type	Location
Various coastal lands	High value/high vulnerability habitat	Island-wide
Uninhabited and lightly inhabited islands of Hog Island, Prudence Island, Patience Island, and Hope Island	Conservation, major parks and open space, forested.	Portsmouth
Town Pond	Conservation	Portsmouth
Melville Ponds Campground	Forested recreation	Portsmouth
Various farmland	Agricultural land preservation	Island-wide
Fort Adams State Park	Developed	Newport
Brenton Point State Park	Developed	Newport
Sachuest Point	Brushland Habitat protection	Middletown
Norman Bird Sanctuary	Brushland Habitat protection	Middletown
Various Country Clubs	Recreation	Island-wide

Cultural and Historic Resources

Significant cultural and historic resources on Aquidneck Island include early farms, lighthouses, a large collection of colonial-era wooden homes, summer residences of wealthy industrialists (the famous mansions), and historic districts. The island's abundant federally recognized historic places (see **Table 7**) help shape the local culture and drive the economy. **Figure 9** illustrates locations of historic districts, sites, and candidate sites in proximity to flood zones.

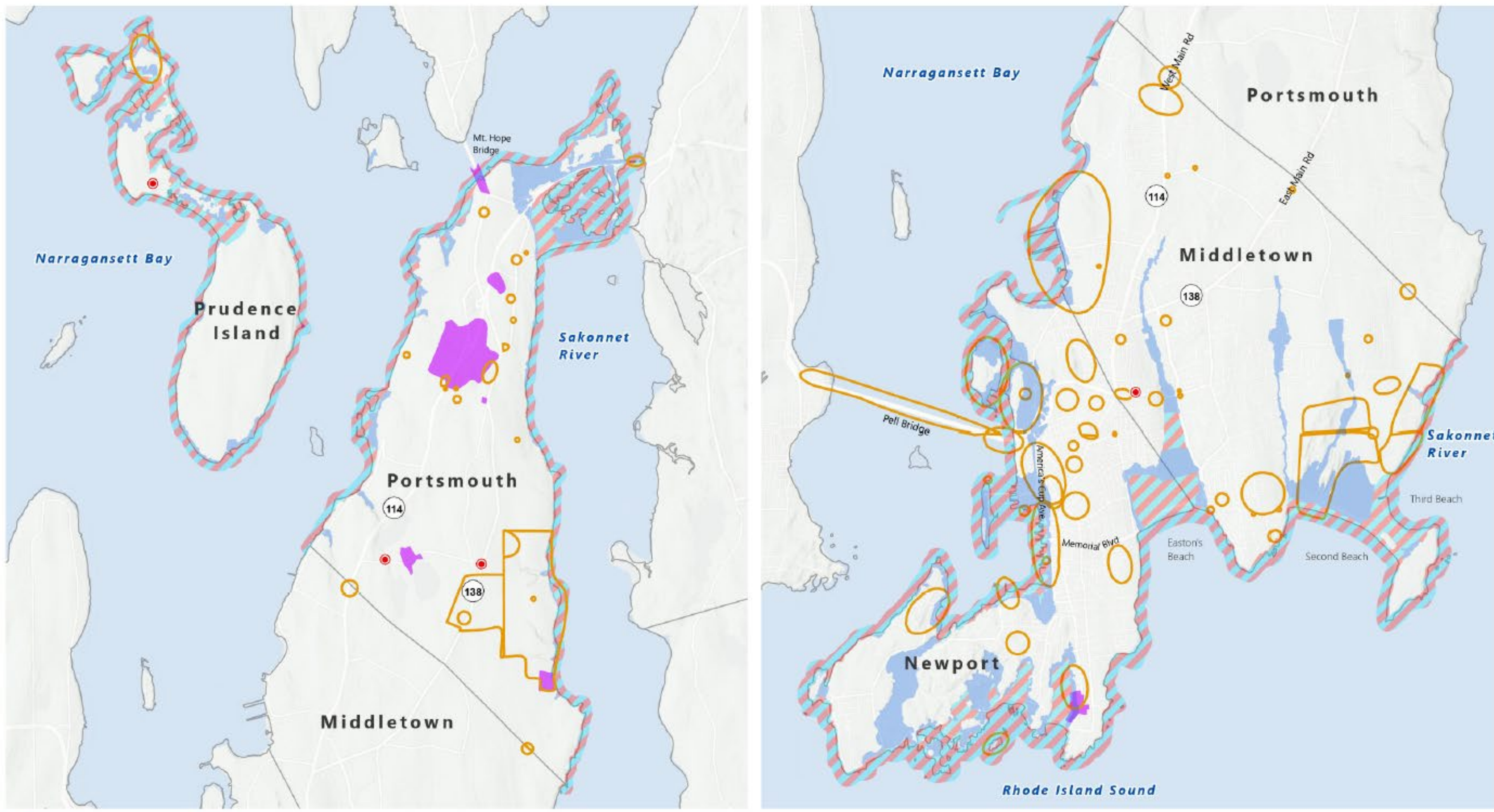
Table 7 Historic Resources

	Portsmouth	Middletown	Newport
National Register Historic Districts	0	2	5
National Register Historic Landmarks	1	0	23 (5 of which are landmark districts)
National Register of Historic Places[9]	12	13	56

9 The National Register of Historic Places is the official federal list of districts, sites, buildings, structures, and objects significant in American history, architecture, archeology, engineering, and culture. National Historic Landmarks are buildings, sites, districts, structures, and objects that have been determined by the Secretary of the Interior to be nationally significant in American history and culture. Upon designation as a National Historic Landmark, landmarks are listed in the National Register of Historic Places if not already listed.

Figure 9 Cultural Resources and Special Flood Hazard Areas

Aquidneck Island Regional Hazard Mitigation and Flood Management Plan | Rhode Island



Historic Sites
Historic Candidate Sites
Historic Districts

AE - FEMA Special Flood Hazard Zone
VE - FEMA Special Flood Hazard Zone

National Historic Landmark District: National Historic Landmarks (NHLS) are buildings, sites, districts, structures, and objects that have been determined by the United States Secretary of the Interior to be nationally significant in American history and culture. NHLs are a separate designation, but upon designation, they are listed in the National Register of Historic Places if not already listed.

0 0.5 1 1.5 Miles

Source: RIGIS, FEMA

Development Trends in the Last 5 Years

Over the past five years, Aquidneck Island's three municipalities, Portsmouth, Middletown, and Newport, have experienced varied development trends in residential, commercial, and cultural sectors. **Table 8** summarizes these recent development patterns, which may inform how each community plans for land use, infrastructure investment, and hazard mitigation. While the specific nature of development differs by town, common themes include a growing interest in mixed-use projects, increasing short-term rental conversions, and active efforts to preserve open space and improve resiliency.

Table 8 Recent Development Trends

	Portsmouth	Middletown	Newport
Residential Development Trends	› Over 93 acres of residential development since 2018. › 152 units are under development off Bristol Ferry Road (Narragansett Bay Club).	› Decrease in subdivision activity. › More interest in multi-family development, including affordable housing. › Conversion of homes to be seasonal or short-term rentals.	› Conversion of homes to seasonal or short-term rentals. › Conversion of existing multifamily dwellings to single family dwellings. › Demolition of vernacular housing to provide for larger homes. › Increasing use of the adaptive reuse legislation. › Limited new home construction. › Continued effort in maintaining and upgrading affordable housing units.
Commercial and Industrial Development Trends	› Very little change in commercial development. › Ongoing requests for boat storage. › Increase interest in ground mounted solar projects. 3 have been approved.	› Some interest in mixed use development that will include retail space. › Continued interest in hotel development. › Low office space vacancy, no interest in building more. In fact, some existing office/light industrial space is being converted into other uses such as storage.	› Continued focus on commercial redevelopment of the City's North End. › Ongoing efforts to address business community concerns regarding parking and traffic congestion. › Supporting workforce housing initiatives. › Low office space vacancy. › Continued hotel and tourism related development.

	Portsmouth	Middletown	Newport
Natural, Historic and Cultural Development Trends	› Aquidneck Land Trust has assisted with the conservation of over 120 acres since 2018. › Ragged Island Brewery has secured 37 acres of farmland for agricultural property.	› Town recently purchased the former Hoogendoorn property (75+ acres) for future recreations and open space development.	› Working on lead abatement issues within the historic building stock. › Continued focus on flooding and stormwater issues in historic neighborhoods. › Ongoing Cliff Walk repairs. › Focus on resiliency and sustainability city wide, evidenced by newly created Resiliency and Sustainability Director position.

While development trends vary across Aquidneck Island, several patterns are notable. All three communities are seeing a rise in seasonal and short-term rentals, which may increase population turnover and emergency preparedness challenges. Middletown and Newport have prioritized multi-family and affordable housing, while Portsmouth has seen steady residential growth but little commercial change.

Across the Island, communities are investing in land conservation, and sustainability – reflected in Newport's creation of a Resiliency and Sustainability Director position and land acquisitions in Middletown and Portsmouth. These trends provide important context for evaluating land use decisions within the broader hazard mitigation strategy.

2

Planning Process

Overview

The three Aquidneck Island communities have come together to address regional natural hazards and develop strategies to enhance resilience in the face of natural disasters and climate change. In 2022, the Town of Portsmouth was awarded a FEMA BRIC Award (EMB-2022-BR-007-004) to develop a multijurisdictional Regional Hazard Mitigation and Flood Management Plan (RHMP). The Town of Portsmouth initiated the RHMP planning effort in 2024 at the recommendation of the Town Planner and serves as the grant manager for this project on behalf of the three island municipalities. This RHMP is the result of a dedicated group of individuals working for nine months to identify natural hazards and propose ways to improve Aquidneck Island's resilience. The draft plan was made available for public comment before it was submitted to the State of Rhode Island Emergency Management Agency (RIEMA) and FEMA for review.

Regional Hazard Mitigation Committee

This RHMP is a product of the Aquidneck Island Regional Hazard Mitigation Committee (RHMC). The RHMC was comprised of municipal employees, state employees, federal Naval employees, and local residents. Committee members participated in three committee meetings and three public workshops and were given an opportunity to comment on the draft plan before it was posted for public comment. A sign-in sheet was completed at each meeting, helping to document participation. See **Chapter 7** for recommendations on enhancing the breadth of RHMC. The 2024/2025 Regional Hazard Mitigation Committee members include:

- Patricia Reynolds, Director of Planning & Economic Development—City of Newport
- Tuuli Martin, City Planner—City of Newport (left July 2024)
- Hayden McDermott*, Assistant Planner—City of Newport
- Harp Donnelly, Fire Chief—City of Newport
- Ryan Duffy, Police Chief—City of Newport
- Michael Griffith, Emergency Management Specialist—Naval Station Newport
- Cornelia Mueller, Community Planning Liaison Officer—Naval Station Newport

- Rae-Anne Culp, Mitigation Planning Supervisor & State Hazard Mitigation Officer—RIEMA
- Paige Myatt*, Director of Climate Resilience—Aquidneck Land Trust (previously Aquidneck Island Regional Resilience Coordinator at Rhode Island Infrastructure Bank)
- Ronald Wolanski, Town Planner—Town of Middletown
- Anita Guo*, Principal Planner/GIS Manager—Town of Middletown
- Jim Peplau, Fire Chief—Town of Middletown (left October 2024)
- Tim Beck, Detective Lieutenant, Deputy Director Middletown Emergency Management—Town of Middletown
- Lea Hitchen*, Town Planner—Town of Portsmouth
- Aaron Lindo, Assistant Town Planner – Town of Portsmouth
- Ray Perry, Director of Emergency Management—Town of Portsmouth
- Paul Ford, Fire Chief—Town of Portsmouth
- Carissa Mills, Hazard Mitigation/Resiliency Planner—VHB (left March 2025)
- Tom Charboneau*, Common Fence Point Preparedness Committee Member—Portsmouth Resident
- Melissa Welch*, Middletown Conservation Committee Member—Middletown Resident
- Tom Gibson*, Friends of the Waterfront, Newport Bridge Realignment Property Advisory Committee, Elizabeth Brook Working Group Member—Newport Resident

* *denotes Aquidneck Island resident*

Additional input was received from:

- Conexión Latina Newport, an organization established to support the Hispanic/Latino community in Newport
- Portsmouth neighborhood preparedness committees: Common Fence Point, Prudence Island, Island Park, and the Hummocks.

The Planning Process

This 2025 RHMP update is the result of a seven-step process that was initiated in April 2024 with the establishment of the RHMC. The Town hired a consultant to assist with this planning effort. Prior hazard mitigation plans served as the foundation for this update, with demographic information and hazard histories updated where needed. The following steps summarize the full planning process.

Step 1: Committee Organization and Project Initiation

The RHMC first met virtually on April 8, 2024, to discuss the mitigation goals and hazards of concern for Aquidneck Island. This list of hazards was crafted from prior mitigation plans and the state's Municipal Resilience Program Community Resilience Building (CRB) workshop Summary of Findings. The list of hazards largely remained the same, with some discussion about which are of highest concern for the island. The RHMC was able to quickly come to an agreement on the eight goals of this mitigation plan effort, including identifying Environmental Justice areas. At the end of this meeting, the RHMC discussed the questions to be included in an online public survey that was promoted along with the public workshops.

Step 2: Planning for Public Outreach and Stakeholder Engagement

The next step in the planning process was to educate the public about the hazard mitigation plan, identify additional areas of concern, and brainstorm what mitigation actions might help the island be more resilient. During this early phase, the RHMC developed a comprehensive list of interest groups, businesses, nonprofits, community organizations, and education centers to invite to participate in the data gathering and plan review process. For the list of invitees, see **Appendix A**.

To support public outreach efforts, the Town of Portsmouth hosted the project's website, which provided a link to the survey, background materials, a list of RHMC members, a calendar of events, and contact information.

On May 30th, 2024, the RHMC hosted an afternoon Hazards and Vulnerability Workshop in Portsmouth open to the public and invited stakeholders. Identical workshops were hosted in Newport on June 6th, 2024, and in Middletown on June 20th, 2024. The three workshops were promoted on municipal websites, the project home page, social media, and print media. Members of the interest groups previously identified were sent a direct email inviting them to participate in the workshops. Nearly 100 people attended the three events and 138 people participated in the online survey.

Over the summer, the consultant compiled the results from the survey and organized the data from the public workshops. During this time, each municipality reported on the status of its prior mitigation actions. Incomplete actions were brought over into this 2025 plan. Newport has the newest plan (dated 2022), so it was expected that many of their actions would move into this RHMP.

Step 3: Review of Municipal Capabilities

Each community also worked with the consultant on updating an inventory of municipal capabilities related to hazard mitigation. These include plans, policies, staffing, and programs already in place that support community resilience across a variety of hazards. It is important to highlight these capabilities in the RHMP and show how they support the hazard mitigation efforts.

Step 4: Public Outreach Results and Identification of Hazard Mitigation Actions

On August 6, 2024, the RHMC met again to discuss the feedback from the public workshops, review the list of incomplete prior municipal mitigation actions, and develop a list of future regional hazard mitigation actions. In this discussion, the committee synthesized comments from each town's public workshop and the online survey to focus on regional efforts for Aquidneck

Island as a whole. Many of the mitigation actions discussed came from public input or were part of prior planning efforts.

Step 5: Identification of Regional Hazard Mitigation Actions

Following this meeting, the consultant created a worksheet for each regional action. At the follow-up meeting on September 6, 2024, the team met virtually to discuss action details such as timing, funding, identifying a champion, obstacles, etc. This meeting, along with other key meeting milestones in the planning process, are summarized in **Table 9**. The RHMC was invited to participate in an anonymous survey to rank mitigation actions by priority (high, medium, or low); however, survey results were not made available for inclusion in this plan.

Step 6: Individual Community Meetings

Each community met with the consultant in September and October to focus on town- or city-specific mitigation actions. At the first meeting, the local planning group and consultant reviewed the list of vulnerable community assets and hazards and created a list of mitigation needs (see **Table 32)** in **Chapter 4: Risk Assessment**, page 87. At the follow-up meetings, mitigation action timing, obstacles, and a champion were identified. Similar to the RHMC, each local team was invited to participate in an anonymous survey to rank the priority of mitigation actions; however, survey results were not made available for inclusion in this plan.

Step 7: Public Comment on Draft Plan

The final step furthered the public input and review process with the local Councils and the general public for review and comment. See **Public Input** on page 29 for more details.

Table 9 provides a summary of the RHMC's meeting dates and planning activities.

Table 9 Planning Process

Date	Meeting Summary/Action
04/08/2024	› Virtual kick-off meeting with consultant. RHMC discussed the hazards of concern, established goals, reviewed public survey questions, and reviewed the planning process.
04/25/2024	› Project webpage, hosted on the Town of Portsmouth's website, goes live.
04/25/02024	› Hazards survey posted on project webpage and promoted via listserv and social media. Hard copies also made available at Portsmouth Town Hall. During the two-month period, 138 people responded.
May 2024	› VHB reviewed prior hazard mitigation plans, comprehensive plans, and CRB summaries of findings.
05/30/2024	› Public workshop in Portsmouth. Discussed vulnerable areas on the island and potential mitigation actions.
06/06/2024	› Public workshop in Newport. Discussed vulnerable areas on the island and potential mitigation actions.
06/20/2024	› Public workshop in Middletown. Discussed vulnerable areas on the island and potential mitigation actions.

Date	Meeting Summary/Action
July 2024	› Individual efforts by each municipality to update the status of prior mitigation actions and determine which to move forward into this new update.
08/06/2024	› Second meeting of the RHMC, at which mitigation actions were discussed, finalized, and prioritized. RHMP plan reviewed by the RHMC. RHMP distributed to Planning Board and Town Council and posted for public comment and sent to neighboring towns. RHMC received comments from public and Town Council. Plan sent to RIEMA for review and FEMA for approval.
09/06/2024	› Follow-up RHMC meeting held virtually to define action details, including timing, potential funding sources, lead/champion roles, and implementation obstacles. Final adjustments were made to mitigation actions prior to submission.
05/19/2025	› Final RHMC meeting held virtually to review final report and agree to submit to RIEMA for review and approval prior to submission to FEMA.

Documents Reviewed

For this mitigation planning effort, the consultant reviewed available plans, studies, reports, and technical research. Pertinent information, including prior mitigation actions, was incorporated into the RHMP. **Table 10** below summarizes the resources reviewed.

Table 10 Documents Reviewed

Name	Relevant Contents	Application for the RHMP
2018 Hazard Mitigation Plan Update, Town of Portsmouth, Rhode Island Strategy for Reducing Risks from Hazards in Middletown, Rhode Island: A Multi-Hazard Mitigation Strategy, 2019 Update 2022 Newport Hazard Mitigation Plan Update, City of Newport, Rhode Island	Review of demographics, hazards of concern, hazard mitigation committee members, and mitigation actions.	Used as a starting point for hazards of concern, impacts, and mitigation actions. Status of prior mitigation actions were documented.
Portsmouth Municipal Resilience Program Community Resilience Building Workshop Summary of Findings, September 2019 Middletown Municipal Resilience Program Community Resilience Building Workshop Summary of Findings, September 2020 Newport Municipal Resilience Program Community Resilience Building Workshop Summary of Findings, September 2020	Community-driven assessment of hazard and climate change impacts and to surface projects, plans, and policies for improved resilience.	Top hazards, capabilities, and concerns were brought into the discussion for this plan. Support for proposed mitigation actions was identified based on strategies and priorities outlined in previous planning documents, as well as through stakeholder input.
Portsmouth, RI Climate Resiliency Planning & Financing Strategy, 2021	Actions to advance the municipal climate resilience goals. Reviews of	

Name	Relevant Contents	Application for the RHMP
Middletown, RI Climate Resiliency Planning & Financing Strategy, 2023	highest priority capital needs and recommendations for sustainable funding.	Top hazards, assets, and high-priority actions identified were brought into the discussion for this plan.
Newport, RI Climate Resilience and Financing Prioritization Report, 2022		
Aquidneck Island Strategic Plan, 2016	Outline of Aquidneck Island Planning Commission’s vision and strategic goals.	Reviewed for challenges faced by the region.
Rhode Island Coastline Coastal Storm Risk Management, Final Integrated Feasibility Study and Environmental Assessment, 2023	Review of flood risk along the shoreline and coastal tributaries of Rhode Island.	Identified problems and opportunities in the focused study areas in Portsmouth, Middletown, and Newport.
Military Installation Resilience Review (MIRR), 2022	Summary of ways to build resilience and enhance hazard readiness and response for Navy assets on Aquidneck Island.	Identified support for proposed mitigation actions.
North End Urban Plan, 2021	Identifies strategies for equitable redevelopment in Newport’s North End, including climate-resilient infrastructure, improved stormwater management, and measures to reduce vulnerability in historically underserved areas.	Identified development trends and potential hazards of concern in this low-lying coastal area.
Prudence Community Wildfire Protection Plan, 2018	Review for wildfire mitigation plans and obstacles on Prudence Island.	Risk information was brought into the section on Brushfires.
Maidford River Restoration Pilot Project, 2023	Review of the proposed solutions to water quality and flooding problems in the Maidford River.	Mitigation action to reduce flooding of the Maidford River was brought forth in this plan.
Memo: Aquidneck Island Climate Resilience Leadership Exchange: Summary of Findings, 2023	Summary of climate-resilient infrastructure projects within each municipality and regionally across the island.	Recommendations for educating the public and improving regional coordination were brought forward as mitigation actions in this plan.
Town of Portsmouth, RI FY 2020–2030 Capital Requests	List of projects that are needed to protect public health and safety or maintain current facilities and infrastructure.	Mitigation or resiliency actions that are in the Capital Improvement Plan were brought forward into this plan. Identified support for proposed mitigation actions.
Town of Middletown, RI, Approved Consolidated Municipal Budget Capital Improvement Program FY 2022–FY 2026		
City of Newport, RI Capital Improvement Program FY 2024–2028		
Portsmouth Comprehensive Community Plan, 2022	Review of each municipality’s vision and goals for long-term planning and development.	Cited information throughout RHMP on local history, planning areas, and support of mitigation actions.
Comprehensive Community Plan, Middletown, RI, 2022		
City of Newport Comprehensive Land Use Plan, 2017		

<table>
<tr><th>Name</th><th>Relevant Contents</th><th>Application for the RHMP</th></tr>
<tr><td>Town of Portsmouth Code of Ordinances, 2022</td><td rowspan="3">Review of zoning regulations relating to floodplain and stormwater management.</td><td rowspan="3">Cited local ordinances as they relate to floodplains.</td></tr>
<tr><td>Town of Middletown Code of Ordinances, 2024</td></tr>
<tr><td>City of Newport Code of Ordinances, 2024</td></tr>
<tr><td>Federal Emergency Management Agency (FEMA) Flood Insurance Study (FIS), Newport County, Rhode Island, 2021</td><td>Flood hazard data for all three communities.</td><td>Used information on sources of flooding.</td></tr>
<tr><td>State of Rhode Island Hazard Mitigation Plan, 2024</td><td>Statewide hazards of concern and history.</td><td>Cited information throughout on hazard descriptions and history.</td></tr>
<tr><td>Rhode Island Department of Environmental Management (RIDEM) 2023 Annual Report to the Governor on the Activities of the Dam Safety Program</td><td>Overview of dam classification and safety status.</td><td>Information was reported in the Background information on dams, as well as in the Hazards of Concern, Dam Failure section.</td></tr>
</table>

Public Input

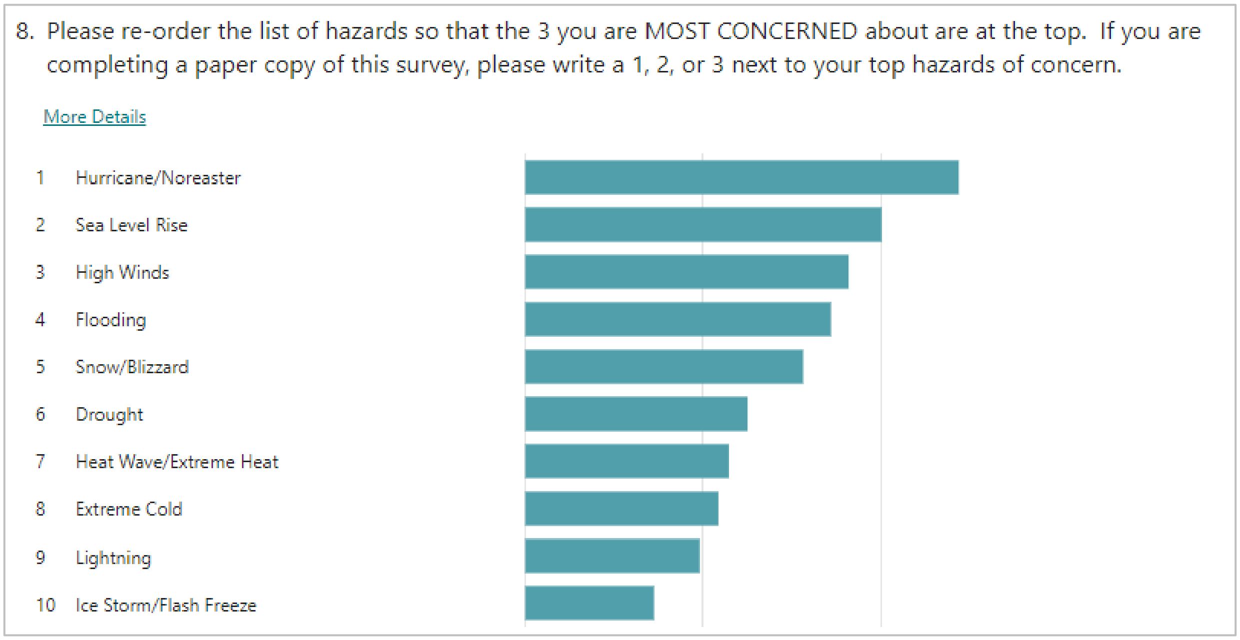
This hazard mitigation plan benefits from the various public input strategies used by the RHMC during the drafting process and prior to the plan's adoption by the municipal councils. Public input for the Aquidneck Island Regional Hazard Mitigation and Flood Management Plan was primarily collected through a public survey, public workshops, a project website, and an invitation to comment.

Survey

Early in the planning process, the RHMC promoted and distributed an anonymous "Hazard Perceptions" survey to collect residents' opinions on the most concerning hazards and neighborhoods. The survey was available digitally on the project's website, and paper copies were available at Portsmouth Town Hall. The RHMC emailed invitations to specific interest groups (identified in **Appendix A**) to encourage them to take the survey. Overall, 138 individuals participated in the survey.

In the survey, Nor'easters, sea level rise, high winds, flooding, and severe winter weather emerged as the most prevalent concerns. The survey also provided the RHMC with a list of flood-prone locations and ideas for making the island more resilient. The RHMC used the input from the survey to focus its mitigation planning efforts. See **Appendix B** for more specific survey results and **Figure 10** for an example from the Hazards Perception Survey

Figure 1 Example Question from the Hazards Perception Survey



Public Workshops

The three municipalities on Aquidneck Island are very community-oriented, and the RHMC felt it would be advantageous to offer local residents and stakeholders a workshop to share ideas. Three identical workshops were held in Portsmouth, Newport, and Middletown. Nearly 100 individuals participated in activities to identify areas of concern, recommend mitigation actions, and highlight existing local strengths—such as emergency response programs, infrastructure, or land use policies—to support community resilience.

Aquidneck Island municipal representatives identify areas at risk.

Common Fence Point Neighborhood Preparedness Committee members discuss potential impacts.

Invitation to Comment

After the RHMC reviewed the draft plan, the RHMC published a digital copy of the draft on the project website and made hard copies available at Portsmouth Town Hall, Middletown Town Hall, and Newport City Hall. The RHMC then extended an invitation to the general public and emailed stakeholders asking for their comments and suggestions on the draft. The local planners in neighboring communities of Bristol, Tiverton, and Jamestown were also emailed a copy of the plan for review.

The public comment period on the draft plan concluded on March 26, 2025. In total, 82 comments were received. Comments ranged from suggestions for additional mitigation actions and identification of additional hazards, to general comments on document style, format, and content organization. Comments were reviewed and where feasible, changes were incorporated into the document. For a complete list of public comments, see **Appendix B**.

The plan was distributed to all neighboring municipalities, including Jamestown, Bristol, Little Compton, Tiverton, North Kingstown, and Narragansett with an invitation to review and provide comments.

Reviews and comments from RIEMA and FEMA were also incorporated in the plan prior to its adoption by the local councils.

3

Natural Hazards

Hazards of Concern

The 2024 State of Rhode Island State Hazard Mitigation Plan Update, prior local Hazard Mitigation Plans, and Municipal Resilience Program Community Resilience Building Workshop Summaries of Findings were used as a starting point for identifying hazards that pose the largest threat to Aquidneck Island. **Table 11** below summarizes the hazards identified by the State and the RHMC. Impacts to a particular location are noted as such.

Table 11 Hazards Identified by the Regional Hazard Mitigation Committee

Natural Hazards Identified by the State	Identified by the RHMC	RHMC Identification Notes
Severe Winter Weather		
Ice Storm	✓	Discussed as winter storms.
Snow	✓	
Flood		
Riverine	✓	Combined all flooding as a hazard. Being a coastal area, flooding from inland waterways and the Narragansett Bay can have compounding effects.
Coastal	✓	
Flash	✓	
Urban/Street	✓	
High Wind	✓	
Extreme Heat	✓	
Hurricane and Tropical Storms		
Storm Surge	✓	Included with flooding.
Nor'easter	✓	
Extreme Cold	✓	
Thunderstorm	✓	
Hail	✓	
Lightning	✓	

Natural Hazards Identified by the State	Identified by the RHMC	RHMC Identification Notes
Dam Failure	✓	
Fire		
Urban	–	Not covered by this natural hazard plan. While still a threat to Aquidneck Island, these are typically man-made disasters.
Wildfire/Brushfire	✓	
Sea Level Rise	✓	
Infectious Disease	–	Not covered by this natural hazard plan. While still a threat to Aquidneck Island populations, disease is generally considered a biological event, not meteorological, environmental, or geological.
Drought	✓	
Earthquake	✓	
Tornado	✓	
Human-Caused Hazards		
Cyber Security	–	
Chemical Incident	–	
Terrorism	–	
Biological Incident	–	
Radiological Incident	–	
Civil Unrest	–	
Technological Hazards		
Infrastructure Failure	–	

Other natural hazards such as landslides and volcanoes are not likely on Aquidneck Island due to the island's flat topography and lack of appropriate landforms. Although the COVID-19 pandemic was a declared biological disaster affecting the State and Newport County from 2020 through 2023, it is not covered in this RHMP. Lessons learned from the pandemic are being carried over to respond to and mitigate future disasters of all types via the local Medical Points of Dispensing Plans developed and maintained under the auspices of the Rhode Department of Health.

In addition to the hazards of concern identified by the State, the RHMC decided to include two additional hazards, tsunamis and space weather, in this plan.

History of Past Disaster Declarations in Newport County

As of October 2024, there have been 17 declared natural disasters in Newport County, Rhode Island, since May 1953. **Table 12** summarizes both the State Executive Orders (EO), Federal Emergency Declarations (EM), and Major Disaster Declarations (DR) that have impacted Aquidneck Island.[10]

Table 12 Natural Disasters That Have Impacted Aquidneck Island

Incident Date (Start)	ID	Incident Type
08/31/1954	DR-23-RI	Hurricane (Carol)
02/07/1978	EM-3058-RI	Snowstorm
02/16/1978	DR-548-RI	Snowstorm
10/15/1985	DR-748-RI	Hurricane (Gloria)
08/26/1991	DR-913-RI	Hurricane (Bob)
03/16/1993	EM-3102-RI	Snowstorm
01/24/1996	DR-1091-RI	Snowstorm
02/17/2005	EM-3182-RI	Snowstorm
01/22/2005	EM-3203-RI	Snowstorm
03/12/2010	EM-3311-RI	Severe Storms and Flooding
03/12/2010	DR-1894-RI	Severe Storms and Flooding
08/26/2011	EM-3334-RI	Hurricane (Irene)
08/27/2011	DR-4027-RI	Hurricane (TS Irene)
10/29/2012 Emergency Declaration	EM-3355-RI	Hurricane (Sandy)
11/03/2012 Disaster Declaration	DR-4089-RI	Hurricane (Sandy)
02/08/2013	DR-4107-RI	Severe Storm
01/26/2015	DR-4212-RI EO-15-02	Severe Winter Storm and Snowstorm
08/21/2021	EM-3563-RI EO 21-88	Hurricane (Henri)
01/28/2022	DR-4653-RI EO 22-10	Snowstorm
09/10/2023 Disaster Declaration	DR-4753-RI	Severe Storms, Flooding, and Tornadoes
12/17/2023 Disaster Declaration	DR-4765-RI	Severe Storms and Flooding
12/20/2023	EO-23-10	High winds and extreme rainfall
01/10/2024	DR-4766-RI EO 24-01	High winds and extreme rainfall
02/12/2024	EO 24-03	Winter Storm

10 Rhode Island Governor's Archive of Executive Orders (archived 2015 to present only) https://governor.ri.gov/executive-order-archive; and Federal Emergency Management (FEMA) declared disasters in Rhode Island https://www.fema.gov/disaster/declarations.

Methodology

Over the past five years, members of the RHMC have participated in hazard mitigation plan updates and community resilience building workshops at which the hazards of concern were identified and ranked. As a consistency check, these results were reviewed by the RHMC at the kickoff meeting. There were slight variations in risk perception from town to town, but overall, the major hazards of concern were the same.

The RHMC used the following scale to identify risk levels.

Probability of Future Occurrence	
Highly Likely	Near 100 percent probability within the next year considering current climate trends
Likely	Between 10 percent and 100 percent probability within the next year or at least one chance in the next 10 years considering current climate trends
Possible	Between 1 percent and 10 percent probability within the next year or at least one chance in the next 100 years considering current climate trends
Unlikely	Less than 1 percent probability in the next 100 years considering current climate trends
Damage Extent	
Minor	Some local property damage but not town-wide; no damage to public infrastructure, essential services not interrupted; no injuries or fatalities
Serious	Scattered major property damage; some minor infrastructure damage; wider geographic area (several towns); essential services are briefly interrupted; some injuries and/or fatalities
Extensive	Consistent major property damage; major damage to public infrastructure (taking up to several days for repair); essential services are interrupted from several hours to several days; many injuries and fatalities
Catastrophic	Property and public infrastructure destroyed; essential services stopped; hundreds of injuries and fatalities

Based on a combination of probability of future occurrence, damage extent, and impacts, the RHMC assigned each hazard a level of concern:

- **Low:** Not expected to occur with any frequency, damages will be limited
- **Medium:** Will occur within the next 10 years but the municipalities have resources to reduce risks
- **High:** Expected to occur within the next five years and is a major concern for the municipalities; island-wide impacts

Table 13 below summarizes the hazards of concern for the RHMC using this ranking scale.

Table 13 Hazards Ranked

Hazard	Probability of Future Occurrence	Damage Extent	Level of Concern/Risk Rank
Hurricane/Nor'easter	Highly likely	Extensive	High
Flooding (heavy rain, runoff, flash, inland, high tide, storm surge)	Highly likely	Serious	High
Severe Winter Weather	Highly likely	Serious	High
High Wind	Highly likely	Minor	Medium
Drought	Likely	Serious	Medium
Heat Wave	Highly likely	Minor	Medium
Extreme Cold	Likely	Minor	Medium
Sea Level Rise[11]	Highly likely	Serious	Medium
Lightning/Thunderstorms/Hail	Highly likely	Minor	Low
Brushfires	Highly likely	Minor	Low
Dam Failures	Possible	Serious	Low
Tornadoes	Possible	Serious	Low
Earthquakes	Possible	Serious	Low
Tsunami	Possible	Serious	Low
Space Weather (Solar Flares, Solar Storms, and Electromagnetic Pulses)	Unlikely	Serious	Low

This RHMP does not profile climate change as an independent hazard. According to the National Climate Assessment and Development Advisor Committee January 2013 Draft Climate Assessment Report, "Extreme weather events have become more frequent during the past half-century, and this trend is projected to continue.[12] For instance, more frequent intense precipitation events may translate into more frequent flooding episodes. The National Climate Assessment and Development Committee has documented that the average temperature across the United States has increased 1.5°F since 1895, with much of the increase occurring since 1980.

Weather events have, and will, continue to become more intense and frequent and will result in health- and livelihood-related impacts such as water supply, agriculture, transportation, and energy. The impact of dynamic storm events includes, but is not limited to, more frequent and intense heat waves, increases in ocean and freshwater temperatures, frost-free-days, heavy downpours, floods, sea level rise, droughts, and wildfires.[13]" As such, this RHMP treats climate change as an ongoing amplifier to the identified natural hazards.

11 Sea level rise is a slow phenomenon. Impacts of which may not be measurable within the span of this 5-year plan.

12 IPCC, 2012 - Field, C.B., V. Barros, T.F. Stocker, D. Qin, D.J. Dokken, K.L. Ebi, M.D. Mastrandrea, K.J. Mach, G.-K. Plattner, S.K. Allen, M. Tignor, and P.M. Midgley (Eds.) Available from Cambridge University Press, The Edinburgh Building, Shaftesbury Road, Cambridge CB2 8RU ENGLAND, 582 pp.

13 National Climate Assessment and Development Advisory Committee (NCADAC) January 2013 Draft Climate Assessment Report. http://ncadac.globalchange.gov/

The following subsections are organized by the level of risk as identified in **Table 13.** Climate change impacts will be mentioned for each hazard. Local historic records are not available for all hazards. Where indicated, Newport County data was used in the absence of more local data.

Hurricanes

Description

Hurricanes are a type of tropical storm. Tropical and extratropical storms are two distinct types of weather systems characterized by their formation, structure, and associated meteorological conditions.

Bowen's Wharf after Hurricane Sandy 2012. Photo credit: Newport Daily News

Tropical storms originate over warm ocean waters, typically in tropical and subtropical regions. They form when warm, moist air rises, creating an area of low pressure at the surface. Warm ocean waters provide the heat and moisture necessary for their development. Tropical storms have a well-defined center—called the "eye"—surrounded by bands of thunderstorms. They have warm core temperatures, meaning that the strongest winds and heaviest rainfall are concentrated near the center. Their primary energy source is the heat released when moist air rises and condenses into clouds. Tropical storms are often driven by easterly trade winds and move generally west and north, though their paths can be influenced by various atmospheric factors.[14]

There are three categories of tropical storms:

- **Tropical Depression**: maximum sustained surface wind speed is less than 39 mph
- **Tropical Storm**: maximum sustained surface wind speed from 39–73 mph
- **Hurricane**: maximum sustained surface wind speed exceeds 73 mph

Hurricanes are categorized according to the Saffir-Simpson Hurricane Wind Scale (**Table 14**) with ratings determined by wind speed and central barometric pressure. Hurricane categories range from one through five, with Category 5 being the strongest (winds greater than 155 mph). The Saffir-Simpson scale is based primarily on wind speeds and includes estimates of barometric pressure and storm surge associated with each of the five categories. It is used to give an estimate of the potential property damage and flooding expected along the coast from a hurricane landfall.

14 2024 State of Rhode Island Hazard Mitigation Plan.

Flooding at JT Connell Highway on Sept 2, 2021, after the remnants of Hurricane Ida.

Underground catch basin (left) and road (right) collapsed after heavy rainfall from the remnants of Hurricane Ida in 2021. Photo credit: Portsmouth Police Department.

Table 14 Saffir/Simpson Hurricane Wind Scale[15]

WIND SPEED	TYPICAL EFFECTS
Category 1—Weak 74–95 mph (64–82kt)	*Minimal Damage:* Damage is primarily to shrubbery, trees, foliage, and unanchored mobile homes. No real damage occurs in building structures. Some damage to poorly constructed signs.
Category 2—Moderate 96–110 mph (83–95kt)	*Moderate Damage:* Considerable damage to shrubbery and tree foliage; some trees are blown down. Major structural damage to exposed mobile homes. Extensive damage to poorly constructed signs. Some damage to roofing materials, windows, and doors; no major damage to the building integrity of structures.
Category 3—Strong 111–130 mph (96–113kt)	*Extensive Damage:* Foliage torn from trees and shrubbery; large trees blown down. Practically all poorly constructed signs are blown down. Some damage to roofing materials of buildings, with some window and door damage. Some structural damage to small buildings, residences, and utility buildings. Mobile homes are destroyed. Minor amount of failure of curtain walls (in framed buildings).
Category 4—Very Strong 131–156 mph (114–135kt)	*Extreme Damage:* Shrubs and trees are blown down; all signs are down. Extensive roofing material and window and door damage occurs. Complete failure of roofs on many small residences and complete destruction of mobile homes. Some curtain walls experience failure.
Category 5—Devastating Greater than 155 mph (135kt)	*Catastrophic Damage:* Shrubs and trees are blown down; all signs are down. Considerable damage to roofs of buildings. Very severe and extensive window and door damage. Complete failure of roof structures on many residences and industrial buildings, and extensive shattering of glass in windows and doors. Some complete buildings fail. Small buildings are overturned or blown away. Complete destruction of mobile homes.

Location

Aquidneck Island's close proximity to the Atlantic Ocean renders it particularly susceptible to hurricanes and the resulting loss of human life and property.

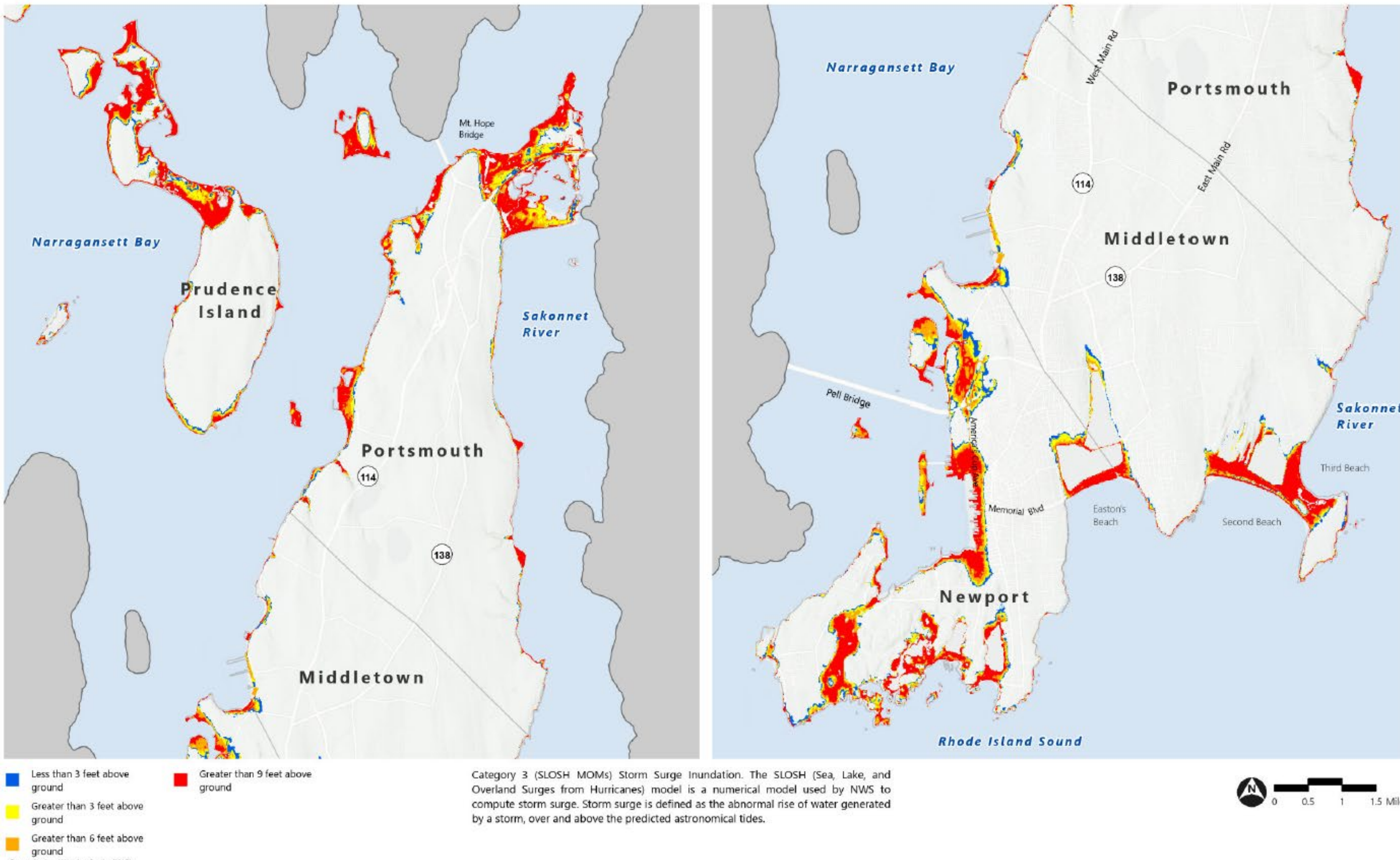
Extent (Event Magnitude)

Hurricanes that reach Rhode Island are usually weak (Category 1) or downgraded tropical systems. While Category 1 hurricanes and tropical systems have relatively low wind speeds, the storms can still bring a lot of rain and storm surge, which can cause extensive damage to the coastal areas of the island. **Figure 11** illustrates the island's susceptibility to storm surge based on a Category 3 Hurricane.

15 National Weather Service, National Hurricane Center

Figure 11 Hurricane Storm Surge Inundation—Category 3 Hurricane

Aquidneck Island Regional Hazard Mitigation and Flood Management Plan | Rhode Island



Category 3 (SLOSH MOMs) Storm Surge Inundation. The SLOSH (Sea, Lake, and Overland Surges from Hurricanes) model is a numerical model used by NWS to compute storm surge. Storm surge is defined as the abnormal rise of water generated by a storm, over and above the predicted astronomical tides.

Impact and Damage Extent

Hurricane-strength storms can cause coastal and inland flooding. Extensive rain and flooding can damage homes and roads and cripple the island. The high winds can down power lines and trees and damage older structures. During extremely dangerous conditions, municipalities may elect to open emergency shelters. Damage extent is dependent upon the size and timing of the storm. A slow-moving storm may bring more rain to the area than a fast-moving storm.

Impacts from Hurricane Irene in 2011 included heavy rain, inland flooding, and wind damage. In 2012, Hurricane Sandy caused extensive coastal erosion and town-wide power outages throughout the island. See **Chapter 4: Risk Assessment** for the wind impacts from a probable Category 2 hurricane.

Secondary Hazards—Hurricane Spawned Tornadoes

While Rhode Island is not traditionally considered a tornado-prone area, tornadoes can develop in association with hurricanes. These events typically occur in the forward-right quadrant of the hurricane as it approaches or makes landfall, due to the combination of wind shear and convective activity in that region. Though these tornadoes are often relatively weak, they can still contribute to localized structural damage and safety risks – particularly in exposed or already weakened areas. Emergency planning for hurricanes should therefore include an understanding of this secondary hazard and potential overlapping warning alerts.

History

Since 1851, Newport County has experienced 68 hurricanes of varying magnitude.

In 1985, **Hurricane Gloria** left the area without power for three days. Along with the interruption of school and business activity, the roof of the Defiance Fire Station was destroyed.

The largest recorded hurricane to cross over Aquidneck Island was **Hurricane Bob** in 1991, a Category 2 storm at landfall.[16] Bob brought sustained winds of 100 mph and gusts up to 125 mph, causing widespread damage. Nearly 60 percent of Rhode Island lost power, and coastal flooding and beach erosion were reported throughout Aquidneck Island. Total damages in Rhode Island were estimated at over $115 million.

In 2011, **Hurricane Irene** hit Aquidneck Island as a tropical storm. Despite the relatively low wind speeds, sustained winds over a six- to 12-hour-long duration resulted in widespread tree damage and power outages to roughly half a million customers throughout the state. Aquidneck Island experienced two days of complete power outage. Numerous trees, poles, and wires were downed throughout the area. The island experienced storm surge, debris, and road flooding. Collective effects throughout Massachusetts and Rhode Island resulted in one fatality, no injuries, and $127.3 million in property damage.[17]

In October 2012, **Hurricane Sandy** severely impacted coastal Rhode Island as it came ashore with tropical storm strength winds. Aquidneck Island was mainly impacted by waves and high winds.

16 NOAA Historical Hurricane Tracks (accessed July 2024) https://bit.ly/3ywNxOx

17 NOAA Storm Event Database (accessed July 2024).

Tree damage was widespread. Newport's downtown area experienced extensive coastal flooding. Easton's Beach and associated structures and the Cliff Walk were damaged by Sandy's 12-foot waves. In Middletown, there was extensive damage to Sachuest Point Road and a mechanical failure of the Wave Avenue pumping station's elevated generator.

Tropical Storm Isaias (downgraded from a hurricane) knocked out power to tens of thousands of Rhode Island residents on the evening of August 4, 2020. Although there were no reported damages in Newport County, it is likely that heavy rain and strong winds led to tree damage and downed wires.

Tropical Storm Henri (downgraded from a hurricane) brought heavy rain and winds up to 70 mph to the area on August 22, 2021. Approximately 60 homes in Newport County were damaged by the storm. Multiple trees and wires were down around the island.

Probability of Future Occurrence

Likely.

Climate Change Impacts

Warming global air and water temperatures may increase the intensity of hurricanes that travel along the Atlantic Coast.

Nor'easters

Description

Typically occurring during the fall, winter, and early spring, Nor'easters are known to produce heavy snow, rain, and heavy waves along the coast. Nor'easters are strong low-pressure systems that can form over land or coastal waters along the Mid-Atlantic and New England. The storm radius is often as large as 1,000 miles, and the horizontal storm speed is about 25 mph, traveling up the eastern United States coast. Sustained wind speeds of 10 to 40 mph are common during a Nor'easter, with short-term wind speeds gusting up to 70 mph. Unlike hurricanes and tropical storms, Nor'easters can sit offshore, wreaking damage for days.

Also called East Coast Winter Storms, Nor'easters are characterized by:

- A closed circulation
- Location within the quadrilateral bounded by 45°N, 65°W to 45°N, 70°W along the northern boundary, and 30°N, 85°W to 30°N, 75°W along the southern boundary.
- General movement from the south-southwest to the north-northeast
- Winds greater than 23 mph
- Above conditions that persist for at least a 12-hour period[18]

18 Hersher, et al. An East Coast Winter Storm Climatology. Northeast Regional Climate Center, Cornell University, Ithaca, NY, 2001.

The magnitude or severity of a severe winter storm or Nor'easter depends on several factors, including a region's climatological susceptibility to snowstorms, snowfall amounts, snowfall rates, wind speeds, temperatures, visibility, storm duration, topography, season, and timing of the storm – such as whether it occurs during weekday commuting hours or on a weekend when fewer people may be traveling.

The extent of a severe winter storm (including Nor'easters that produce snow) can be classified by meteorological measurements and by evaluating its combined impacts. For measuring wind effects, the Beaufort Wind Scale is a system that relates wind speed to observed conditions at sea or on land (See **Table 18**). The snow impact of a Nor'easter can be measured using the National Oceanic and Atmospheric Administration's (NOAA) Regional Snowfall Index (See the section **Severe Winter Weather**).

The Dolan-Davis classification system for Nor'easters was developed to complement the Saffir-Simpson Scale used for hurricanes.[19] According to the Dolan-Davis Scale, there are five storm classes:

- **Class I (weak):** these storms often result in minor beach erosion and no property damage, with mean wave heights of 2.0 meters
- **Class II (moderate):** these storms can cause moderate beach erosion but do not typically result in property damage, with mean wave heights of 2.5 meters
- **Class III (significant):** In these storms, erosion extends across a beach, resulting in moderate property damage, with mean wave heights of 3.2 meters
- **Class IV (severe):** During these storms, beach erosion is severe, and property damage includes loss of structures at a community-wide scale, with mean wave heights of 5.0 meters
- **Class V (extreme):** During these storms, erosion is extreme along beaches, and there is extensive damage at a regional scale, with losses in millions of dollars resulting from mean wave heights of 6.8 meters.

Location

Aquidneck Island's close proximity to the Atlantic Ocean renders it particularly susceptible to Nor'easters and the resulting damages and loss of human life and property.

Extent (Event Magnitude)

On average, Aquidneck Island experiences or is threatened by a Nor'easter every year or two.

Impact and Damage Extent

Most damage on Aquidneck Island from Nor'easters is to utilities, roads, stormwater infrastructure, personal property, trees, and snow loads on roofs. Debris in streams and streets can impair drainage and result in more flooding. Expected damages are similar to those from a hurricane but potentially with less storm surge. During the Blizzard of 1978, the largest

19 Nor'Easters | Atlantic Coastal Storms.

Nor’easter on record on the island, many people in Rhode Island were without heat and electricity for over a week.

Park Avenue, Portsmouth, January 2024 Photo credit: Portsmouth EMA

History

Table 15 Nor'easter History[20]

Date	Comments
02/06/1978	The largest Nor’easter on record, the Blizzard of 1978 brought 27-40 inches of snow across Rhode Island along with wind speeds of up to 80 mph, storm surge, and flooding along coastal areas. Many roads were impassable and homes without power for days.
02/11/1994	Major Nor’easter in the region. School closed by noon, business and highway travel disrupted.
02/18/1998	Heavy rainfall, isolated flash floods, and thunderstorms, mainly to central and southern Rhode Island. 2.16 inches of rain at T. F. Green Airport in nearby Warwick during a 12-hour period. In neighboring Middletown, the Maidford River rose out of its banks, flooding a part of a neighborhood. Reports of minor street flooding in Newport.
02/23/1998	Second Nor’easter to affect the region in less than one week brought heavy rainfall and strong winds. Winds of 47 mph reported in Newport.
03/21/1998	Spring Nor'easter brought a mixture of snow, sleet, and rain to Rhode Island. Strong northeast winds gusting from 35 to 50 mph occurred over the central and southern portion of the state.
05/25/2005	Late-season Nor’easter brought strong winds and heavy rains, which mainly affected the western part of the state.

20 NOAA Storm Event Database, Bristol County. https://www.ncdc.noaa.gov/stormevents/

Date	Comments
10/25/2005	Nor'easter entrained with energy and moisture from the remnants of Hurricane Wilma brought rainfall amounts between 2 and 2.5 inches and damaging winds to portions of Rhode Island. The high winds brought down limbs, trees, and wires, resulting in scattered power outages.
02/12/2006	A strong Nor’easter produced heavy snow and windy conditions across Rhode Island. Snowfall ranged from 9 to 14 inches.
10/30/2011	A rare and historic October Nor'easter brought very heavy snow and high winds. The Automated Surface Observing System at Newport State Airport recorded sustained winds of 36 mph and gusts to 53 mph.
02/07/2013	Winter Storm Nemo, a major snowstorm with powerful winds, resulted in severe power outages across the region for days.
02/08/2015	Long duration Nor’easter dumped 2 to 4 inches of snow in Newport County
03/2018	Three Nor’easters in the month of March brought high winds, rain, and eventually snow throughout the area.
01/29/2022	Nor’easter brought high winds, poor visibility, and snow totals in excess of 20 inches in Newport.

Probability of Future Occurrence

Highly likely.

Climate Change Impacts

Similar to hurricanes, changes in air and water temperatures may lead to stronger Nor’easters along the Atlantic Ocean. Aquidneck Island should expect stronger and more frequent severe storms.

Flooding (Heavy Rain, Runoff, Flash, Riverine Flooding, High Tide, and Storm Surge)

Description

Aquidneck Island experiences many types of flooding, none of which are independent from one another. As such, the RHMC grouped all types of flooding together as a singular hazard. Descriptions of each flooding type are included below.

Flooding in Portsmouth.
Photo credit: Portsmouth Police Department.

According to the 2024 State of Rhode Island Hazard Mitigation Plan Update, "Flooding is a localized hazard that is generally the result of excessive precipitation. Flooding is the most common natural hazard, due to the widespread geographical distribution of river valleys and coastal areas, and the attraction of human settlements to these areas. Floods are among the most frequent and costly natural disasters in terms of human hardship and economic loss."

The National Flood Insurance Program defines flooding 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."

Flooding due to **runoff** (sometimes called urban flooding) occurs when water runs over the land's impervious surfaces (paved areas, building subdivisions, and highways) during a heavy rain event. Two major environmental modifications are primarily responsible for drastically altering the rain fall-runoff relationship.

1. Making the land surface impervious by covering it with pavement and construction work
2. Installing storm sewer systems that collect urban runoff and rapidly discharge large volumes of water into stream networks and/or freshwater wetland systems

Riverine flooding occurs when heavy rainfall or snowmelt causes the water in rivers and streams to flow over their banks. The severity of the flood depends on the saturation of the surrounding ground, the amount of precipitation, and duration of the event. Riverine flooding is most likely to occur in the late summer and early spring due to snowmelt and spring rainfall.

Coastal flooding occurs when seawater inundates the land. This can occur from a storm making landfall or an unusually high tide (also called a King Tide, Spring Tide, or Moon Tide).[21] Because of development pressures and population increases on the coast, a greater number of structures are at risk to coastal flooding.

FEMA maintains regulatory flood maps called Flood Insurance Rate Maps. Insurance companies refer to these when providing coverage to homeowners. These maps are available for viewing at Town Hall, at City Hall, and online at the FEMA Map Service Center. The public can request a change in the flood zone designation for their property by applying to FEMA (Letter of Map Change) for a formal designation of the property relative to the flood zone. **Table 16** further describes flood zone designations. For more information, see https://www.fema.gov/flood-maps/change-your-flood-zone.

Table 16 FEMA Flood Zone Descriptions

Flood Zone	Description
VE	Coastal areas that have a one percent annual chance of flooding and face additional risk from fast-moving waves generated by storms. .
A	Areas with one percent annual chance of flooding where no base flood elevation has been determined.
AE	One percent annual chance of flooding and a 26 percent chance of flooding over the life of a 30-year mortgage. Base Flood Elevation is provided.
AO	One percent or greater chance of shallow riverine flooding each year, usually in the form of sheet flow, with an average depth ranging from one to three feet. These areas have a 26 percent chance of flooding over the life of a 30-year mortgage
X	Areas subject to inundation by the 0.2 percent annual-chance flood event.

High tide flooding, also called sunny-day flooding or king tide flooding, is the temporary inundation of low-lying coastal areas during exceptionally high tide events. Roads, parking lots, and storm drains are most often impacted. These vulnerable areas are not represented on FEMA flood maps.

Storm surge can be the most threatening part of a hurricane. According to the National Hurricane Center, storm surge is an abnormal rise of coastal water generated by a storm, over and above the predicted astronomical tides. The rise in water level occurs primarily due to winds pushing water toward the shore. The rise in water level due to storm surge can cause extreme flooding in coastal areas, particularly when storm surge coincides with normal high tide, resulting in storm tides reaching up to 20 feet or more in some cases. Besides the inundation of normally dry areas, battering waves associated with storm surge pose risk to structures. Strong currents associated with storm surge can severely erode beaches and coastal roads and undermine the foundations of structures.[22] These vulnerable areas are not represented on FEMA flood maps.

21 For more information on King Tides, visit https://www.savebay.org/king-tides-ri/ and The RI King Tides Initiative - MyCoast.

22 National Oceanic and Atmospheric Administration, “Storm Surge Overview,” https://www.nhc.noaa.gov/surge/ accessed July 2024.

Location

Low-lying areas around the coast, streams, and rivers are the most vulnerable to flooding. Developed floodplains at risk of flooding on Aquidneck Island include:

Portsmouth:

- Common Fence Point Neighborhood
- Park Avenue
- Island Park Neighborhood
- Glen Road
- Melville Park

Middletown:

- Atlantic Beach District
- Paradise Brook northwest of the intersection of Wapping Road and Berkley Avenue
- Some residential properties along Bailey Brook and Maidford River

Newport:

- Newport Harbor waterfront
- Washington and Thames Streets
- Area north of Easton Pond along Ellery Road
- Area north of Almy Pond
- Goat Island
- Wellington Avenue/King Park area

Several coastal areas are protected by seawalls.

According to the 2021 Flood Insurance Study, the principal flood sources on Aquidneck Island are the Atlantic Ocean, Narragansett Bay, Sakonnet River, Bailey Brook, Maidford River, and Paradise Brook.[23]

Extent (Event Magnitude)

Localized flooding can be expected regularly on Aquidneck Island. The island has been experiencing more and more high tide flooding in recent years.

Impact and Damage Extent

Hurricanes and Nor'easters usually bring coastal and riverine flooding, but flooding can also happen outside of these extreme energy systems. Along the Aquidneck Island coast, hurricanes and other storms accompanied by heavy winds and rain make the area vulnerable to personal, property, and environmental damage occasioned by flooding. Storm surge coupled with large,

23 Federal Emergency Management Agency (FEMA), Flood Insurance Study, Newport County, Rhode Island, July 6, 2021. https://map1.msc.fema.gov/data/44/S/PDF/44005CV000C.pdf?LOC=ffac1a1058e4e1f8bf7f33f59c3ecc50

fast-moving waves can scour beaches and building foundations. Coastal storms that occur during the summer are likely to catch visitors and seasonal residents off-guard, without a plan to evacuate.

Vulnerable structures include stormwater infrastructure, dams, residential homes, marinas, water supply lines, and roads.

While riverine flooding and runoff do not have the velocity associated with coastal flooding, the water can still cause damage, close roads, and collect debris. Bridges along flooded streams can be compromised as water rises and scour away at the foundations.

Saltwater intrusion into freshwater systems is another concern. Large storms push seawater up into rivers and estuaries, causing flooding and impacts on freshwater drinking resources. The timing of storms around high tide can influence the extent of the damage.

History

The most significant riverine flood on Aquidneck Island occurred in March 2010, when a 250-year storm event brought five to eight inches of rain in a short period. This led to widespread flooding across the state, with basements inundated in Jamestown and Portsmouth and millions of dollars in damages. **Table 17** summarizes this event along with other notable flood incidents in Newport County since 2010.

Table 17 History of Flooding in Newport County Since 2010[24]

Date	Damage (reported)	Comments
03/30/2010	$3.2 million	Significant statewide flood event. Five to eight inches of rain fell across Newport County. Many basements were flooded in Jamestown and Portsmouth.
07/28/2012	$5,000	Heavy rainfall and flash flooding in urban areas. A car was stuck in flood waters on East Main Road in Middletown. East Main Road was closed near Valley Road and the Shaw's plaza due to flooding. Several streets in Newport were closed due to flooding. Daley's Brook was overrunning onto Forest Road, with six to 10 inches of water over the road.
08/15/2012	$0	Heavy rainfall and flash flooding. Water overwhelmed storm drains.
06/07/2013	$15,000	Significant urban flooding from the remnants of Tropical Storm Andrea. Three to five inches of rain fell across Newport County. The underpass to the Newport Bridge was flooded and impassable. A small car was stuck in floodwaters.
07/16/2014	$5,000	Heavy rainfall and flash flooding.
07/14/2020	$0	Thunderstorms produced localized flooding. Up to one foot of flood waters on several roads. The Newport Public Library was closed due to flooding.
09/02/2021	Unknown	Remnants of Hurricane Ida caused localized street flooding.

24 NOAA National Centers for Environmental Information, Storm Event Database. https://www.ncdc.noaa.gov/stormevents/

Coastal Flooding in Portsmouth (2024). Photo credit: Portsmouth EMA

Stream flooding at the Newport Rotary. Photo credit: Newport Fire Department.

The remnants of Hurricane Ida in 2021 and the resulting heavy rainfall caused an underground catch basin in Portsmouth to collapse (see picture on page 37). Homes situated on hillsides above the coastal flood zones experienced basement flooding as water rushed down the hills and slammed into the sides of the houses. Water infiltrated into the basements, mostly through basement windows, at levels not seen in the past. Eleven of the homes needed emergency pump-out services from the Fire Department.

Probability of Future Occurrence

Flooding is highly likely, expected multiple times a year.

Climate Change Impacts

Changing climate conditions are likely to bring more rainfall events to Aquidneck Island and fewer snowstorms. More intense storms will stress the rivers and natural floodplains designed to carry floodwaters. Rising sea levels (see **Sea Level Rise** on page 62) will exacerbate the extent of flooding and push the impacts to areas that currently seem otherwise protected.

Severe Winter Weather

Description

The majority of Rhode Island lies outside the heavy snow and ice regions of the Northeast. Due to its maritime climate, Rhode Island generally experiences cooler summers and warmer winters than inland areas. However, snow and ice do occur and can cause extensive damage. The two major threats from these hazards are snow loading on rooftops and loss of power due to ice on electrical lines, which can mean loss of heat for many residents.

Snow in Portsmouth.
Photo credit: Portsmouth Police Department.

Winter storms vary in size and strength and can be accompanied by strong winds that create blizzard conditions and dangerous windchill. There are three categories of winter storms.

- A **blizzard** is the most dangerous of the winter storms. It consists of low temperatures, heavy snowfall, and winds of at least 35 mph.
- A **heavy snowstorm** is one that drops four or more inches of snow in a twelve-hour period.
- An **ice storm** occurs when moisture falls and freezes immediately upon impact.

Location

A severe winter storm can have a serious impact on private and public structures, as well as the general population throughout Aquidneck Island.

Extent (Event Magnitude)

On average, Aquidneck Island receives 37 inches of snow during the winter months. The average winter temperature (December through February) on Aquidneck Island is 40 degrees Fahrenheit.[25]

25 U.S. Climate Data https://www.usclimatedata.com/

The Sperry–Piltz Ice Accumulation (SPIA) Index (see **Figure 12**) is a scale for rating ice storm intensity based on the expected storm size, ice accumulation, and damages on structures, especially exposed overhead utility systems. The SPIA Index uses forecast information to rate an upcoming ice storm's impact from 0 (little impact) to 5 (catastrophic damage to exposed utility systems). Aquidneck Island expects at least level 1 isolated or localized utility interruptions every year due to ice.

Figure 2 Sperry Piltz Ice Accumulation (SPIA) Index.

The Sperry-Piltz Ice Accumulation Index, or "SPIA Index" – Copyright, February, 2009

ICE DAMAGE INDEX	* AVERAGE NWS ICE AMOUNT (in inches) *Revised-October, 2011	WIND (mph)	DAMAGE AND IMPACT DESCRIPTIONS
0	< 0.25	< 15	Minimal risk of damage to exposed utility systems; no alerts or advisories needed for crews, few outages.
1	0.10 – 0.25	15 - 25	Some isolated or localized utility interruptions are possible, typically lasting only a few hours. Roads and bridges may become slick and hazardous.
	0.25 – 0.50	> 15	
2	0.10 – 0.25	25 - 35	Scattered utility interruptions expected, typically lasting 12 to 24 hours. Roads and travel conditions may be extremely hazardous due to ice accumulation.
	0.25 – 0.50	15 - 25	
	0.50 – 0.75	< 15	
3	0.10 – 0.25	> = 35	Numerous utility interruptions with some damage to main feeder lines and equipment expected. Tree limb damage is excessive. Outages lasting 1 – 5 days.
	0.25 – 0.50	25 - 35	
	0.50 – 0.75	15 - 25	
	0.75 – 1.00	< 15	
4	0.25 – 0.50	> = 35	Prolonged & widespread utility interruptions with extensive damage to main distribution feeder lines & some high voltage transmission lines/structures. Outages lasting 5 – 10 days.
	0.50 – 0.75	25 - 35	
	0.75 – 1.00	15 - 25	
	1.00 – 1.50	< 15	
5	0.50 – 0.75	> = 35	Catastrophic damage to entire exposed utility systems, including both distribution and transmission networks. Outages could last several weeks in some areas. Shelters needed.
	0.75 – 1.00	> = 25	
	1.00 – 1.50	> = 15	
	> 1.50	Any	

(Categories of damage are based upon combinations of precipitation totals, temperatures and wind speeds/directions.)

Source: SPIA Index

Impact and Damage Extent

The combination of wind, ice, and snow can have a crippling effect on Aquidneck Island. Heavy and/or excessive snowfall can hamper emergency response services, stress roofs, and slow plowing efforts, as well as cause power outages. The local economy slows when businesses are closed due to winter weather. Heavy snow and ice can take down trees, knock out power, block roads, and damage structures. Falling trees have taken out power lines, damaged buildings, and essentially shut down the island. Particularly when ice is present, fallen trees can cause streams and drainage areas to dam up, increasing flooding. Flash freezes and icy roads from rain or high tides can also cause dangerous driving conditions.

History[26]

Aquidneck Island is subject to annual snowstorms and Nor'easters. A few of the more significant ones crippled not only Aquidneck Island but the entire state. During the blizzard of 1978, Newport County received 28 inches of snow, while other areas in Rhode Island got upwards of 40 inches. Businesses across the state were closed for several days. More than 9,000 people in Rhode Island sought refuge in makeshift shelters, hotels, and movie theaters. This blizzard is still regarded as the storm of the century, the one against which all subsequent storms are compared.

In February 2013, Winter Storm Nemo temporarily crippled the region. Power lines were downed and heavy snow hampered driving conditions. The governor declared a state of emergency and enacted a state travel ban that lasted nearly 24 hours. Strong winds and wet snow led to extensive power outages. Thirteen inches of snow fell across Newport County during this event.

Blizzard conditions were present in Newport County during a late-January 2015 winter storm. Again, the Rhode Island governor issued a travel ban to keep people off the roads. Sixteen to 19 inches of snow fell across Newport County.

In March 2018, nine to fourteen inches of snow fell throughout Newport County. Blizzard conditions were observed locally. A wind sensor on the Newport Bridge measured a wind gust of 64 mph.

In December 2020, up to seven inches of snow fell during a heavy snowstorm in southern New England. Strong damaging winds of up to 43 mph caused coastal flooding and downed trees.

In February 2021 and 2023, two more snowstorms brought heavy snow to Newport County. Aquidneck Island received up to seven inches during each storm.

Bannister's Warf, December 2020. Photo credit: Savana Dunning/ Newport Daily News

26 2022 Newport Hazard Mitigation Update and NOAA Storm Events Database for Newport County (2024).

Probability of Future Occurrence

Highly likely.

Climate Change Impacts

Aquidneck Island is likely to see less snowfall over the winter season but may see more intense blizzards when they do occur. If there is enough moisture in the atmosphere, it may fall as freezing rain, coating everything in ice. Aquidneck Island should expect more ice events.

High Winds

Description

Wind is the movement of air caused by a difference in pressure from one place to another.

Local wind systems are created by the immediate geographic features in a given area, such as mountains, valleys, or large bodies of water. National climatic events such as high gale winds, tropical storms, thunderstorms, Nor'easters, hurricanes, and low-pressure systems produce wind events in Rhode Island. Wind can cause blowing debris, interrupt elevated power and communications utilities, and intensify the effects of other hazards related to winter weather and severe storms.

The Beaufort Wind Scale[27] (see **Table 18**) is a 13-level scale used to describe wind speed and observed wind conditions at sea and on land. A wind classification of 0 has wind speeds of less than 1 mile per hour (1 kilometer/hour) and is considered calm. A higher classification of 10, with wind speeds reaching 63 miles an hour (101 kilometers/hour), blows down trees and causes considerable damage.

Table 18 Beaufort Wind Scale

Beaufort Number	Description	Wind Speed (km/h)	Observations
0	Calm	<1	Smoke rises vertically
1	Light air	1-5	Smoke drifts slowly
2	Light breeze	6-11	Leaves rustle, wind vanes move
3	Gentle breeze	12-19	Leaves and twigs on trees move
4	Moderate breeze	20-29	Dust picked up from ground
5	Fresh breeze	30-38	Small trees sway in wind
6	Strong breeze	39-51	Large branches move
7	Near gale	52-61	Trees move, hard to walk
8	Gale	62-74	Twigs break off trees
9	Strong gale	75-86	Branches break off trees
10	Whole gale	87-101	Trees uprooted
11	Storm	102-120	Buildings damaged
12	Hurricane	>120	Severe building and tree damage

27 Source: NOAA Storm Prediction Center. Developed in 1805 by Sir Francis Beaufort.

Location

Wind events are expected throughout Aquidneck Island.

Extent (Event Magnitude)

The windier part of the year lasts from approximately October 13 to April 23, with average wind speeds of more than 8.3 mph (13.3 km/h).[28]

Impact and Damage Extent

Strong wind gusts of 40 miles an hour (Beaufort Wind Scale of 8) can blow twigs and small branches from trees. Occasional gusts and sustained winds at this speed (and above) are of concern to the region. Damages from wind events range from power outages to property damage to vehicles and buildings and fallen trees and tree limbs. Previous wind events on Aquidneck Island have resulted primarily in power outages and downed tree limbs with minimal property damage. It is important that municipalities on Aquidneck Island maintain their public tree trimming programs, which reduce the likelihood of fallen trees/limbs disrupting transportation routes, taking down power lines, and/or damaging the tree canopy.

History[29]

The region has experienced multiple damaging wind events over the past decade, many of which are summarized in **Table 19**.

Table 19 Recent History of High Winds in Newport County

Date	Magnitude (mph)	Comments
02/16/2016	51	Winds gusted as high as 59 mph at the Halfway Rock station (located about four miles up the bay, north of the Newport Bridge). No significant damage was reported.
04/15/2016	35	Halfway Rock recorded sustained wind speeds of 40 mph. No damage was reported.
10/29/2017	50	Strong to damaging winds from Tropical Storm Phillipe.
03/02/2018	58	Newport State Airport in Middletown measured a wind gust to 67 mph. At 2:24 PM EST, an amateur radio operator in Newport reported a wind gust to 62 mph. At 3:20 PM EST, a tree fell on the front yard of a property near the intersection of Lawrence Avenue and Ruggles Avenue in Newport; the tree struck and killed the property owner.
02/25/2019	52	At 4:25 PM EST a weather station at Newport reported a sustained wind of 41 mph and a wind gust to 61 mph.
06/29/2019	51	At 4:17 PM EST, a weather station near Newport reported a wind gust to 59 mph.
08/08/2019	50	Tree damage in Newport.

28 WeatherSpark https://weatherspark.com/y/26159/Average-Weather-in-Newport-Rhode-Island-United-States-Year-Round accessed 06/20/2021

29 NOAA Storm Event Database (2023)

Date	Magnitude (mph)	Comments
10/16/2019	35	Rose Island weather station reported sustained winds of 43 mph.
02/07/2020	63	A weather station in Newport recorded a gust to 62 mph. The Automated Surface Observing Systems (ASOS) at Newport Airport recorded a gust to 53 mph. In Newport, multiple trees were reported down across town.
04/13/2020	50	Wind gusts to 58 mph reported.
07/14/2020	50	On Washington Street near Newport Harbor, a large tree was down. A small sailboat was blown over in the harbor. Large branches were down, with power outages, on both Bellevue Avenue and Easton's Beach.
08/25/2020	65	High winds caused damage to two boats in the harbor.
03/02/2021	53	Weather station at Rose Island recorded a gust to 58 mph. At the Newport State Airport, the ASOS had a strong wind gust of 53 mph.

Downed tree blocking a Newport road in 2018.

Probability of Future Occurrence

Highly Likely.

Climate Change Impacts

Changes in atmospheric circulation are predicted to occur. See **Hurricanes** and **Nor'easters** above.

Drought

Description

The American Meteorology Society defines drought as a continuous period of abnormally dry weather long enough to cause a serious hydrological imbalance. Drought differs from other natural hazards in that it does not occur suddenly. Rather, a drought evolves over months or even years and, while causing very little structural damage, can have profound economic, environmental, and social impacts.

There are four different ways that a drought can be defined:

1. **Meteorological:** When precipitation measurements are lower than normal. Due to climatic differences, what is considered a drought in one location may not be a drought in another location.
2. **Agricultural:** When the amount of moisture in the soil no longer meets the needs of a particular crop.
3. **Hydrological:** When surface and subsurface water supplies are below normal.
4. **Socioeconomic:** When physical water shortage begins to affect people.

Characteristics and impacts of drought differ in many ways, so it is difficult to quantify drought. The Palmer Drought Severity Index (PDSI) uses temperature and precipitation levels to determine dryness, measuring a departure from the normal rainfall in a given area. The advantage of the PDSI is that it is standardized to local climate, so it can be applied to any part of the country to demonstrate relative drought or rainfall conditions. A monthly PDSI value below -2.0 indicates moderate drought, and a value below -3.0 indicates severe drought.

The U.S. Drought Monitor tracks drought conditions in Rhode Island and throughout the nation. They create maps based on climate data, hydrologic and soil conditions, and reported impacts and observations from over 350 contributors nationwide.

Rhode Island, as with most of the United States, uses both the PDSI and the Crop Moisture Index (CMI) as indices for a drought occurrence. A derivative of the PDSI, the CMI provides information on the short-term or current status of purely agricultural drought or moisture surplus. The PDSI is most effective for determining long-term drought conditions, while the CMI is effective at ranking short-term drought.

The Rhode Island Drought Steering Committee assigns drought levels for the seven designated drought regions in the state, based on hydrological indices such as precipitation, groundwater, stream flow, and the PDSI, as well as on local supply indices such as static groundwater levels and reservoir levels. Drought planning regions include the North West Region, the North East Region, the Central West Region, the Central East Region, The Southern Region, and the Eastern Region, which includes all of Aquidneck Island.[30] The Committee issues Normal, Advisory, and Watch levels statewide. Warning and Emergency levels are issued on a regional basis and consider local conditions, source of water supply, and water storage capacity issues.

30 Rhode Island Division of Statewide Planning, State Guide Plan Element 721, Report 115. Rhode Island Water, 2030. Accessed April 7, 2025.

The U.S Drought Monitor uses a tiered classification system to describe drought severity, based on the Palmer Drought Severity Index. These categories range from D0 (Abnormally Dry) to D4 (Exceptional Drought) and are used nationally to monitor and respond to drought conditions. Each level is associated with escalating impacts on agriculture, water supply, and community health. **Table 20** outlines these drought severity categories and their potential implications for Aquidneck Island.

Table 20 Drought Severity [31]

Severity	Category	PDSI Index Value	Drought Level	Possible Impacts
Exceptional Drought	D4	-5 or less	Emergency	Widespread crop/pasture losses, shortages of water creating water emergencies.
Extreme Drought	D3	-4 to -4.9	Warning	Major crop/pasture losses, widespread water shortages or restrictions.
Severe Drought	D2	-3 to -3.9	Watch	Crop or pasture losses likely, water shortages common, water restrictions imposed.
Moderate Drought	D1	-2 to -2.9	Advisory	Some damage to crops/pastures, developing water shortages, voluntary water-use restrictions requested.
Mild Drought/Abnormally Dry	D0	-1 to -1.9	Normal	Short-term dryness slowing planting or crop growth.
Incipient Dry Spell		-0.9 or less	–	–

Location

The potential for a drought exists throughout Aquidneck Island. Although temporary drought conditions may occasionally exist in Rhode Island and affect Aquidneck Island, devastating long-term drought conditions are unlikely in this temperate region.

Extent (Event Magnitude)

According to The National Weather Service, Rhode Island receives an average of 39 to 54 inches of rain annually. Notwithstanding the same, the state experiences extended periods of dry weather. Drought has affected Rhode Island on a reoccurring basis, mostly the relatively moderate Abnormally Dry (D0) or Moderate Drought (D1) conditions.

Impact and Damage Extent

The main impacts of meteorological drought are periods of very high fire danger and low drinking water supplies. Aquidneck Island's drinking water is supplied by various surface water reservoirs throughout the state. Changes in water levels can impact not only the quantity of available water but also the quality. Drought can also diminish water quality. When river and stream levels are low, there is less water available to dilute pollutants such as agricultural runoff,

31 Drought Monitor https://droughtmonitor.unl.edu/About/WhatistheUSDM.aspx

septic effluent, and industrial discharge. This can lead to higher concentrations of contaminants, increasing the risk of waterborne illnesses and ecological harm.

Prolonged dry conditions can accelerate brushfires, especially in areas with a lot of dried vegetation. These brushfires in undeveloped areas become especially problematic when they reach urban boundaries.

Furthermore, drought conditions have been known to trigger rapid increase of gypsy moth populations in the region, as the extended period of dry weather (specifically in May and June) slows the fungus that usually keeps the gypsy moth caterpillars at bay. The moths denude trees, which can have cascading effects on the local ecosystem. The increase in fuel availability associated with forest pest damage (e.g., standing dead trees and downed woody debris in forested areas) contributes to more hazardous and extreme wildfire behavior.

History

Historically, Rhode Island has ranged from near-normal moisture conditions to moderate and severe droughts throughout the past century. Since 2000, the longest duration of drought (D1–D4) in Rhode Island lasted 36 weeks, beginning on May 19, 2015, and ending on January 19, 2016. The most intense period of drought occurred the week of September 29, 2020, when D3 affected 99.21 percent of Rhode Island land.[32]

During the drafting of the RHMP in November 2024, Aquidneck Island was experiencing abnormally dry conditions (Category D0).

Table 21 History of Droughts in Rhode Island[33]

Date	Area Affected	Category	Remarks
1930–1931	Statewide	D1/D2	Stream flow of 70% normal.
1941–1945	Statewide	D1	Stream flow of 70% normal in Blackstone and Pawtuxet Rivers.
1949–1950	Statewide	D1/D2	Stream flow of 70% normal.
1963–1967	Statewide	D1–D3	Water restrictions/well replacements common.
1980–1981	Statewide	D1	Groundwater deficient in eastern part of state. Considerable crop damage.
1987–1988	Southern part of the state	D0/D1	$25 million crop damage.
1998–1999	Statewide	D1–D3	Spring through summer, the state experienced 75% of normal flow.

32 NOAA National Integrated Drought Information System https://www.drought.gov/states/Rhode-Island. Accessed July 2024.

33 USGS; RI Water Resources Board http://www.wrb.ri.gov/work_programs_drought/Drought_Facts_110607.html; and NOAA National Centers for Environmental Information https://droughtmonitor.unl.edu/AboutUSDM/AbouttheData/DroughtClassification.aspx

Date	Area Affected	Category	Remarks
2012	Statewide	D2	January through April, meteorological drought due to precipitation levels one half of normal.
2016	Statewide	D2	August to November, Severe Drought due to below normal precipitation.
2020	Statewide	D3	September to November. Extreme Drought.
2021	Statewide	D0	March to May.
2022	Statewide	D0-D3	May to October.
2023	Statewide	D0	Abnormally Dry.

Probability of Future Occurrence

Highly likely.

Climate Change Impacts

Even though rain events may intensify due to climate change, the periods between them may be longer. Rhode Island expects longer periods of drought. According to the 2016 Rhode Island Hazard Identification and Risk Assessment, "Recent climate change studies[34] have indicated that although precipitation is projected to increase throughout this century, it will be in the form of short duration, intense, and less frequent events. In addition, it is projected by the Northeast Climate Impacts Assessment Group and the New York City Panel on Climate Change that most of this increased precipitation may occur during colder times of the year, such as winter, in the form of snow or ice. Furthermore, it is projected that the frequency and intensity of both long-term and short-term droughts throughout the Northeast will increase throughout the century with the impacts beginning to occur with a greater degree of frequency beginning in the mid-century (2050s)."

Extreme Temperatures

Description

Extreme cold may accompany winter storms or be left in their wake and can occur without storm activity. The definition of an excessively cold temperature varies according to the normal climate of a region. In Rhode Island, extreme cold usually involves temperatures below zero degrees Fahrenheit.[35]

The wind chill index attempts to quantify the cooling effect of wind with the actual outside air temperature to determine a wind chill temperature that represents how cold people and animals feel, based on the rate of heat loss from exposed skin. A wind chill index of -5 degrees Fahrenheit means that exposed skin loses heat as it would in calm air at -5 degrees Fahrenheit, even if the actual air temperature is warmer. The National Weather Service (NWS) issues a wind

34 Information derived from two recent studies: Confronting Climate Change in the Northeast, by the Northeast Climate Impacts Assessment Group, July 2007, and Climate Risk Information, by the New York City Panel on Climate Change, 2/17/09.

35 Rhode Island State Hazard Mitigation Plan 2019

chill advisory when wind chill temperatures are potentially hazardous and a wind chill warning when the situation can be life-threatening.[36]

The NWS issues heat advisories in the Northeast when the maximum expected heat index reaches 95 degrees Fahrenheit or higher for two or more consecutive days. Excessive heat warnings are issued at higher thresholds, typically a hear index of 100 to 105 degrees Fahrenheit or more, depending on regional standards.

The heat index is the temperature the human body feels when the relative humidity is combined with air temperature.

Location

An extreme heat or cold event would be a regional issue affecting Aquidneck Island and significant portions of Southern New England. Coastal regions like Aquidneck Island are generally buffered from extreme temperatures and may be spared the worst.

Extent (Event Magnitude)

The Wind Chill Temperature Index measures the extent of extreme cold, and extreme heat is generally measured through the Heat Index. Both indices provide a measure of how temperatures feel.

Table 22 Extreme Temperature Indices

Index	Threshold	Description
Heat Index	≈ 100 °F to 105 °F	Heat advisory begins regionally.
	≈ 110 °F or higher	Excessive Heat Warning begins.
Wind Chill Index	≤ -20 °F to -30 °F	Typical criteria for Cold Weather Warning (varies by locale)
	≤ -10 °F to -15 °F	Cold Weather Advisory (varies by locale)

Impact and Damage Extent

Extreme temperatures could have a serious impact on private and public structures, as well as the general population throughout Aquidneck Island. During a heat wave, water supplies for drinking and firefighting may be stressed. Extreme temperatures also add stress to the power grid and natural environments.

36 Rhode Island State Hazard Mitigation Plan 2019

Personal exposure to dangerous heat conditions may lead to heat cramps, heat exhaustion, and heat stroke. These are especially important to monitor in children, the elderly, and vulnerable populations that are not able to move to cooler conditions.

Exposure to extreme cold can lead to hypothermia and frostbite. During extended periods of extreme cold temperatures, there is a greater likelihood of frozen water pipes and service lines, increased fuel usage, and icy roads. On Aquidneck Island, the supply of natural gas used to heat homes was once a major concern but has been improved with infrastructure upgrades. The concern now is fuel redundancy—the ability of a fuel system to maintain or restore function if a single component fails.

Extreme temperatures may also lead to economic impacts such as increased energy costs, loss of productivity, and strain on healthcare systems.

History[37]

NOAA's Storm Events Database has documented the following extreme temperature events:

- In July 2011, Newport State Airport reported heat indexes of 106 to 110 degrees Fahrenheit over a five-hour period.
- In February 2015, the Newport State Airport recorded wind chills as low as 26 degrees Fahrenheit below zero.
- In February 2016, wind chills of 34 degrees Fahrenheit below zero were reported at Newport State Airport.

Probability of Future Occurrence

Likely.

Rhode Island currently experiences an average of about ren days per year with temperatures above 90 degrees Fahrenheit, and this number is projected to rise to 20 to 40 days annually by mid-century depending on emissions scenarios.[38]

Climate Change Impacts

Temperatures in Rhode Island have risen almost four degrees Fahrenheit since the beginning of the 20th century.[39] Over the coming century, extremely hot days (over 90 degrees Fahrenheit) are projected to increase in New England.[40]

While extreme cold events may still occur, they are expected to become less frequent and less severe over time, even as variability increases. Brief periods of intense cold may still result from Arctic air outbreaks. Recent climate trends show warmer winters and hotter summers across

37 NOAA Storm Events Database (2024)

38 Resilient Rhody, 2018

39 NOAA Centers for Environmental Information, State Climate Summaries 2022. https://statesummaries.ncics.org/chapter/ri/

40 Confronting Climate Change in the Northeast, by the Northeast Climate Impacts Assessment Group, July 2007

Rhode Island, with a decline in the number of days below 32 degrees Fahrenheit and a rise in high-heat events.[41]

Sea Level Rise

Description

Sea level rise is a direct result of global warming. Melting glaciers and ice sheets, accelerated by warmer ocean water and rising air temperatures, and thermal expansion of ocean water are the primary causes of sea level rise. Coastal land subsidence, or sinking land, often caused by natural geologic processes, also contributes to sea level rise. It is estimated that Rhode Island has been sinking at a rate of four inches per 100 years.[42]

In Rhode Island, hazard mitigation activities generally plan for one, three, five, or seven feet of sea level rise. This does not include the periodic storm surge event.

Location

All of the Aquidneck Island coastline is susceptible to sea level rise and associated impacts such as coastal erosion and flooding. Newport and Portsmouth are surrounded on three sides by the ocean. The south-facing sandy beaches on Aquidneck Island have seen the greatest amount of erosion due to sea level rise.

In Newport, sea level rise will cause more frequent flooding and may cause permanent destruction of the low-lying waterfront, which is the center of social tourism and economic activities. Middletown is less vulnerable to near-term sea level rise, but in the long term, projections from, the Rhode Island Coastal Resources Management Council, based on NOAA's intermediate-high scenario, estimate that sea levels could rise up to five feet by 2100. This would likely impact parcels along Wave Avenue in the Atlantic Beach District. The same five feet of sea level rise would cut off Portsmouth's Common Fence Point and Island Park neighborhoods from the rest of the island.

41 2024 State of Rhode Island Hazard Mitigation Plan

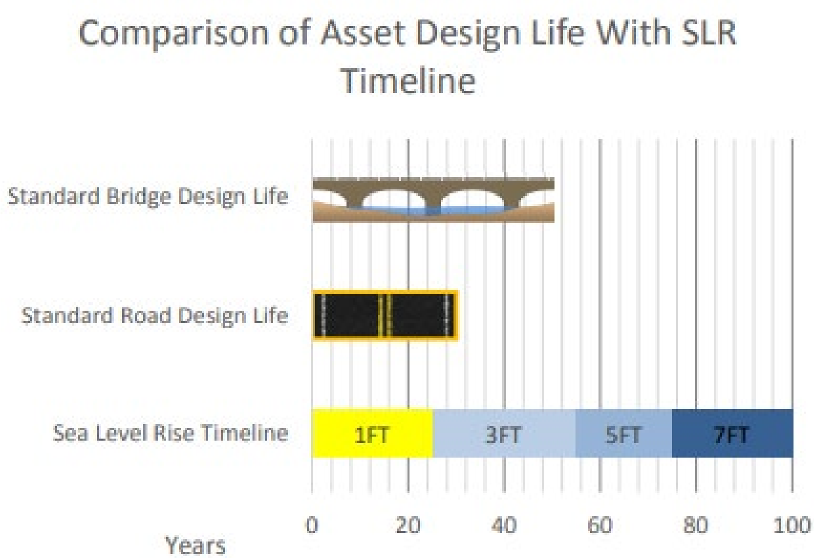
42 2024 State of Rhode Island Hazard Mitigation Plan

Erosion of the Cliff Walk in March 2022.

Flooding on Anthony Road, Portsmouth 2023.

In 2016, the Rhode Island Division of Statewide Planning developed a Technical Paper summarizing the threat of sea level rise and storm surge to transportation assets. The State has identified assets vulnerable to one, three, five, and seven feet of sea level rise. During the design life of most roads and bridges, Rhode Island will see a predicted three feet of sea level rise, as illustrated in **Figure 13**. **Table 23** lists the roads on Aquidneck Island that are most susceptible to sea level rise, and **Figure 14** and **Figure 15** map the implications of one-, three-, five-, and seven-foot sea level rise on Aquidneck Island.

Figure 13 Asset Design Life and Projected SLR.



Source: Rhode Island Division of Statewide Planning, [Municipal Transportation Assets | Rhode Island Division of Statewide Planning].

Table 23 Roads Most Vulnerable to Sea Level Rise[43]

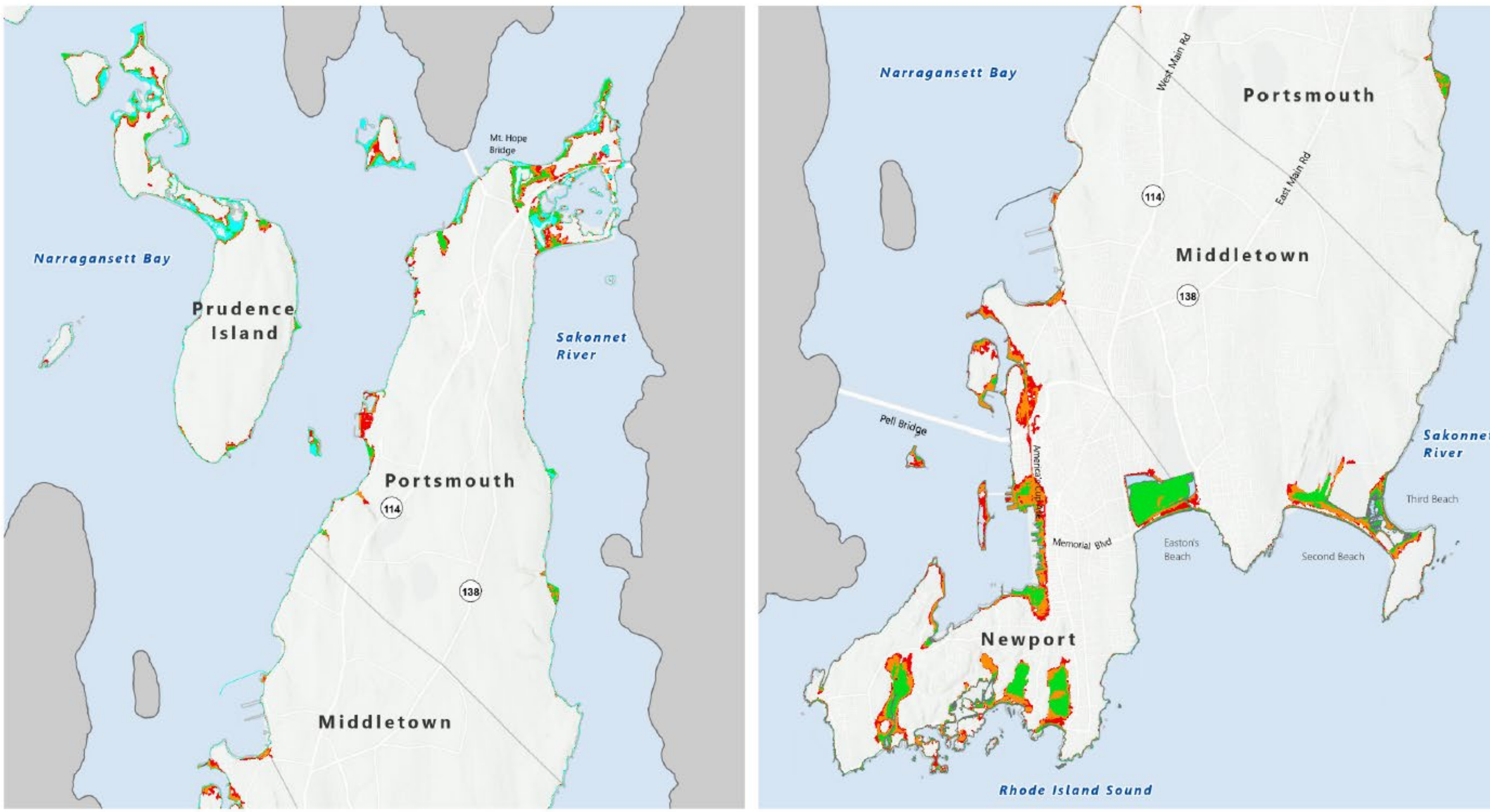
Portsmouth	Middletown	Newport
Boyds Lane	Third Beach Road	Memorial Boulevard
Narragansett Avenue*	Purgatory Road	Americas Cup Avenue
Neck Farm Road*	Hanging Rock Road	West Marlborough Street
Common Fence Point Boulevard	Sachuest Point Road	Ocean Avenue
Park Avenue	Aquidneck Avenue	State Highway 138 East and West
State Highway 24 North & South	Defense Highway	Wellington Avenue
Anthony Road	Wave Avenue	On-Ramp RI-138 West
Mount Hope Bridge		Off-Ramp RI-238 East
Lagoon Road		
South Prudence Bay Island Park		Clinton Street

*Prudence Island

43 https://planning.ri.gov/sites/g/files/xkgbur826/files/documents/sea_level/statewide/Newport.pdf , Portsmouth.pdf, https://planning.ri.gov/sites/g/files/xkgbur826/files/documents/sea_level/statewide/Middletown.pdf.

Figure 3 Sea Level Rise With Nuisance (10-year) Storms

Aquidneck Island Regional Hazard Mitigation and Flood Management Plan | Rhode Island



1 foot Sea Level Rise (High Tide) (feet above grade)

3 foot Sea Level Rise (High Tide) (feet above grade)

5 foot Sea Level Rise (High Tide) (feet above grade)

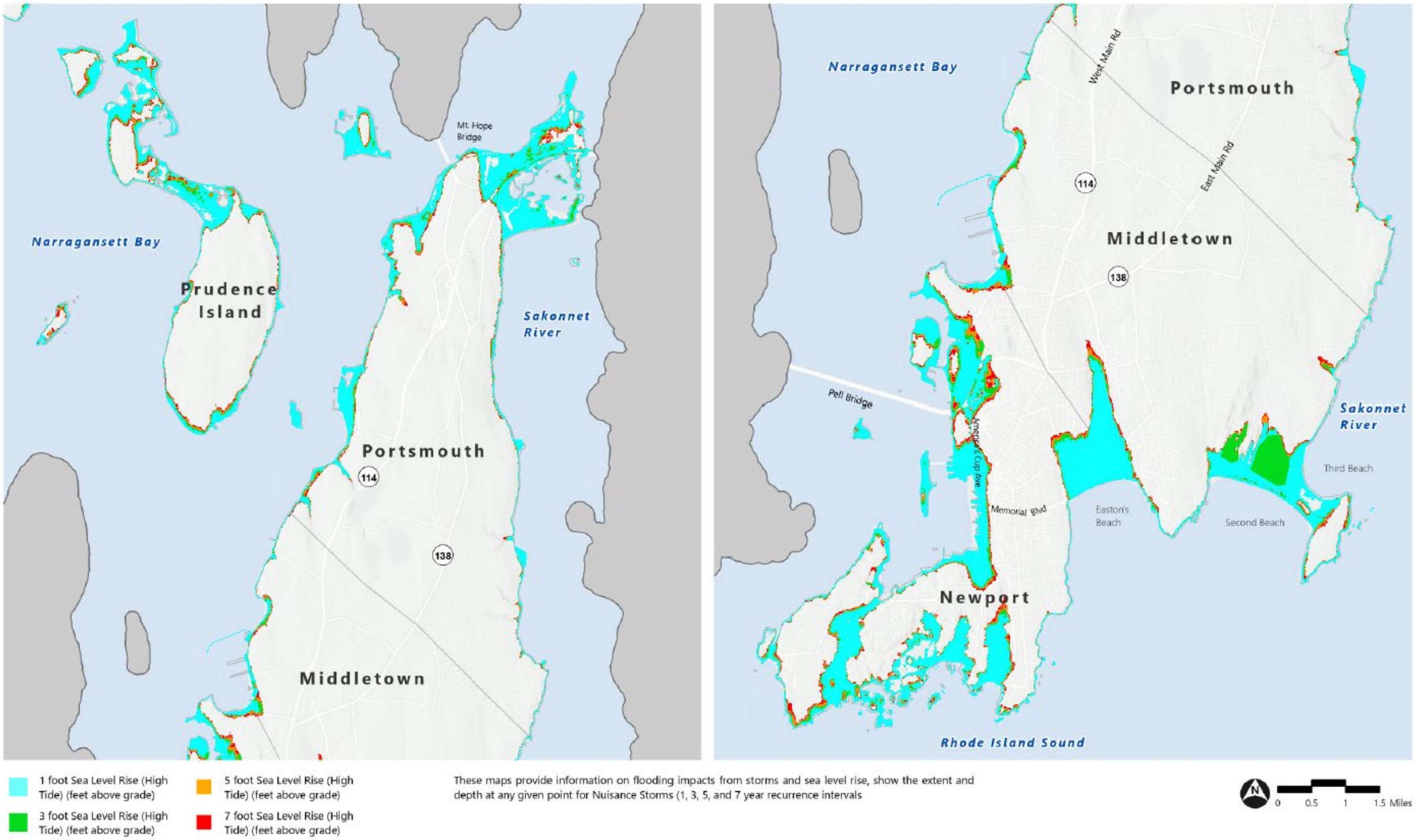
7 foot Sea Level Rise (High Tide) (feet above grade)

These maps provide information on flooding impacts from storms and sea level rise, show the extent and depth at any given point for Nuisance Storms (1, 3, 5, and 7 year recurrence intervals

Source: RIGIS, FEMA, Stormtools

Figure 15 Sea Level Rise With 100-Year Storms

Aquidneck Island Regional Hazard Mitigation and Flood Management Plan | Rhode Island



Source: RIGIS, FEMA, Stormtools

Extent (Event Magnitude)[44]

Although the impacts of sea level rise vary across different land use types on the island, the data on the rate at which sea level rise is occurring is consistent throughout the State. Rhode Island could see one foot of sea level rise by 2050 and is projected to experience sea levels three to five feet above 1990 levels by 2100.

Impact and Damage Extent

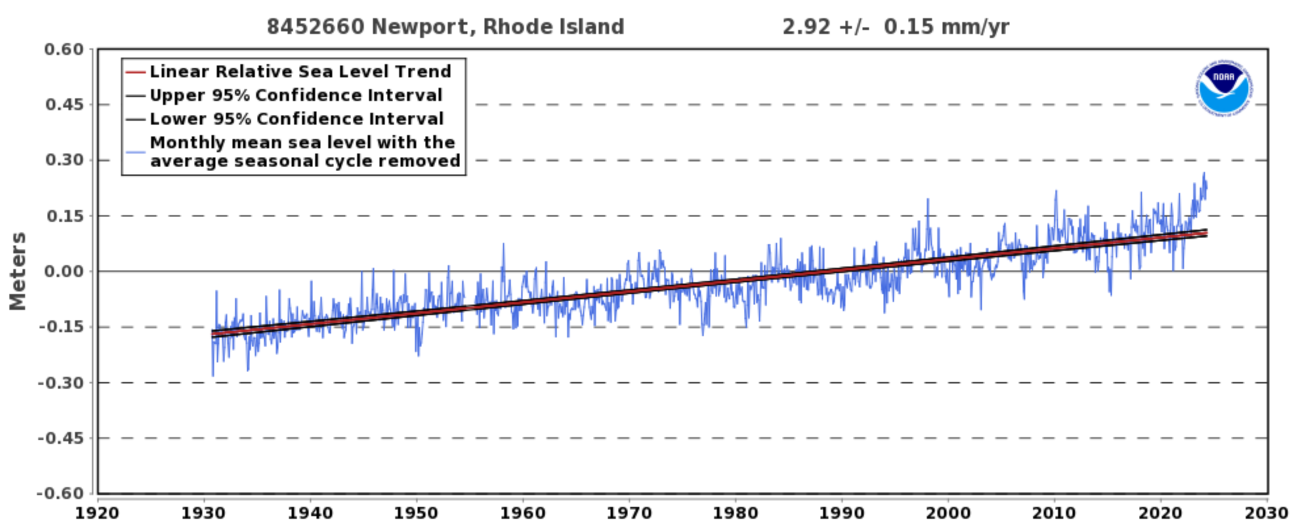
Sea level rise can have widespread flooding impacts across Aquidneck Island. During extremely high tide events, seawater sometimes already enters drainage infrastructure outfalls and floods parking lots. Sea level rise will only exacerbate this. It will also cause gradual loss of coastal properties and infrastructure, including homes, businesses, critical facilities, roads, bridges, and public transportation infrastructure, which can result in substantial economic losses for individuals and communities. Saltwater intrusion into freshwater sources can contaminate drinking water supplies. The flooding will also cause habitat loss of salt marshes, which serve as breeding and feeding grounds for various species.

History[45]

Data from the Newport tide gauge has shown a steady sea level rise over the past 90 years, with levels rising more than 10 inches since 1930 (see **Figure 16**). This averages an increase of one inch per decade, slightly higher than the global average.

The water temperature in Narragansett Bay has increased by three degrees Fahrenheit in the last 100 years, increasing thermal expansion.

Figure 4 Sea Level Rise Trends in Newport, RI



Source: Sea Level Trends - NOAA Tides & Currents

44 RI Coastal Resources Management Council Shoreline Change Special Area Management Plan (SAMP), June 2018.

45 2024 State of Rhode Island Hazard Mitigation Plan

Probability of Future Occurrence

Highly likely.

Climate Change Impacts

According to the U.S. Army Corps of Engineers, by 2100, sea levels along Rhode Island's Newport coastline are projected to rise up to an additional five feet.[46] As coastal storms become stronger in response to warmer ocean temperatures, higher sea levels will result in more intensive erosion along barrier beaches and shorelines.

Lightning/Thunderstorms/Hail

Description

Thunderstorms are formed when the right atmospheric conditions combine to provide moisture, lift, and warm unstable air that can rise rapidly. Thunderstorms occur at any time of the day and in all months of the year but are most common during summer afternoons and evenings and in conjunction with frontal boundaries. The NWS classifies a thunderstorm as severe if it produces hail at least one inch in diameter, winds of 58 mph or greater, or a tornado. About 10 percent of the estimated 100,000 annual thunderstorms that occur nationwide are considered severe. Thunderstorms can be dangerous and destructive, with the potential to form in less than 30 minutes, giving very little warning; produce lightning, hail, tornadoes, powerful straight-line winds, and bring heavy rains that produce localized flooding.

All thunderstorms contain lightning. Thunderstorms can occur singly, in clusters, or in lines. Therefore, it is possible for several thunderstorms to affect one location over the course of a few hours. Lightning is caused by the attraction between positive and negative charges in the atmosphere, resulting in the buildup and discharge of electrical energy. Lightning is one of the most underrated severe weather hazards, ranking as the second-leading weather killer in the United States. Hundreds of people are injured by lightning every year.[47] Lightning often strikes as far as 10 miles away from any rainfall.

Meanwhile, hail is formed when strong updrafts lift water droplets to heights at which they freeze, then grow as they combine with liquid water in the atmosphere. When these hailstones become heavy enough, they fall to the ground at speeds of up to 120 mph. Hail falls along swaths up to 10 miles wide and 100 miles long. When larger than three-quarters of an inch in diameter, hail can damage both property and crops. Some storms produce hail over four inches in diameter. Hail causes about $1 billion in damage annually in the U.S.[48]"

Location

All of Aquidneck Island is susceptible to lightning/thunderstorms and hail.

46 USACE Sea-Level Change Curve Calculator

47 NOAA Lightning Safety https://www.noaa.gov/jetstream/lightning/lightning-safety.

48 Rhode Island State Hazard Mitigation Plan 2019

Extent (Event Magnitude)

The NWS classifies a thunderstorm as severe if it produces hail at least one inch in diameter, winds of 58 mph or greater, or a tornado. Similar to modern tornado characterizations, lightning events are often measured by the damage they produce. An individual facility's vulnerability to lightning strike is highly impacted by its construction, location, and nearby trees or other tall structures. A rough estimate of a structure's likelihood of being struck by lightning can be calculated using the structure's ground surface area, its height, and the distance between the structure and the downward-moving tip of the stepped leader, the negatively charged channel jumping from cloud to earth. In general, buildings are more likely to be struck by lightning if they are located on high ground or if they have tall protrusions, such as steeples or poles, to which the stepped leader can jump.

The NWS and NOAA use the Lightning Activity Level (LAL) scale to characterize lightning intensity during thunderstorms. The scale ranges from LAL 1 (no thunderstorms) to LAL 6 (dry lightning), which is often associated with wildfire risk. The LAL scale provides a standardized method for assessing lightning frequency and risk.

Table 24 Lightning Activity Level Scale

Lightning Activity Level (LAL)	Definition
LAL 1	No thunderstorms
LAL 2	Isolated thunderstorms. Light rain will occasionally reach the ground. Lightning is very infrequent, one to five cloud to ground strikes in a five-minute period.
LAL 3	Widely scattered thunderstorms. Light to moderate rain will reach the ground. Lightning is infrequent, six to ten cloud to ground strikes in a five-minute period.
LAL 4	Scattered thunderstorms. Moderate rain is commonly produced. Lightning is frequent, 11 to 15 cloud to ground strikes in a five-minute period.
LAL 5	Numerous thunderstorms. Rainfall is moderate to heavy. Lightning is frequent and intense, greater than 15 cloud to ground strikes in a five-minute period.
LAL 6	Dry lightning (same as LAL 3 but without the rain). This type of lightning has the potential for extreme fire activity and is normally highlighted in fire weather forecasts with Red Flag Warning.

Hail is another hazard commonly associated with severe thunderstorms. Hail forms when strong updrafts carry raindrops high into cold regions of the atmosphere, where they freeze and accumulate layers of ice before falling to the ground. Hailstones vary widely in size, from small pellets to several inches in diameter, and can cause extensive damage to vehicles, roofs, crops, and other exposed infrastructure.

Table 25 Hail Size Scale

Hail Diameter	Size Description
¼″	Pea Size
½″	Mothball Size
¾″	Penny Size
7/8″	Nickel Size
1″	Severe Criteria – Quarter Size
1 ¼″	Half Dollar Size
1 ½″	Walnut or Ping Pong Ball Size
1 ¾″	Golf Ball Size
2″	Hen Egg Size
2 ½″	Tennis Ball Size
2 ¾″	Baseball Size
3″	Teacup Size
4″	Grapefruit Size
4 ½″	Softball Size

The NWS categorizes hailstones primarily by diameter for severe storm warnings, with one inch (quarter size) serving as the threshold for severe classification. Larger hail sizes are commonly reported using comparisons to familiar objects, such as golf balls (1.75 inches), baseballs (2.75 inches), and softballs (4.5 inches)/

Internationally, the TORRO Hailstorm Intensity Scale (H0 to H10) provides a more detailed classification, linking hail diameter to expected damage. Lower levels (H0 to H2) indicate small hail with minimum damage potential, while mid-range levels (H3 to H5) correspond to crop and property damage, and higher levels (H6 to H10) reflect large to giant hail capable of severe structural damage and serious injury risk. This scale offers a standardized framework that helps characterize hailstorm severity and impacts.

Impact and Damage Extent

Lightning can strike buildings and accessory structures, often causing structure fires. Electrical and communications utilities are also vulnerable to direct lightning strikes and to outages caused by toppled trees. Damage to these lines has the potential to cause power and communication outages for businesses, residences, and critical facilities. Strong thunderstorms with high winds can also scatter debris and break tree limbs, causing damage and injury or disruption to traffic and the electrical grid.

Human vulnerability is largely determined by the availability and reception of early warnings for the approach of severe storms, and by the availability of nearby shelter. Swimming, boating, and fishing are particularly dangerous during periods of frequent lightning strikes. Individuals who immediately seek shelter in a sturdy building or metal-roofed vehicle are much safer than those who remain outdoors. Early warnings of severe storms are also vital for aircraft flying through the area.

Structural vulnerability to hail varies. Metal siding and roofing is better able to stand up to the damages of a hailstorm than many other materials, although they may be damaged by denting. Glass windows and exposed vehicles are also susceptible to hail damage. Vegetation and crops are extremely susceptible to hailstorm damage.

History

There has been no reported loss of human life on Aquidneck Island in the past 50 years due to lightning or hail.

Table 26 Lightning and Hail Events on Aquidneck Island[49]

Date	Comments
05/24/2000	Nickel-sized hail from a severe thunderstorm fell in Portsmouth.
09/02/2000	Lightning struck two utility poles in Portsmouth, causing high-tension wires to fall to the ground, temporarily closing roads. Lightning also struck a house in Portsmouth, starting a fire.
09/09/2000	Lightning struck a house in Newport, causing a small fire.
06/24/2008	Quarter-sized hail accompanied a severe thunderstorm in Newport.
07/01/2009	Penny-sized hail reported in Portsmouth.
06/05/2010	Portsmouth fire department communications were knocked out by a lightning strike.
08/07/2014	Quarter-sized hail reported at the Newport Naval Base.
06/21/2016	Penny-sized hail fell in Newport.
03/29/2020	Quarter-sized hail reported in Providence County.
07/17/2021	Dime-sized hail reported in Providence County.
09/28/2021	Dime-sized hail reported in Providence County.
06/27/2023	A house was hit by lightning on Slocum Road in Portsmouth.
05/08/2024	Quarter-sized hail was reported in Portsmouth.

Probability of Future Occurrence

Highly likely.

49 NOAA Storm Event Database (2024)

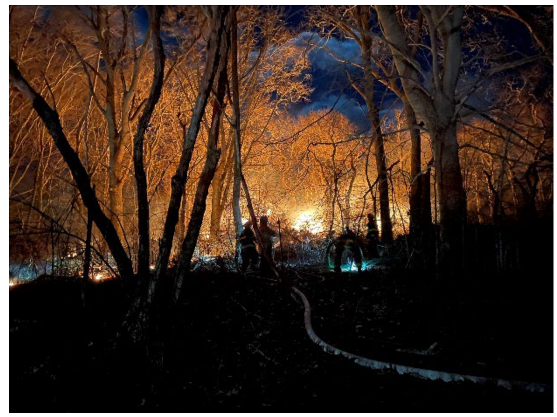
Climate Change Impacts

Changing weather patterns may lead to more severe thunder and lightning storms that produce hail.

Brushfire

Description

Brushfires are fueled by natural cover, including native and non-native species of trees, brush and grasses, and crops, along with weather conditions and topography. While available fuel, topography, and weather provide conditions that allow wildfires to spread, most wildfires are caused by people through criminal or accidental misuse of fire.



Brushfire in Portsmouth.
Photo credit: Portsmouth Police Department.

Brushfires pose serious threat to human safety and property in rural and suburban areas. They can destroy crops, timber resources, recreation areas, and habitat for wildlife. Wildfires are commonly perceived as hazards in the western part of the country; however, smaller brushfires are a growing problem in the wildland/urban interface of the eastern United States, including Rhode Island.

Brushfires are dependent upon the quantity and quality of available fuels. Fuel quantity is the mass per unit area. Fuel quality is determined by a number of factors, including fuel density, chemistry, and arrangement. Arrangement influences the availability of oxygen. Another important aspect of fuel quality is the total surface exposed to heat and air. Fuels with large area-to-volume ratios, such as grasses, leaves, bark, and twigs, ignite easily when dry.

Climatic and meteorological conditions that influence wildfires include solar insulation, atmospheric humidity, and precipitation, all of which determine the moisture content of wood and leaf litter. Dry spells, heat, low humidity, and wind increase the susceptibility of vegetation to fire. In Rhode Island, common factors leading to large fires include short-term drought, humidity below 20 percent, and fuel type.

Various natural and human agents can be responsible for igniting brushfires. Natural agents include lightning, sparks generated by rocks rolling down a slope, friction produced by branches rubbing together in the wind, and spontaneous combustion.

Human-caused brushfires are typically worse than those caused by natural agents. Arson and accidental fires usually start along roads, trails, streams, or at dwellings that are generally on lower slopes or bottoms of hills and valleys. Nurtured by updrafts, these fires can quickly spread uphill. Arson fires are often set deliberately at times when factors such as wind, temperature, and dryness contribute to the fire's spread.

The temperate climate on Aquidneck Island is unlikely to endure long periods of drought that lead to widespread vegetation loss. Destructive lightning fires in remote locations are rare, but there is always a risk of fires from arson or careless fire use.

Location

The open fields, forested areas, and grassy areas throughout the island are most at-risk to brushfire. The wildland urban interface, the area where the built environment meets with the undeveloped wildlands, is also vulnerable to fast spreading brushfires. On Aquidneck Island, these areas include open fields, forested areas, and grassy areas. The U.S. Forest Service Wildland Urban Interface 2020 map[50] identifies the following wildland urban interface areas on Aquidneck Island:

- Open space along Lagoon Road in Portsmouth
- Common Fence Point in Portsmouth
- Island Park in Portsmouth
- Narragansett Avenue and two isolated neighborhoods on Prudence Island, Portsmouth

Being largely undeveloped, Prudence Island is most at risk for brushfires. Approximately 85 percent (3,030 acres) of the island is protected from development. Most of the island is a mix of forests, shrublands, and open fields. Structures are built primarily along the shoreline, concentrated on the eastern side of the island.[51] The combination of island remoteness, impeded access into undeveloped areas, limited wildland firefighting equipment, limited available responders, and limited water supply infrastructure raises the risk potential for a brushfire to get out of control.

Extent (Event Magnitude)

Aquidneck Island experiences an average of one brushfire per year, with a burn area of generally less than an acre. The extent has decreased over the years due to better response equipment, faster response time, and the widespread use of cell phones to report fires. However, the wildland-urban interface is growing, potentially putting more infrastructure and lives at risk.

Impact and Damage Extent

Brushfires primarily impact timber and forest ecosystems, although the threat to nearby buildings is always present. Individual buildings may be more or less vulnerable to damage from brushfires based on factors such as the clear distance around the structure and the structure's construction materials.

The likelihood of brushfires occurring and having widespread impacts on Aquidneck Island has decreased over the years as fields and wooded areas are developed, although extensive tracts of undeveloped lands along Lagoon Road in Portsmouth remain a concern. During abnormally dry or drought conditions, brushfires can accelerate.

50 U.S. Forest Service- Geospatial Data Discovery website: https://data-usfs.hub.arcgis.com/documents/usfs::wildland-urban-interface-2020-map-service/about

51 Prudence Island Community Wildfire Protection Plan, 2018

Another factor that could contribute to the spreading of fires impacting residential areas is the increase in the use of residential propane tanks, especially when homes are close to each other, as is the case in Common Fence Point and the Hummocks and Island Park neighborhoods of Portsmouth, where property lots are small and homes closely located.

On Prudence Island there are a few isolated homes in densely forested areas where there is only a single road for egress.

Prudence Island developed a Community Wildfire Protection Plan in 2018 that served to model fire behavior, evaluate fire suppression capability, and identify mitigation actions that improve wildland fire response and reduce wildland fire risk, many of which have been implemented. Recent improvements in wildland suppression capability may not, however, be sufficient to offset the shift in forest composition and structure witnessed during the past decade, which serves to increase fire potential. Prudence Island remains at moderate to high risk for an extensive wildfire with widespread impacts.

History

There have been no significant brushfires in the past 25 years on Aquidneck Island. Regular prescribed burns are conducted on Prudence Island for both habitat maintenance and training.

During the draft writing of this plan in November 2024, the State had been under a Red Flag Warning—an alert for when the combination of dry fuels and weather conditions support extreme fire danger.

Probability of Future Occurrence

Likely.

Climate Change Impacts

Fire behavior is expected to become more extreme with the anticipated change in temperature and precipitation patterns associated with a changing climate. These changes in environmental conditions will result in more abundant fuel across all habitat types, particularly in forested areas through the secondary impact of increased pest species that are attracted to stressed trees. Extreme fire behavior in forested areas is generally driven by an increase in woody debris and a change in both understory and overstory composition, both of which are occurring at an extraordinary rate due to climate change. Longer dry periods and droughts are expected to increase the probability of brushfires in future years.

Dam Failure

Description

RIDEM classifies dams as high hazard, significant hazard, or low hazard.

- **High Hazard Dam**: Failure or maloperation will result in a probable loss of human life
- **Significant Hazard Dam**: Failure or maloperation results in no probable loss of human life but may cause major economic loss, disrupt lifeline facilities, or impact other concerns detrimental to the public's health, safety, or welfare
- **Low Hazard Dam**: Failure or maloperation results in no probable loss of human life and low economic losses

Each dam's hazard classification determines the frequency of inspection. The higher the classification, the more frequently the inspection is conducted. As of 2023, there were 95 high hazard dams, 81 significant hazard dams and 494 low hazard dams in the state.[52]

As part of each RIDEM inspection, the major components of the dam—the embankment, spillway, and low-level outlet—are subjectively rated as good, fair, or poor. Good means the dam meets the minimum U.S. Army Corps of Engineers guidelines. Fair means the dam has one or more components that require maintenance. Poor means a component of a dam has deteriorated beyond maintenance and requires repair.

Owners of high and significant hazard dams are also required by RIDEM to prepare and maintain EAPs. These plans outline procedures to be followed in the event of a potential or actual dam failure and are intended to protect lives and minimize property damage. While responsibility typically rests with the dam owner, public sector roles may vary based on the dam's location and jurisdiction.

Location

As noted in **Table 4**, on page 14 there are various dams on Aquidneck Island. **Appendix D Community Assets Maps** identifies the specific locations of these dams. According to the RIDEM 2023 Annual Report to the Governor on the Activities of the Dam Safety Program, two dams in Middletown have been identified as having unsafe conditions.

- **Gardiner Dam:** Vegetation prohibited inspection, deteriorated spillway, unknown operability of low-level outlet. However, a 2023 Inspection Report by Pare Corporation[53] rated the Gardiner Pond dam structure in fair condition, meaning that it needs to be maintained but still functions as originally intended.
- **Easton North**: Vegetation prohibited inspection; vegetation affected spillway flow. However, a 2023 inspection done by Pare Corporation[54] determined the dam to be in fair condition, meaning that it needs to be maintained but still functions as originally intended.

---

52 2023 Annual Report to the Governor on the Activities of the Dam Safety Program. https://dem.ri.gov/sites/g/files/xkgbur861/files/2024-05/damrpt23.pdf

53 Gardiner Pond North Dam, Visual Inspection/Evaluation Report. October 11, 2023. https://dem.ri.gov/sites/g/files/xkgbur861/files/programs/maps/mapfile/damfiles/583.pdf

54 Eason Pond North Dam, Visual Inspection/Evaluation Report. October 26, 2023. https://dem.ri.gov/sites/g/files/xkgbur861/files/programs/maps/mapfile/damfiles/584.pdf

Similarly, a 2023 Inspection Report by Pare Corporation[55] rated the Easton South dam structure in fair condition, meaning that it needs to be maintained but still functions as originally intended.

Extent (Event Magnitude)

All three dam hazard classifications are represented on Aquidneck Island. The extent of a failure would vary. The RHMC has identified failure as a break in the dam that would send water downstream.

Easton Pond Dam South (left) and Easton's Beach (right) during a storm in December 2023. Photo credit: City of Newport.

Impact and Damage Extent

The RHMC recognizes that dam failure is not a natural hazard itself, but several of the hazards in the Committee's hazard list could bring dam failure upon Aquidneck Island. Severe winter storms, flooding, and a hurricane could all bring enough rain or snowfall to cause dam failure. The age of these nearby dams also poses a risk to their structural integrity. A failure of the Easton Pond South Dam would cause significant damage to Memorial Boulevard and several hundred feet of Easton's Beach. Detailed inundation areas are available in Dam Emergency Action Plans, which are filed with RIEMA and RIDEM.

55 Eason Pond South Dam, Visual Inspection/Evaluation Report. October 26, 2023. https://dem.ri.gov/sites/g/files/xkgbur861/files/programs/maps/mapfile/damfiles/585.pdf

History

There have been two minor dam incidents with the Newport-owned reservoirs in recent history. A dam incident was detected in the Lawton Valley Reservoir Dam (located in Portsmouth) in February 2000, when the vegetation on the earth concrete dam was deemed excessive and recommendations were made to remove it. Additionally, missing riprap and erosion issues required repair, according to inspection records submitted through FEMA's National Dam Safety Program.

Another dam incident was recorded in March 2000 with the Harold E. Watson Reservoir Dam (located in Little Compton). During the inspection, the dam was found to have an eroded embankment, and recommendations were made to remove excessive vegetation and regrade the crest and plant it with grass for erosion protection. These findings were also documented through the National Dam Safety Program.

Probability of Future Occurrence

Possible.

Climate Change Impacts

Related to flooding, more intense rain events may stress the structural integrity of dams, which could lead to failure.

Tornadoes

Description

A tornado is a violent windstorm with a twisting, funnel-shaped cloud, often spawned by strong thunderstorms or hurricanes. In the case of hurricanes, tornadoes typically develop in the front-right quadrant of the storm's path – commonly referred to as the "danger quadrant" – due to favorable wind shear and atmospheric instability. Tornadoes are produced when cool air overrides a layer of warm air, forcing the warm air to rise rapidly. The damage from a tornado is a result of the high wind velocity and wind-blown debris.

Tornado season is generally March through August, although tornadoes can occur at any time of year. Over 80 percent of all tornadoes strike between noon and midnight.

Tornado in Portsmouth, October 2019. Photo Credit: Portsmouth Police Department.

During an average year, about 1,000 tornadoes are reported across the United States, resulting in 80 deaths and over 1,500 injuries. The most violent tornadoes are capable of tremendous destruction, with wind speeds of 250 mph or more. Damage paths can be more than one mile wide and 50 miles long.

Tornadoes are categorized according to the damage they produce using the Fujita Scale (F-scale). **Table 27** shows the standard and Enhanced Fujita (EF) Scales. The standard F-scale was used until 2007 before being replaced by the EF scale by the National Weather Service. An F0 tornado causes the least amount of damage, while an F5 tornado causes the most amount of damage. Relatively speaking, the size of a tornado is not necessarily an indication of its intensity.

Table 27 Fujita Scale

Fujita (F) Scale			Enhanced Fujita (EF) Scale		
F Number	Fastest ¼ mile (mph)	3 Second Gust (mph)	EF Number	3 Second Gust (mph)	Damage Scale
0	40–72	45–78	0	65–85	Light damage. Some damage to chimneys; branches broken off trees; shallow-rooted trees pushed over; sign boards damaged.
1	73–112	79–117	1	86–110	Moderate damage. Peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos blown off roads.
2	113–157	118–161	2	111–135	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars overturned; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground.
3	158–207	162–209	3	136–165	Severe damage. Roofs and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted; heavy cars lifted off the ground and thrown.
4	208–260	210–261	4	166–200	Devastating damage. Well-constructed houses leveled; structures with weak foundations blown away some distance; cars thrown and large missiles generated.
5	261–318	262–317	5	Over 200	Incredible damage. Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 meters (109 yards); trees debarked; incredible phenomena occur.

On August 7th, 1986, a rare outbreak of seven tornadoes occurred in New England. One such tornado, rated F2 on the Fujita Scale, carved its way through Cranston and Providence, Rhode Island, causing twenty injuries and $2,500,000 in damages. **Table 28** highlights more tornado events that have affected Rhode Island.

Location

The risk of tornadoes is low for the State of Rhode Island, but with the recent changing weather patterns and touchdowns of tornadoes, it would be unwise not to consider them a possible hazard.

Extent (Event Magnitude)

Historically, Newport County rarely experiences tornado activity. In 2019, an EF-0 tornado touched down in nearby Portsmouth and lasted for only about a minute. It is expected that future tornadoes will be 0 or 1 on the F-Scale of magnitude.

Impact and Damage Extent

Tornadoes can cause significant damage to buildings, trees, and above-ground utility lines. Flying debris can cause injuries to residents.

History

Table 28 Recent Tornado Events in Rhode Island[56]

Date	EF-Scale	Injuries	Damage	Location
8/16/2000	0	0	$0	Providence County
8/7/2004	0	0	$0	Kent County
7/23/2008	1	0	$47,987	Bristol County
8/10/2012	0	0	$50,000	Washington County
10/24/2018	1	0	unknown	North Providence and Lincoln
10/02/2019	0	0	$5,000	Portsmouth
11/13/2021	1	9	$50,000	Westerly
08/18/2023	1/2	1	$250,000	Scituate, Johnston, North Providence

Probability of Future Occurrence

Unlikely.

Climate Change Impacts

It is uncertain how climate change will affect tornado outbreaks on Aquidneck Island.

Earthquake

Description

An earthquake (also known as a quake, tremor, or temblor) is the result of a sudden release of energy in the Earth's crust that creates seismic waves. The seismicity or seismic activity of an area refers to the frequency, type, and size of earthquakes experienced over a period of time. Earthquakes are measured with a seismometer. The size or magnitude is recorded on a device known as a seismograph. Earthquakes with a magnitude of 3 or lower are mostly imperceptible

56 NOAA Storm Event Database (2023)

(too low to recognize). Magnitude 7 or above earthquakes can cause serious damage over large areas.

Although earthquakes are not considered to be a major problem in the Northeast United States, they are more prevalent than one might expect. **Table 29** presents historical seismic activity for Rhode Island. It highlights the earthquake epicenter – the point on the Earth's surface directly above where the earthquake originates – as well as the Richter magnitude at the epicenter and the Mercalli intensity level. Richter magnitudes are technical, quantitatively based calculations that measure the amplitude of an earthquake's largest recorded seismic wave. Richter magnitudes are based on a logarithmic scale and are commonly scaled from 1 to 8. The higher the magnitude on the Richter Scale, the more severe the earthquake. Mercalli intensity levels are based on qualitative criteria that use the observations of the people who have experienced the earthquake to estimate the intensity level. The Mercalli scale ranges from I to XII. The higher the intensity level on the scale, the closer the person is to the epicenter.

Table 29 Magnitude Scale Comparisons

Modified Mercalli Intensity	Richter Scale Magnitude	Description of Intensity Level
I	1 to 2	Not felt except by a very few under especially favorable circumstances.
II	2 to 3	Felt only by a few persons at rest, especially on upper floors of buildings. Delicately suspended objects may swing.
III	3 to 4	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibration similar to the passing of a truck. Duration estimated.
IV	4	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
V	4 to 5	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
VI	5 to 6	Felt by all; many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
VII	6	Damage negligible in building of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken. Noticed by persons driving motorcars.
VIII	6 to 7	Damage slight in specially designed structures; considerable in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
IX	7	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
X	7 to 8	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.

Modified Mercalli Intensity	Richter Scale Magnitude	Description of Intensity Level
XI	8	Few, if any, (masonry) structures remain standing. Bridges destroyed. Rails bent greatly.
XII	8 or greater	Damage total. Lines of sight and level distorted. Objects thrown into the air.

Despite the low probability of a high-impact earthquake, the following characteristics may increase Rhode Island's earthquake vulnerability:

› **Hard Rock:** Due to the geological makeup of New England's base rock, seismic energy is conducted on a greater scale (four to 10 times that of an equivalent Richter magnitude earthquake in California).

› **Soft Soil:** Many coastal regions of New England are made up of soft soils. These soils can magnify an earthquake by as many as two times.

› **Masonry Structures:** The New England region, being one of the first settled areas of the United States, has an abundance of older, unreinforced masonry structures that are inherently brittle and very vulnerable to seismic forces.

› **Low Public Awareness of Vulnerability:** In Rhode Island, there is little public recognition of earthquake threat and no established system of educating or informing the public of the threat or how to prepare for or respond during an earthquake. Therefore, higher losses will occur here compared to other regions of the country.

Location

Rhode Island is located on the North American tectonic plate and is in a region of historically low seismicity. Only three or four earthquakes of Modified Mercalli Intensity Scale V or greater have been centered in Rhode Island, including the 1951 South Kingstown earthquake, which had a magnitude of 4.6 on the Richter scale.

Extent (Event Magnitude)

The outwash deposits in the areas surrounding Narragansett Bay are prone to seismic amplification, which would increase the intensity of an earthquake.

Impact and Damage Extent

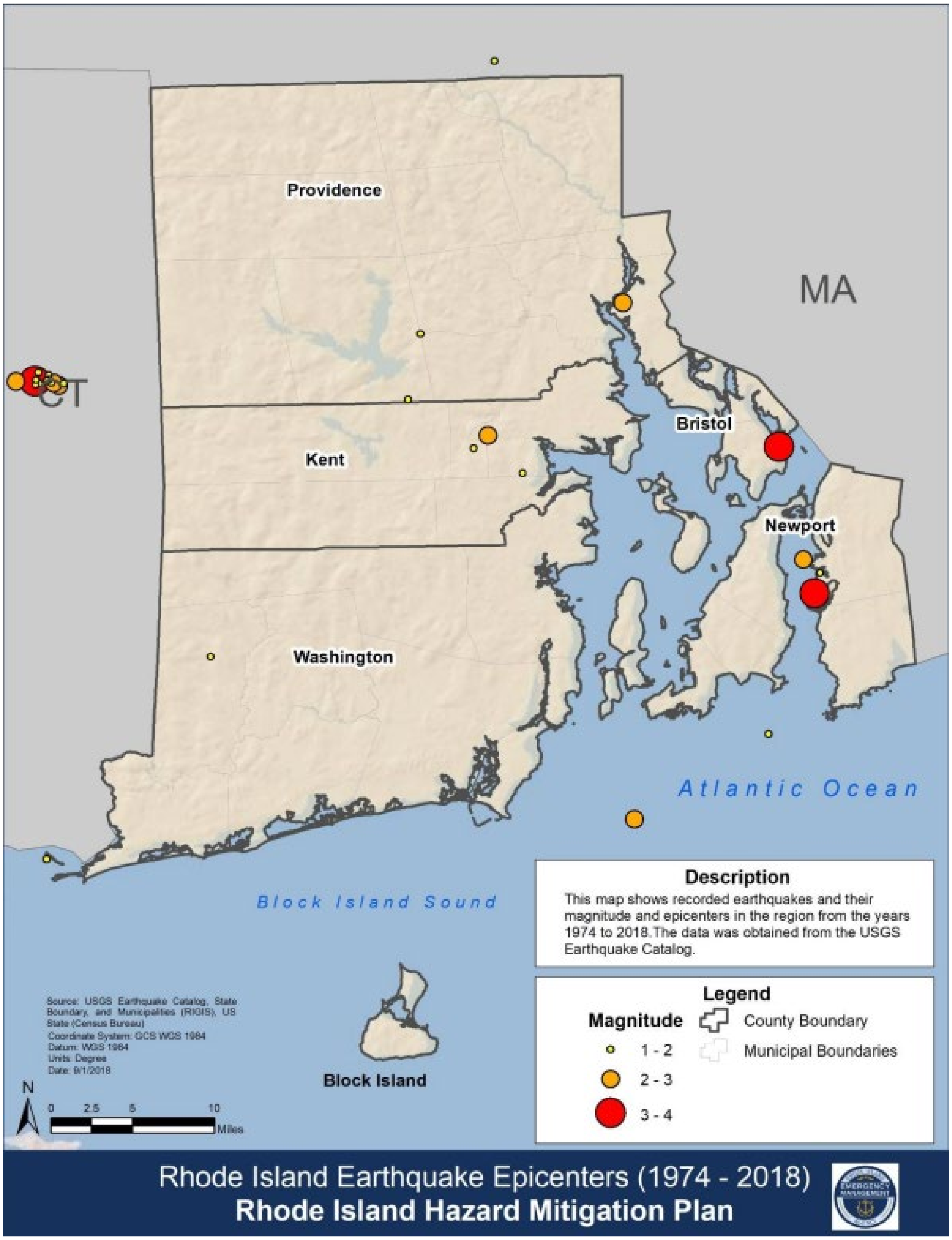
While the likelihood of an earthquake striking Aquidneck Island is relatively low, the hazard could inflict island-wide damage, causing power outages, building collapses, water main breaks, dam failures, gas leaks, fires, injuries, or deaths. Buildings that are most vulnerable to earthquakes are historic structures.

History

Only a few earthquakes have been felt and centered in Rhode Island. One past occurrence of note is the 1951 South Kingstown earthquake that had a magnitude of 4.7 on the Richter scale. Other past earthquakes were centered in Narragansett Bay and most significantly impacted Newport, Bristol, and Providence counties. See **Table 30** and **Figure 17** for more details.

No major earthquakes have happened on Aquidneck Island.

Figure 17 Rhode Island Earthquake Epicenters (1974–2018)



Source: Rhode Island Emergency Management Agency

Table 30 Historic Seismic Activity in/Near Rhode Island[57]

Date	Epicenter	Epicenter Magnitude	Mercalli Intensity Level
06/10/1951	South Kingstown, RI	4.6	Intensity level V felt beyond just in Kingston.
10/16/1963	Coastal MA	4.5	Caused some cracked plaster (MMI V) at Chepachet, Rhode Island.
6/14/1973	Western Maine	unknown	The intensities in Rhode Island were IV at Charlestown and I-III at Bristol, East Providence, Harmony, and Providence.
10/01/1974	West Warwick	2.5	Intensity level II.
03/11/1976	Near Newport, RI	3.5	Intensity level VI shock effects felt throughout Southern New England. This earthquake has the distinction of being the largest earthquake to originate in Rhode Island.
04/20/2002	Plattsburgh, NY	5.2	Intensity level II to III shock effects felt throughout Rhode Island.
03/11/2008	Central Connecticut	2.9	No data reported for Rhode Island.
06/23/2010	Ontario-Quebec	5.0	Felt throughout Rhode Island.
2011	Rhode Island	0.9	Felt locally.
2012	Rhode Island	1	Felt locally.
2013	Kingston, RI	Unknown	Felt locally.
04/04/2013	Hope Valley, RI	1.8	Felt locally.
01/12/2015	Wauregan, CT	3.3	Felt locally in RI.
07/22/2015	East Providence, RI	2.3	Felt locally in RI.
11/08/2020	Buzzards Bay	3.6	Felt locally in RI, likely on Aquidneck Island.
11/22/2020	Buzzards Bay	2.0	Felt locally in RI, likely on Aquidneck Island.
06/12/2022	Narragansett Bay	1.6	Felt locally in RI, epicenter between Aquidneck Island and Hog Island.

Probability of Future Occurrence

Possible.

Climate Change Impacts

It is uncertain how climate change will affect earthquake magnitude in and around Aquidneck Island.

Tsunamis

Description

Although tsunamis were not discussed in the Rhode Island State Hazard Mitigation Plan, they are profiled in the Massachusetts and Connecticut Plans. The Portsmouth Hazard Mitigation

57 United States Geologic Survey http//neic.usgs.gov/neis/states/rhode_island/rhode_island_history.html and Earthquake Hazards Program "*Did You Feel It*" Archives.

Committee perceives a probable likelihood of tsunamis in the future and is thus including them as an identified hazard in this plan.

Tsunamis (seismic waves) are a series of giant ocean waves created by underwater geologic activity, such as an earthquake, landslide, volcanic eruption, or impact from a meteorite. This series of waves can travel hundreds of miles per hour across the open ocean and develop waves of 100 feet or more.

The configuration of the ocean floor and magnitude of the tsunami will influence the size of the wave(s) when they hit land. The Pacific coastlines of California, Oregon, Washington, Alaska, and Hawaii are the U.S. locations that most frequently experience tsunamis. Because earth movements associated with large earthquakes are thousands of square kilometers in area, any vertical movement of the seafloor immediately changes the sea-surface. Tsunamis are most commonly generated by earthquakes in marine and coastal regions. Major tsunamis are produced by large (greater than 7 on the Richter scale), shallow focus (less than 30km deep in the earth) earthquakes associated with the movement of oceanic and continental plates. Underwater landslides associated with smaller earthquakes are also capable of generating destructive tsunamis.[58]

Although the East Coast of the U.S. is much less likely to be affected by a tsunami than the country's Pacific Coast, tsunami threats do exist in Atlantic coastal areas. If a tsunami were generated near Rhode Island, there would be little warning time to evacuate to higher ground. Tsunami exposure could have extensive and prolonged impacts to Rhode Island residents, economy, natural systems, and infrastructure.

Traditionally, the magnitude of tsunamis has been measured by the wave height, speed, and associated earthquake magnitude. Tsunamis are categorized by their coastal impacts, including wave height, flooding, and damage. The Soloviev-Imamura scale ranges from one (minor, barely noticeable) to six (catastrophic destruction and high casualties). Unlike earthquake magnitude scales, which measure energy at the source, this scale reflects the tsunami's effects on land, making it useful for assessing local risk and response.

Location

All of Portsmouth is susceptible to tsunami damage, but low areas of the Island Park neighborhood and Common Fence Point are most vulnerable to tsunami waves that come onshore.

Extent (Event Magnitude)

Due to the low magnitude of seismic activity in the Atlantic Ocean, tsunamis that form off the coast of New England would be relatively small, with wave heights typically less than those seen in the Pacific.

58 NOAA Tsunami webpage https://www.tsunami.noaa.gov/

Impact and Damage Extent

The energy carried by a tsunami wave can cause widespread devastation over coastal areas. Expected impacts on Aquidneck Island from a significant tsunami event would include:

- **Inundation and Flooding:** Rapid and extensive flooding of low-lying coastal neighborhoods could result in structural damage or destruction of residential, commercial, and public buildings. Floodwaters may inundate transportation routes, complicating emergency response and evacuation.
- **Debris Impact and Erosion:** The force of tsunami waves can uproot trees, damage or destroy coastal infrastructure, and cause severe shoreline erosion. Coastal habitats such as salt marshes, which provide critical ecological services, can be heavily damaged or lost.
- **Contamination of Water Supplies:** Saltwater intrusion into freshwater aquifers and wells is likely, compromising drinking water quality and availability for an extended period. Floodwaters may carry harmful contaminants from industrial sites or sewage systems, posing public health risks.
- **Casualties and Displacement:** Due to the short warning time typical of East Coast tsunamis, residents may be caught off guard, leading to potential injuries or fatalities. Significant population displacement and temporary shelter needs could arise, straining local resources.

Evacuation planning is complicated by the limited higher ground on portions of Aquidneck Island and constrained egress routes, particularly on Prudence Island, which would hinder rapid and safe evacuations. Critical facilities located in vulnerable zones may face operational disruptions or damage

History

Rhode Island has not been impacted by a significant tsunami. Historically, the frequency of tsunami or run-up events on the East Coast of the United States is approximately one event for every 29 years.[59]

Probability of Future Occurrence

While tsunamis are less frequent in the Atlantic than in the Pacific, they remain a possible hazard due to subduction zones in the Caribbean Sea and other seismic sources. These zones can generate powerful underwater earthquakes capable of triggering tsunamis.

Climate Change Impacts

Sea level rise and rising temperatures will accelerate ice melt and collapse of glaciers globally, which may cause massive landslides or glacial earthquakes capable of triggering tsunamis that could impact Rhode Island. Additionally, higher baseline sea levels will likely increase the extent and severity of tsunami-related flooding and erosion.

59 ResilientMass Plan: 2023 MA State of Hazard Mitigation and Climate Adaptation Plan.

Space Weather

Description

Space Weather includes solar wind, solar flares, and coronal mass ejections, including any condition in outer space that impacts technology on Earth. These events are naturally occurring phenomena that have the potential to result in failure of electric power systems; satellite, aircraft, and spacecraft operations; telecommunications; position, navigation, and timing services; and other technologies and infrastructures.[60]

One hazard of space weather is electromagnetic pulses (EMP), which, according to the U.S. Department of Energy, are "intense pulses of electromagnetic energy resulting from solar-caused effects on man-made nuclear and pulse power devices." EMPs can occur naturally, such as a solar storm that causes a geomagnetic disturbance, or can be caused by humans, such as a nuclear or non-nuclear explosion that creates high magnitude electric and magnetic fields and induced currents in the earth and electric grid.

Americans are protected from EMPs by the Critical Infrastructure Protection Act, an amendment to the Homeland Security Act of 2002 that requires reporting of EMP threats, EMP research and development, and an education campaign on EMPs for planners and emergency responders. EMP mitigation is difficult and largely done at the national level. The federal government has focused efforts on shielding critical infrastructure from EMP effects.[61]

Location

Space weather can occur in any location and is relatively unpredictable.

Extent (Event Magnitude)

The strength of space weather is directly related to the magnitude of the solar flare/storm or high-altitude nuclear explosion. **Appendix H** lists the NOAA Space Weather Scales for geomagnetic storms, solar radiation storms, and radio blackouts.

Impact and Damage Extent

EMPs can impact a wide range of electronic systems and devices, such as communication systems on the power grid and global-positioning systems used for navigation. This could cause widespread destruction of property and life. See **Appendix H** for a description of damage for each type of space weather.

History

NOAA's Space Weather Prediction Center (SWPC) issued a Geomagnetic Storm Warning for Friday, May 10, 2024, highlighting solar eruptions could cause geomagnetic storm conditions to persist through that weekend. The first of several Coronal Mass Ejections (CMEs) reached

60 U.S. Department of Homeland Security, Federal Operating Concept for Impending Space Weather Events, May 2019 https://www.fema.gov/sites/default/files/2020-07/fema_incident-annex_space-weather.pdf

61 U.S. Department of Homeland Security, Science and Technology. *Electromagnetic Pulse Shielding Mitigations, Best Practices for Protection of Mission Critical Equipment.* August 2022.

Earth. This became known as the Gannon Storm. The CME was strong and SWPC issued a series of geomagnetic storm warnings. SWPC observed G4 conditions. Emergency Response Communications Teams in Portsmouth and around the State were participating in a day long Emergency Armed Forces Day Cross Band Test of two-way emergency communications between military communicators and stations in the amateur civilian radio service. The storm made completely inoperable our ability to communicate with any of the military installations under the designated frequencies, including the Naval Station in Newport and other military units in the region and nation.[62]

Thanks to early warnings and strong teamwork, the people who run critical systems like power, farming, and satellites were able to prevent most of the damage from the May 2024 storm. Two recent exercises, one in Texas and one in Maryland, highlighted the need for the press, media and the public to become more knowledgeable, to improve information flow among stakeholders, and implement mitigation measures to protect vulnerable systems. Emergency management authorities are increasingly improving resiliency from space weather storm impacts.

Probability of Future Occurrence

Unlikely, although possible. The probability of a Carrington event, which was the most intense geomagnetic storm in recorded history, occurring over next decade is approximately 12 percent.[63]

At this time, there are no feasible local mitigation actions available to reduce the impacts of space weather; however, the hazard is included in this plan due to its potential to affect regional infrastructure and emergency communications.

Climate Change

Changing climate patterns globally and in Rhode Island will worsen the effects of most natural hazards and affect future planning and mitigation efforts. Changes are already being observed and documented. On Aquidneck Island, climate change can be seen in sea level rise, high coastal flood waters, storm surges, and intense coastal storms. Long-term climate change is likely to cause the following impacts on Aquidneck Island:

- Heavier, more frequent precipitation events, which may cause more coastal and riverine flooding and flash flooding events
- Longer periods of drought and heat waves, which may affect public health and water availability and may increase the threat of brushfires
- More frequent or intense high-wind events, such as hurricanes and Nor'easters, which can cause dangerous storm surge, damage trees, cripple the electric grid, and damage property
- Increasing air and water temperatures

62 NOAA, *Strong geomagnetic storm reaches Earth, continues through weekend | National Oceanic and Atmospheric Administration*.

63 On the probability of occurrence of extreme space weather events - Riley - 2012 - Space Weather - Wiley Online Library.

How rapidly these climate changes will be felt is debatable, but municipalities certainly need to be prepared. The communities on Aquidneck Island aim to become more adaptable/resilient to the changing conditions and responsive to weather emergencies.

Portsmouth Concerns

As with any community, Portsmouth is not uniformly vulnerable to natural hazards and climate change. Low-lying coastal neighborhoods such as Common Fence Point, Island Park, and Hummocks have already seen an increase in flooding from high tides, storm surge, and heavy rain. Prudence Island, despite its year-round population of roughly 100 residents, is susceptible to increased flooding, droughts, and brushfires due to climate change. These issues emphasize the importance of robust emergency preparedness, response, and resiliency planning.

Middletown Concerns

In recent years, Middletown has experienced an increase in the frequency and intensity of severe weather events and heat waves. The impacts from such hazards include coastal flooding of critical infrastructure, bridges, roads, and low-lying areas of the coast; inland flooding from intense rain events; and property damage from trees, wind, snow, and ice. Longer periods of elevated heat during the summer have raised concerns about vulnerable segments of the population, including people who are elderly and disabled.[64]

Newport Concerns

The Point Neighborhood (east of the Goat Island causeway), one of Newport's most historic areas, has experienced flooding from both storm surge and freshwater stormwater that is unable to drain. Unless adaptation actions are implemented, this area will likely see massive flooding during future hurricanes and rainfall events.

There are four drinking water reservoirs (South Easton Pond, North Easton Pond/Green End Pond, Nelson Paradise Pond, and Gardiner Pond) located along the shoreline, protected by low berms that may be at increasing risk of failure due to more frequent and intense coastal storms driven by climate change.[65]

In Newport, climate change has become a real concern for historic preservationists, coastal homeowners, waterfront businesses, the U.S. Navy, and the city. Through the exercise of creating this plan, the City of Newport is exploring ways to reduce its long- and short-term risks to a variety of hazards. Any storm that comes up on the eastern seaboard will likely impact Newport. As climate conditions intensify, the RHMC is prepared to update this regional plan accordingly.

64 Middletown Municipal Resilience Program, Community Resiliency Building Workshop Summary of Findings, September 2020.

65 Rhode Island Coastline Coastal Storm Risk Management, Final Integrated Feasibility Study and Environmental Assessment, 2023.

4

Risk Assessment

FEMA has an online mapping application that identifies communities most at risk for natural hazards. Called the National Risk Index, the RHMC used this application to get a high-level view of Newport County's expected annual losses and vulnerability to numerous natural hazards. The Risk Index considers expected annual losses for hazards, social vulnerability, and community resilience. See **Appendix C** for the full report. **Table 31** below shows the Risk Index for each hazard. Overall, the Risk Index for Newport County is relatively low compared to the rest of the United States.

Table 31 FEMA National Risk Index for Newport County

Hazard	Risk Index	Expected Annual Loss
Hurricane	Relatively Low	Very Low
Coastal Flooding	Relatively Low	Very Low
Riverine Flooding	Relatively Low	Relatively Low
Winter Weather	**Very Low**	Very Low
High Winds	**Very Low**	Relatively Low
Drought	Relatively Low	Relatively Low
Extreme Temperatures	**Very Low**	Very Low
Lightning	Relatively Low	Relatively Low
Hail	**Very Low**	Very Low
Wildfire	**Very Low**	Very Low
Tornado	**Very Low**	Very Low
Earthquake	**Very Low**	Very Low

Compared to the rest of the country, Aquidneck Island and Newport County may have a relatively low risk of disasters, but that is not a reason to sit by idly as the waters rise.

The following sections summarize Aquidneck Island resources at risk to natural hazards and some potential losses or impacts from major storm events.

Facilities/Resources Inventory

The first step in the assessment process was to inventory the facilities and resources of special concern to each municipality. In developing the inventory, the community's lifelines were considered. Lifelines are the most fundamental services in the community that, when stabilized, enable all other aspects of society to function, like government and business. They are essential to human health and safety or economic security. When disrupted, decisive intervention (e.g., rapid re-establishment or employment of contingency response solutions) is required to stabilize the incident. Taking mitigation steps to protect these assets pre-event helps avoid interruptions to these vital services. Lifelines include the following:

- **Safety and Security**—law enforcement/security, fire service, search and rescue, government service, community safety
- **Food, Hydration, and Shelter**—food, hydration, shelter, agriculture
- **Health and Medical**—medical care, public health, patient movement, medical supply chain, fatality management
- **Energy**—power grid, fuel
- **Communications—**infrastructure, responder communications, alerts, warnings, and messages, finance, 911, and dispatch
- **Transportation—**highway/roadway/motor vehicle, mass transit, railway, aviation, maritime
- **Hazardous Materials—**facilities, hazardous materials, pollutants, contaminants
- **Water Systems—**potable water infrastructure, wastewater management

The RHMC identified the following as critical infrastructure/community assets:

- Drainage systems and streets located in flood-prone areas
- Bridges
- Wastewater facilities
- Water supply systems
- Other services/utilities
- Communication towers
- Dams
- Critical municipal hazard response facilities
- Populations
- Businesses
- Schools
- Recreational facilities
- Natural resources
- Historic resources

Specific most vulnerable assets are identified in the municipalities' Critical Infrastructure/Community Assets Matrices in **Appendix F**.

Hazard Mitigation Mapping

Municipal geographic information systems (GIS) databases, including parcel data, orthophotography, and FEMA flood zone information, were used to complete the assessment.

Such mapping allowed the consultant to estimate potential fiscal and population impacts for individual parcels.

The final output of this exercise is the Aquidneck Island Community Assets Map in **Appendix D**. The focus of the map is not to duplicate all the spatial information generated through the inventory process but rather to present the location of the identified vulnerable resources and areas.

Fiscal Impact Analysis

The built environment is vulnerable to the impacts from flooding and strong winds. Aquidneck Island has an estimated 23,000-plus buildings with a total replacement value (excluding contents) of $13 billion. Approximately 85 percent of the buildings and 65 percent of the value are associated with residential housing.[66]

The more costly hazards of concern on Aquidneck Island are hurricanes, flooding, and future sea level rise. All involve a lot of water in the low-lying coastal communities, which would disrupt and even shut down transportation, commerce, and local services. Below are examples of how those three hazards can impact the tax base and economy.

Hurricanes

HAZUS-MH is a FEMA software tool that contains models for estimating potential losses from earthquakes, floods, and hurricanes. The RHMC used HAZUS-MH to understand the potential risk from a large hurricane. For this plan, two scenarios were run to capture the region's risk from wind-borne hurricane damage. The first looks at the wind speed of the path of historic Hurricane Carol in 1954. The second scenario looks at the probability of major hurricanes (Category 3 or stronger).

HAZUS Qualitative Damage Description

No Damage or Very Minor Damage

› Little or no visible damage from the outside. No broken windows or failed roof deck. Minimal loss of roof cover, with no or very limited water penetration.

Minor Damage

› Maximum of one broken window, door, or garage door. Moderate roof cover loss that can be covered to prevent additional water from entering the building. Marks or dents on walls requiring painting or patching for repair.

Moderate Damage

› Major roof cover damage, moderate window breakage. Minor roof sheathing failure. Some resulting damage to interior of building from water.

66 HAZUS MH Version 6.1

Severe Damage

- Major window damage or roof sheathing loss. Major roof cover loss. Extensive damage to interior from water.

Destruction

- Complete roof failure and/or failure of wall frame. Loss of more than 50 percent of roof sheathing.

Hurricane Carol 1954

In 1954, Hurricane Carol, one of the worst hurricanes on record in Rhode Island, hit Aquidneck Island as a Category 1 storm with peak gusts at 110 mph. It tore through Southern New England, causing extensive damage throughout Rhode Island. If this same storm were to strike again today, it would cause over $503 million dollars in total economic losses (property damage and business interruption loss) on Aquidneck Island. Approximately 1,735 buildings would be at least moderately damaged.[67] Approximately 214 would be completely destroyed. **Table 32** expands on these damages. For a detailed HAZUS Hurricane Global Risk Report for Hurricane Carol, see **Appendix E**.

Aftermath of Hurricane Carol, Newport. Photo Credit: Newport Daily News.

67 A representative analysis. No particular building is identified.

Table 32 HAZUS-MH Scenarios for Aquidneck Island

1954 Hurricane Carol Scenario—If It Happened Today[68]

Estimated Damage	Amount
Debris generated	67,397 tons
Buildings destroyed	214
Buildings at least moderately damaged	1,735 (7% of the total number of buildings)
Displaced households	256 households displaced 172 people out of a population of 60,109 seek temporary shelter in public shelters.
Essential facility damage (fire, police, schools)	17 of 41 facilities non-operational for less than a day One school at least moderately destroyed, other facilities remain operational.
Residential property (capital stock)	$444,129,790
Business interruptions	$58,941,100

Stone Bridge, once connecting Portsmouth and Tiverton, was battered by Hurricane Carol.
Photo Credit: The Providence Journal.

68 HAZUS-MH Hurricane Global Risk Report, run August 2024.

Probabilistic Hurricane Scenario

A probabilistic hurricane model was run in HAZUS-MH to estimate the wind damages from 10-, 20-, 50-, 100-, 200-, 500-, and 1,000-year hurricanes on Aquidneck Island. **Table 33** estimates wind speeds for each of the scenarios. Reference **Hurricanes** on page 37 for recent recorded hurricane wind intensities on Aquidneck Island.

Table 33 HAZUS-MH Hurricane Scenarios for Aquidneck Island

Return Period (% Chance)	Wind Speed (mph) at Benton Point, Newport	Wind Speed (mph) at Naval Station Newport, Middletown	Wind Speed (mph) at Island Park, Portsmouth
10 (10% in any given year)	N/A	N/A	N/A
20 (5% in any given year)	67	65.7	66.1
50 (2% in any given year)	87.3	85.5	86.4
100 (1% in any given year)	98.6	96.7	97.7
200 (0.5% in any given year)	108	105.9	107.1
500 (0.2% in any given year)	117.9	116.2	117.3
1,000 (0.1% in any given year)	124.3	122.3	124.3

For the purpose of this plan, a 1 percent annual chance storm of Category 2 or greater with winds 96–100 mph was used to estimate a moderate hurricane. Less intense storms are more in line with what the island has been experiencing.

Wind damages from the probable storm are summarized in **Table 34**.

Table 34 HAZUS-MH Probabilistic Scenario for 1 Percent Annual Chance Major Hurricane on Aquidneck Island

Probabilistic Category 2 Hurricane (Wind Speeds 96–110 mph)—If It Happened Today[69]

Estimated Damage	Amount
Debris generated	53,225 tons
Buildings destroyed	121
Buildings at least moderately damaged	1,221 (5% of total number of buildings)
Displaced households	159 households displaced 113 people out of a population of 60,109 seek temporary shelter in public shelters
Essential facility damage (fire, police, schools)	17 of 41 facilities non-operational for less than a day. One school at least moderately damaged, other facilities remain operational
Residential property (capital stock)	$311,361,070
Business interruptions	$40,637,700

Flooding

Although wind and heavy snow can certainly rack up substantial damages, flooding is one of the hazards that most frequently affects island populations. Local parcel data and FEMA's 1 percent annual chance floodplain data were used to generate estimates of potential fiscal impacts from natural hazard events such as flooding. The information used from the tax assessor's database and GIS included the improvement values, land usage, and unit counts. Note that this analysis does not account for sea level rise, erosion, or storm surge. The analysis showed that Aquidneck Island is comprised of 24,192 acres of land, with about 5,534 acres in the regulatory floodplain. These flood-prone areas are largely located along the perimeter of the island, northeast of Boyds Lane in Portsmouth; along the Maidford River, Paradise Brook, and Bailey Brook in Middletown; and in the area between Harrison Avenue and Moorland Road in Newport. These FEMA-mapped areas do not consider erosion, sea level rise, or inadequate storm drainage.

During non-cyclone events, flooding can still impact the island. **Table 35** and **Table 36** display potential damage estimates of property values of buildings within the Town's Special Flood Hazard Area (SFHA), or regulatory floodplain. Land value was not considered for this exercise. Approximately 23 percent of the island's land area falls within the regulatory floodplain. This percentage was calculated to assist with identifying which areas are at greater risk. According to **Table 35**, the total potential building damages island-wide for these floodplain areas are about $3.2 billion.

69 HAZUS-MH Hurricane Global Risk Report, run August 2024.

Table 35 Value of Structures in the Floodplain

Flood Zone	# of Parcels	Building Value
VE	1,209	$1,365,468,804
AE	2,502	$1,842,333,465
A	14	$7,752,900
TOTAL	**3,725**	**$3,215,565,179**

On average, 76 percent of Aquidneck Island's revenue is generated from real estate taxes.[70] Should any of the properties forming the tax base be destroyed due to flooding, a causal effect would be those property owners whose parcels remain intact would carry an increased financial burden with regards to property taxes. It is an important course of action for the municipalities to protect both lives and property from natural disasters. However, as Aquidneck Island's population grows, the burden of protecting lives and property grows.

Using data from the E-911 structure data from Rhode Island GIS and information from the municipal tax assessors, **Table 36** summarizes the value of the insurable buildings that are located within the Special Flood Hazard Areas.

The buildings that are located in each SFHA were first selected. The municipal parcel information for each building was then used to determine the building value. Parcels in the SFHA that do not have structures were not included in this assessment.

Using the Rhode Island GIS e911 structure file, FEMA flood insurance rate maps, and municipal GIS data, it was determined that approximately $3 billion in building values are located in the floodplain. Most of those are residential properties.

Table 36 Value of Structures in the Floodplain by Land Use Type

Land Use Type	# of Parcels with Parcels in the Floodplain	Assessed Building Value
Residential	3,306	$2,120,080,379
Business	177	$457,715,900
Mixed Use	107	$110,509,300
General Industry	90	$295,561,200
Commercial	45	$231,698,400
TOTAL		**$3,215,565,179**

There are 1,781 flood insurance policies in place for an area that has an estimated 2,267 structures in the regulatory floodplain (VE, AE, and A zones). In the lower risk X zones, 777 policies are in place. These policies are more affordable than those in the AE, A, and VE zones, which represent areas with higher flood risk.

70 Based on municipal budgets for fiscal year 2023. 81% of Newport's revenue is generated from property taxes, 84% in Portsmouth, and 63% in Middletown.

Table 37 Flood Insurance Information

	Newport	Middletown	Portsmouth	Aquidneck Island
Structures in the SFHA[71]	1,041	107	1,119	2,267
Total Number of Policies	1,162	98	521	1,781
X Zone	481	57	239	777
A Zone	608	24	251	883
VE Zone	73	17	31	121
Total Premiums	$891,310	$56,004	$498,822	$1,446,136
Insurance in Force	$306,112,000	$36,355,000	$139,611,000	$482,078,000
Total Number of Closed Paid Losses	224	36	137	397
$ of Closed Paid Losses	$9,057,493	$370,648	$840,343	$10,268,484
Repetitive Loss Properties	24 (9 residential, 10 non-residential)	3 (residential)	7 (6 residential, 1 non-residential)	34
Severe Repetitive Loss Properties	5 (2 residential, 3 non-residential)	0	0	5

Areas that did not experience flooding previously are now more vulnerable as sea level rises and riverine flood intensity and frequency increases. Most development predates recent regulations requiring flood proofing, leaving many vulnerable areas unprepared to face a storm of any significance.

FEMA A Zone vs. AE Zone

Both are considered SFHAs—areas with a 1 percent annual chance of flooding and a 26 percent chance of flooding over the life of a 30-year mortgage.

AE Zone: Base Flood Elevations (BFE) are provided on FEMA maps. Formerly A1-A30 numbered zones.

A Zones: Detailed studies indicating depth or base flood elevation have not been conducted.

Each municipality has identified critical community assets, listed in the Critical Infrastructure/Community Assets (**Appendix D**). Flood-prone areas across Aquidneck Island contain critical and sensitive infrastructure and services that are vulnerable to flood impacts. These include drainage systems, streets, bridges, wastewater and water supply infrastructure, utility and communications systems, dams, hazard response facilities, population centers, businesses, schools, recreational spaces, and historic resources. The magnitude of potential losses would depend on the type, location and extent of flooding.

Local zoning laws help dictate future development while maintaining Aquidneck Island's unique character. Continued enforcement of Rhode Island State building codes and new regulations will lessen potential damage caused by flooding. The codes adopted by Aquidneck Island range from building codes and design standards, to zoning regulations.

71 Estimated number of structures based on E-911 building footprint GIS data and the FEMA Digital Flood Insurance Rate Map (DFIRM), 2022.

Sea Level Rise

It is worth noting that although some buildings and roads may be past their design life by the time sea level rise impacts them, current planning efforts can better safeguard future developments.

With 60 miles of coastline, even on a sunny day, large areas of Aquidneck Island are susceptible to impacts from one, three, or five feet of sea level rise by 2100. It is difficult to quantify some impacts of sea level rise, such as saltwater intrusion into marshes and drinking water. While parts of Rhode Island's coast have been part of a University of Rhode Island-based STORMTOOLS Coastal Environmental Risk Index assessment that predicts storm surge and wave and shoreline change maps (erosion) and damage functions, this type of analysis has not been conducted for Aquidneck Island.

As sea levels rise and storm surge boundaries move inland, more and more properties will be impacted by coastal flooding. Permanently flooded roads could isolate and ultimately flood entire neighborhoods. As sea levels rise, coastal land values may decrease as more areas are permanently flooded.

A moderate sea level projection of three feet can be expected within the next 40 years, within the design life of most roads. Under a three-foot sea level scenario, 4.2 miles of roads on Aquidneck Island would be impacted.[72] A very high-level analysis estimates the 4.2 linear miles of critical roadway could cost more than $19 million to reconstruct. For the repair of more substantial roads, the addition of stormwater management and other roadway infrastructure would significantly increase costs. Future adaptation efforts may require not only reconstructing these roads but also evaluating the feasibility and costs associated with raising them, particularly in flood-prone areas. A preliminary study to assess evaluation options, such as raising critical roadways by one foot, is recommended and is further discussed in the strategies section.

Population Impact Analysis

Of primary concern during a hazard event is protecting the health and safety of Aquidneck Island residents. In addition to knowing the total population, it is also important to estimate how many people would be impacted by loss of service or need to evacuate. According to the 2023 American Community Survey five-year estimates, there are 30,193 housing units in Aquidneck Island supporting a population estimate of 59,942. During a moderate hurricane, up to 159 households may be displaced and seek shelter. The population on Aquidneck Island is generally concentrated in the inland areas.

2020 Census data was used in **Figure 18** to estimate the most densely populated areas.

Vulnerable populations include elderly/senior citizens, people with special needs, people with disabilities, students, visitors and tourists, business owners, veterans, low-income residents, and the working waterfront community.

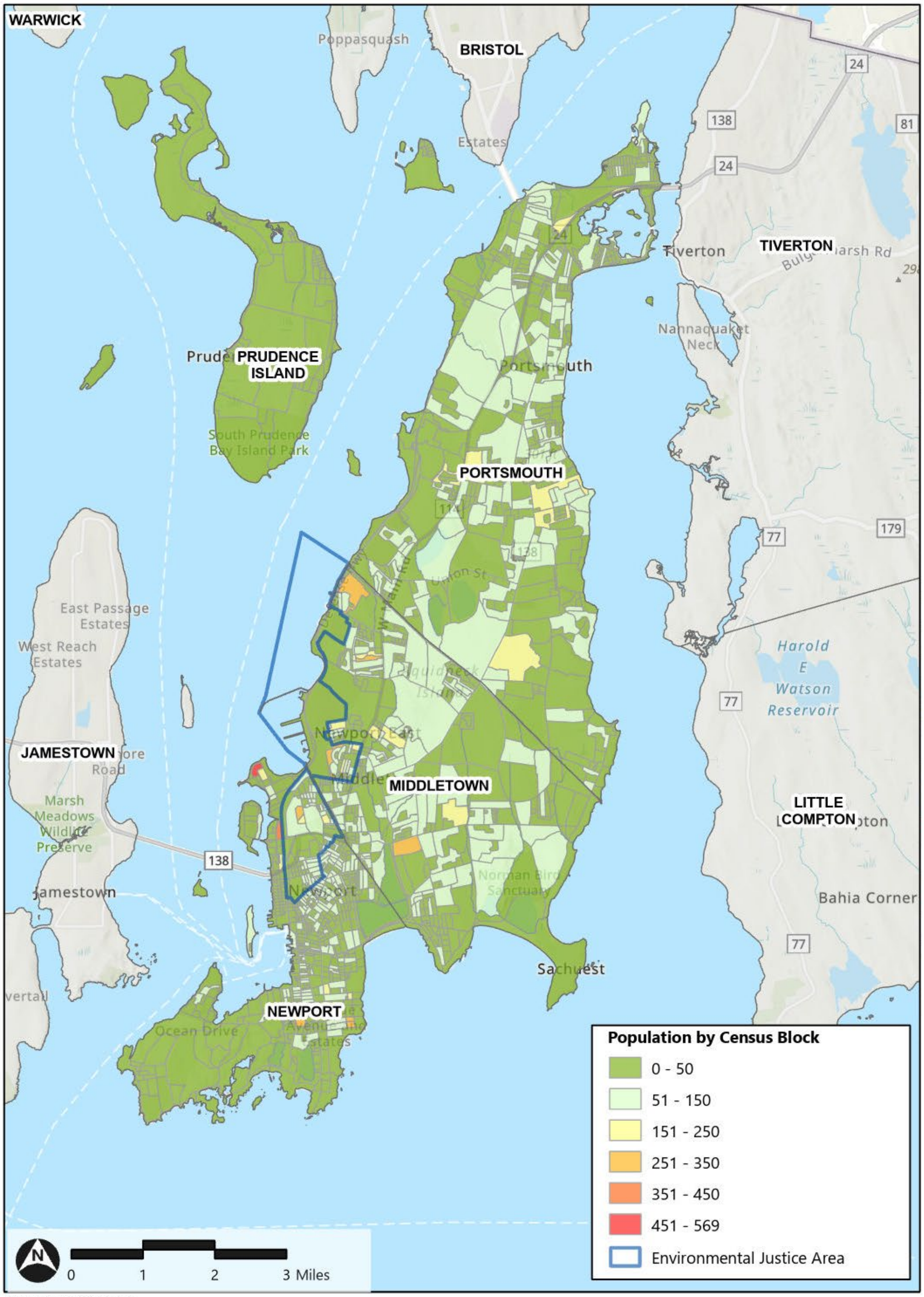
72 Rhode Island Division of Statewide Planning

More than 50 percent of Newport houses are used as rental properties.[73] Renters may not be aware of flood risks or have flood insurance covering contents. Additionally, as Aquidneck Island is a tourist destination, its population of renters increases during the summer months, especially in Newport. Non-residents may be unfamiliar with evacuation routes, sheltering options, or flood risks. They also are unlikely to be subscribed to the municipal Code Red systems that sends out automated emergency alerts. Each of these factors puts them at greater risk to the impacts of hazard events. Improving emergency response and educating these populations is important to all three communities.

In addition to direct damage to personal property, a significant hazard can disrupt vital services, compromise utilities, and cause emotional strain from financial and physical losses. These impacts are especially acute when residents are forced to evacuate their homes.

73 U.S. Census Bureau, Population Estimates Program v2024. https://www.census.gov/quickfacts/fact/table/newportcityrhodeisland#

Figure 5 2020 Population by Census Block



Source: 2020 Census

Community Anchor Points

A community is more than the people and their homes. Community institutions or anchor points are features of a city or town that enrich the lives of residents. Examples include schools, libraries, health centers, hospitals, public safety centers, community support organizations, and religious institutions. Loss of these resources can slow down recovery. On Aquidneck Island, these anchor points can be impacted by a variety of hazards. The following community anchor points are located in the flood zone and therefore especially vulnerable to flooding. See **Appendix D** for a detailed map of community assets on Aquidneck Island.

Table 38 Community Institutions in the Flood Zone

Name	Address
Aquidneck Island Adult Learning Center/Newport Community School	23 America's Cup Avenue, Newport
Dr. Martin Luther King, Jr. Community Center	20 Dr. Marcus Wheatland Boulevard, Newport
Christian Congregation in the United States	5 Dr. Marcus Wheatland Boulevard, Newport
The Zabriskie Memorial Church of Saint John the Evangelist	61 Poplar Street, Newport
U.S. Customs and Border Protection Port of Entry	320 Thames Street, Newport
Newport Fire Department Station 1	21 West Marlborough Street, Newport
U.S. Naval War College	686 Cushing Road, Newport
Turning Around Ministries	40 Dr. Marcus Wheatland Boulevard, Newport
Common Fence Point Arts, Wellness, and Community Center	933 Anthony Road, Portsmouth

Environmental Justice

There are nearly 6,000 low-income individuals living in flood-prone areas of Newport and Middletown. These communities are particularly susceptible to hardships related to natural hazards and climate change.

- Residents of these communities may lack adequate health care, medicine, health insurance, and access to public health warnings in a language they can understand. In addition, they may not have access to transportation to escape the impacts of extreme weather, or home insurance and other resources to relocate or rebuild after a disaster.
- Disadvantaged communities in Newport have higher rates of health conditions such as asthma. Periods of extreme heat and warming conditions can worsen pollen, air quality, and asthma.
- In addition to causing damage to homes, flood waters can promote mold growth in Newport's low-lying North End neighborhood, which is already overburdened from flooding and suffering from asthma.
- Residents may not feel welcome to access resources during a disaster, such as free meals, hotels, etc., if they do not see other people of the same socioeconomic status using it or telling them about it.

- Federal funding and post-disaster assistance are not available to those without Social Security numbers.
- During the winter, many seasonal employees are out of work and are already experiencing hardships, which can be compounded if there is a weather emergency.

The North End of Newport has been identified as a critical area for near-future economic and innovation development in the Newport Comprehensive Plan and Newport Tree, Park, and Open Space Master Plan. The North End Urban Plan aims for more diverse economic opportunities and establishing a connection between the North End and Newport's downtown and waterfront.

Disadvantaged communities in Newport's North End have been asked to participate in the implementation of a variety of projects that meet climate adaptation and resiliency goals.

Natural Environment

The following critical natural resources are present on Aquidneck Island:

- Wetlands and salt marshes
- Rivers, creeks, brooks, and associated tributaries
- Floodplains
- Soils
- Habitats and endangered species
- Open space/preserves
- Wooded areas
- Beaches and dunes
- Bays and ocean

Impacts from natural hazards and climate change are not uniform throughout the island. The RHMC and participants in the Community Building Workshops have identified the following items as key environmental areas of concern:

- Erosion and loss of beaches, dunes, wetlands, and salt marshes
- Beach closures due to intense rain events
- Long-term viability of drinking water reservoirs
- More frequent flooding of smaller tributaries
- Risk to low-lying homes due to high groundwater levels
- Impacts of tree health from pests and natural aging
- Threats to open space

Hurricanes, Nor'easters, floods, or any weather-related hazard event will have particular impacts on the natural environment. Differences in storm size, speed of movement, wind speeds, storm surge heights, timing with respect to tides, and landfall location relative to vulnerable resources makes for high variability in impacts and related costs.

In particular, climate change is expected to result in more frequent heavy rains, affecting stream flow.[74]

When the natural environment is impacted there are both direct and indirect costs. Impacts of severe weather events to the natural environment include both direct costs—such as loss of habitat and salinization of land/groundwater; and indirect costs—such as widespread inland damage to the built environment, threats to ecosystems/species, and contamination of drinking water supply.

Vulnerability of Future Structures

Aquidneck Island is not uniformly vulnerable to natural hazards and climate change. Certain locations, resources, and populations have and will be affected to a greater degree than others. The local zoning districts help to maintain these less densely developed areas. Development growth should only occur if there are ample municipal services, funds, and community buy-in to support the new infrastructure.

Aquidneck Island's vulnerability to natural hazards is not expected to dramatically change over the next five years due to widespread increased development.

› In Portsmouth, only modest growth in population and residential development is expected between now and 2040.[75]
› Approximately 60 percent of Middletown is zoned residentially. Planned growth in Middletown is in the general vicinity of the intersection of West Main and East Main Roads, which is already an established business corridor.[76]
› 90 percent of Newport is developed with well-established land use patterns. Mitigation efforts to date have focused on making existing development more resilient.[77]

Enforcement of current building codes will ensure that new development or redevelopment will be stronger and more resilient than some of the older, historic structures on Aquidneck Island. Although not all of the strategies described in this section represent true mitigation actions, they remain important steps for the region to take to improve overall resilience.

The communities on Aquidneck Island anticipate the following changes that may impact future vulnerability:

74 Rhode Island's Environmental Climate Change Coordinating Council (EC4) Science and Technical Advisory Board, *Current State of Climate Science in Rhode Island,* May 1, 2016 Microsoft Word - STAB_Ann_Rpt_Final.docx (ri.gov)

75 Portsmouth Comprehensive Community plan December 2022.

76 Middletown, Rhode Island Comprehensive Community Plan 2014.

77 Newport, RI Climate Resilience & Financing Prioritization Report, 2022.

- Expansion at Naval Station Newport may put more people at risk to a vulnerable coastal area.
- Potential development and redevelopment in Newport's North End may be impacted by future coastal storms and flooding. This area is also planning for more green infrastructure to mitigate risks.
- The planned Marine Village development in Portsmouth is located on an undeveloped brownfield in the floodplain associated with Weaver Cove. This development will have 400 residential units, a marina, retail, and restaurant components. Having more people and infrastructure along the coast may increase the vulnerability of that region.

Anticipated Future Vulnerability of Infrastructure

As climate conditions change, increased storm intensity or frequency may put considerable stress on the infrastructure on Aquidneck Island. Roads will flood more often and may eventually become unusable. Drainage infrastructure may be overwhelmed more often. Increased runoff could threaten the quality of drinking water supply. Fire hydrants, pump stations, and sewer and water lines will be stressed or inaccessible by the rising streams and rivers. Areas that are not used to flooding may see flood waters inch closer to their property.

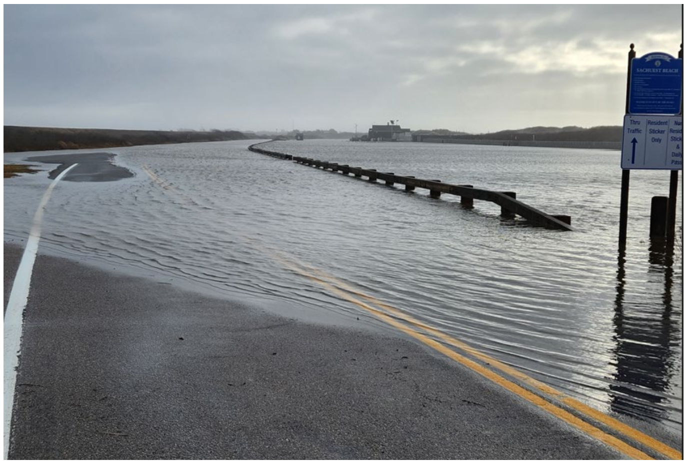
More intense heat waves are tempered by the island's proximity to the ocean, but they may put greater stress on the electric grid during the summertime, when the population on Aquidneck Island is higher.

Road flooding at the entrance to Common Fence Point, Portsmouth. Grant money was used to install a better drainage system to reduce the flooding depicted above, but concerns grow as tides creep higher and water egresses in from the drainage system during extreme high-tide events.

Regional Needs Matrix

The Regional Needs Matrix (**Table 39**) is the result of RHMC brainstorming, the review of the various Aquidneck Island resiliency studies, workshops, and reports. The table summarizes the identified regional needs and the proposed regional mitigation actions to help reduce vulnerability and improve resilience. Details for each mitigation action are in **Chapter 6**.

Critical infrastructure and community assets for each community are listed in **Appendix D**.



Sachuest Beach/Second Beach in Middletown on January 10, 2024.

Wind damage at Naval Station Newport.

Table 39 Aquidneck Island's Regional Resilience Initiatives

Needs	Challenges	Initiatives
Island-Wide Emergency Management	The local first responders in Portsmouth, Middletown, and Newport prioritize preparing and responding to emergencies. However, disaster- and catastrophe- level events call multi-organizational planning and preparedness beyond the department-level planning and preparedness practiced by the towns' Fire and Police Departments. Not only is there limited bandwidth to focus on coordinated disaster- and catastrophe-level responses and planning, but this approach also requires unique skillsets. Disaster-level planning calls for the creation of numerous detailed plans (emergency operations planning, emergency operations center, operations plan, damage assessment, evacuation, critical transportation, commodities dispensing, medical dispensing, volunteer management, mass casualty, reunification center plan, mass sheltering, debris removal, continuity of ops, hazard mitigation, etc.) and identification of resources to execute and manage them. Having each municipality create essentially the same plans and staff and train the overhead management positions needed in a disaster is neither efficient nor achievable.	1. Build a regional emergency operations center and/or dual incident command post hybrid capability. *(Capacity Building)* 2. Establish Aquidneck Island emergency management capabilities (i.e., an agency or a coordinator). *(Capacity Building)* 3. Develop a Comprehensive Evacuation Plan for all of Aquidneck Island, in collaboration with communities along most probable evacuation routes. *(Preparedness)* 4. Partner with the University of Rhode Island to deploy RI-CHAMP advance storm modeling for Aquidneck Island. *(Capacity Building)*

Needs	Challenges	Initiatives
	A Regional Emergency Management Agency is a best practice nationally and can be implemented without compromising any one municipality's authority over response operations within their normal jurisdictions. There is no comprehensive evacuation plan for Aquidneck Island, the State, or our region. If evacuation becomes necessary, it will require carefully planned coordination among many entities. Aquidneck Island is very vulnerable to substantial damage from hurricanes and Nor'easters. Local leaders and planners need a better understanding of the level of risk so that they can plan for appropriate resilience and mitigation actions.	
Drinking Water Protection	Portions of the Easton Pond dams are vulnerable to sea level rise and increased frequency and intensity of coastal storms and precipitation.	5. Implement recommendations of Easton Pond resilience projects. *(Mitigation)*
Population Education	The Aquidneck Island community needs consistent resilience messaging coming from the three municipalities, non-governmental organizations, the U.S. Navy, and businesses.	6. Develop an island-wide public education plan to communicate resiliency efforts and initiatives. *(Preparedness)*
Population Sheltering	The emergency mass sheltering plan for all of Aquidneck and Prudence Islands identifies the Gaudet Middle School in Middletown as the primary shelter and Portsmouth High School as the secondary or overflow shelter. The Gaudet School is being demolished and rebuilt. As storm intensities increase and other hazards become of greater risk, more people beyond those in the predicted inundation zones may need to take refuge in a shelter, but shelters need to meet specific occupancy criteria and be staffed to appropriately serve the needs of sheltering populations. Portsmouth provides the Islands secondary mass shelter at Portsmouth High School, but the generator at the shelter does not supply power to the spaces needed to have a fully functioning shelter in accordance with national standards. Portsmouth is actively working to rectify this deficiency, though addressing the issue will likely be costly.	7. Assess regional emergency sheltering capacity and capabilities. *(Preparedness/Capacity Building)*

Needs	Challenges	Initiatives
Natural System Protection	Local streams and rivers have become infilled with silt and vegetative debris. Restoration can improve the capacity of the floodplain to store stormwater runoff and filter pollutants.	8. Conduct floodplain and stream restoration on local rivers and waterways to make them more efficient at carrying stormwater. *(Mitigation)* › Maidford River › Bailey Brook › Founder's Brook › Elizabeth Brook 9. Explore the feasibility of an enterprise fund for stormwater maintenance. *(Capacity Building)* 10. Explore the feasibility of a regional beach preservation program. *(Mitigation)*

5

Existing Capabilities

Purpose

The Aquidneck Island communities recognize that mitigation initiatives not only benefit the island by reducing human suffering, damages, and the costs of recovery, but also help build and maintain the sustainability and economic health of the region. This section discusses the capabilities and effectiveness of the existing authorities, policies, programs, and resources available to accomplish hazard mitigation. The purpose of the capability assessment is to highlight successes, identify shortcomings, and lay the groundwork for possible improvement.

Prudence Island, Portsmouth seawall restoration (2024).

Local Plans and Regulations

Various plans and regulations support hazard mitigation efforts. **Table 40** identifies these plans and regulations per town, noting their dates and relevant details.

Table 40 Local Plans and Regulations

<table>
<tr><th></th><th>Portsmouth</th><th>Middletown</th><th>Newport</th></tr>
<tr><td>Capital Improvement Plan</td><td>2020–2030</td><td>2022–2026</td><td>2025–2029</td></tr>
<tr><td>Comprehensive Community Plan</td><td>2022
Element 11 discusses natural hazards and climate change</td><td>2015
Chapter III identifies climate change goals</td><td>2021
Chapter 13 includes natural hazards and climate change</td></tr>
<tr><td>Continuity of Operations Plan/Continuity of Government</td><td>Yes</td><td>Underway</td><td>Yes</td></tr>
<tr><td>Emergency Operations Plan</td><td>Yes</td><td>Yes</td><td>Yes</td></tr>
<tr><td>Erosion and Sediment Control Plan and Stormwater Pollution Prevention Plan</td><td>Yes</td><td>Yes</td><td>Yes</td></tr>
<tr><td>Harbor Management Plan and Harbor Ordinances</td><td>Yes</td><td>Yes</td><td>Yes</td></tr>
<tr><td>Municipal Resilience Program Community Resilience Building (CRB) Workshop, Summary of Findings</td><td>2019</td><td>2020</td><td>2020</td></tr>
<tr><td rowspan="5">National Flood Insurance Program</td><td>Participant since 1973</td><td>Participant since 1971</td><td>Participant since 1970</td></tr>
<tr><td colspan="3">Newport County Flood Insurance Study dated July 6, 2021</td></tr>
<tr><td colspan="3">Local National Flood Insurance Program Coordinator: Building Official</td></tr>
<tr><td>Article III, Section F of the Zoning Code of Ordinances is dedicated to floodplain management and minimizing hazards to persons and property from flooding</td><td>Article 10 of the Zoning Code of Ordinances is dedicated to floodplain management and minimizing hazards to persons and property from flooding</td><td>Chapter 15.24 of the City's Building and Construction Code of Ordinances is dedicated to the floodplain management program and minimizing hazards to persons and property from flooding</td></tr>
<tr><td>Development in the Special Flood Hazard Area (SFHA) requires additional permit details</td><td>All proposed development in the SFHA requires a permit</td><td>All proposed development in the SFHA requires a permit</td></tr>
</table>

	Portsmouth	Middletown	Newport
	Copies of Flood Insurance Rate Maps (FIRM), Federal Emergency Management Agency (FEMA) elevation certificates, and additional flood insurance data are available to the public	Copies of FIRMs, FEMA elevation certificates, and additional flood insurance data are available to the public	Copies of FIRMs, FEMA elevation certificates, and additional flood insurance data are available to the public
National Flood Insurance Program's Community Rating System (CRS)	No, do not currently have the capacity	Class 7 15% discount on insurance premiums	Class 7 15% discount on insurance premiums
Neighborhood Emergency Preparedness Committees	Common Fence Point Preparedness Committee Prudence Island Preparedness Committee Island Park and Hummocks Preparedness Committee	No	No
On-Site Wastewater Management Plan	Yes	No, needs support from Town Council	Yes
Open Burning Regulations	Yes	Yes	Yes
Open Space Plan	2023	No	2017
Prudence Island Wildland Fire Prevention Plan (2018)	Yes, reviewed in 2024	N/A	N/A
Soil Erosion, Runoff, and Sediment Control Ordinance	Yes	Yes	Yes
Subdivision and Development Regulations	Yes	Yes	Yes
Substantial Damage and Improvement Requirements	Defined in *Section F Flood Hazard Areas* of the Zoning Ordinance. The State Building Code (RIGL 23-27.3-106.0 to 106.5), which has been adopted by the Town of Portsmouth, covers substantial improvements and substantial damages for structures in the floodplain. Qualifying activities are tracked in the town's electronic building permit system.	Defined in *Article 10 Flood Hazard Areas* of the Zoning Code. The State Building Code (RIGL 23-27.3-106.0 to 106.5), which has been adopted by the Town of Middletown, covers substantial improvements and substantial damages for structures in the floodplain. Qualifying activities are tracked in the town's electronic building permit system.	Defined in *Chapter 15.24 Flood Hazard Area Development* of the Building and Construction Regulations. The State Building Code (RIGL 23-27.3-106.0 to 106.5), which has been adopted by the City of Newport, covers substantial improvements and substantial damages for structures in the floodplain. Qualifying activities are tracked in the town's electronic building permit system.
Tree Trimming Program	Yes	Yes	Yes

	Portsmouth	Middletown	Newport
Zoning Ordinance	Yes Includes zoning standards for the SFHA	Yes Includes floodplain overlay district	Yes Includes floodplain overlay district

Local Departments

Table 41 identifies local departments in each city that can contribute to hazard mitigation efforts.

Table 41 Local Departments

	Portsmouth	Middletown	Newport
Governing Body	Town Council 7 elected members	Town Council 7 elected members	City Council 7 elected members
CEO	Town Administrator	Town Administrator	City Manager
Aquidneck Island Emergency Volunteer Alliance	Established in 2014, a group of volunteers has committed to serve Aquidneck Island in the event of a natural or man-made disaster, in collaboration with the Rhode Island Chapter of the American Red Cross		
Emergency Management Agency	Director (part-time, 20 hrs./week) Partial emergency operations center (EOC) at Town Hall Incident Communications Center (ICC) on second floor of the Fire Department 1 staff car and 1 emergency response vehicle (utility truck)	Emergency Management Agency Director: Fire Chief EOC at Fire Department, 239 Wyatt Road	EMA Director: Fire Chief EOC at Police Station, 120 Broadway
Fire Department	Two fire stations (including 1 on Prudence Island) Staff: 40 full-time firefighters, 35 EMTs, various volunteers on Prudence Island Equipment: 3 engines, 1 ladder truck, 3 EMT rescues, 1 brush truck, 1 utility truck, 1 command car, 4 ancillary vehicles, and 3 marine assists Prudence Island Equipment: 2 engines, 3 tankers, 1 EMT rescue, 1 utility task vehicle (UTV) with EMS skid, 2 pickup trucks, 1 command car	One station at 239 Wyatt Road Staff: 1 captain, 4 full-time firefighters, and 1 dispatcher Equipment: 2 engines, 1 ladder truck, 3 EMT rescues, 1 tanker truck, 1 inflatable rigid hull boat, 1 jet ski, 1 brush truck, 2 pickup trucks, 1 Kubota UTV	Three fire stations Staff: 5 fire prevention, 2 administrative, 88 firefighters Equipment: 5 pump engines, 2 ladder trucks, 3 EMS rescues, 1 fire boat

	Portsmouth	Middletown	Newport
Police Department	One station at 2270 East Main Road Staff: 41 sworn officers	One station at 123 Valley Road	One station/EOC at 120 Broadway Staff: 83 sworn officers, 1 animal control officer, 20 non-sworn civil employees, 33 part-time retired officers Equipment: 18 marked vehicles, 12 unmarked vehicles
Planning	Planning Department Planning Board Prudence Island Planning Commission	Planning Department Planning Board	Department of Planning and Economic Development Planning Board
Zoning	Building Inspection Department, to include two certified safety assessment officials Zoning Board of Review	Building and Zoning Department Zoning Board of Review	Zoning and Inspections Department Zoning Board of Review
Utilities	Water and Fire District	None	Department of Utilities oversees the Water Division (drinking water) and the Water Pollution Control Division (sanitary sewer and stormwater)
Public Works	Department of Public Works	Department of Public Works	Department of Public Services, which includes Public Works, Parks and Recreation, and Engineering
Harbormaster	Full-time (from May through September) civilian within the Portsmouth Police Department	Yes	Staff: 1 full-time harbormaster, 8 assistant harbormasters, 3 administrative personnel, various temporary seasonal employees
Schools	School Department is responsible for maintenance of all school and municipal buildings on school grounds		
Historic Resource Management	None	None	Historic Preservation Planner Historic District Commission Cliff Walk Commission
Environment	Conservation Commission Tree Commission	Conservation Commission Open Space and Fields Committee	Tree and Open Space Commission Energy and Environment Commission

	Portsmouth	Middletown	Newport
Economic Development	Economic Development Committee	Economic Development Department Economic Development Advisory Committee	Planning & Economic Development Waterfront Commission

While each municipality maintains a robust framework of plans, regulations, and emergency management structures, some capacity gaps and needs for enhanced coordination are evident. For example, only Newport and Middletown participate in FEMA's Community Rating System, suggesting an opportunity for Portsmouth to pursue enrollment and training support. Middletown also lacks an On-Site Wastewater Management Plan and Open Space Plan, which could impact long-term resilience planning Capacity constraints are apparent in the limited staffing of emergency management personnel, particularly in Portsmouth, where the EMA director serves part-time. Additionally, only Newport has dedicated staff for historic preservation. Future regional efforts could benefit from more consistent planning timelines, mutual training programs, and broader implementation of resilience-focused land use planning tools.

Local/Regional Implementation Challenges

The following challenges in implementing hazard mitigation measures are common among most coastal municipalities in the region. These challenges can impact the effectiveness of existing authorities, policies, programs, and resources; however, it should be noted that local governments have a number of procedures and tools available that can allow them to adjust their programs, procedures, and resources over time to more effectively mitigate natural hazards.

All three Aquidneck Island municipalities face challenges that affect their ability to prepare for and respond to climate-related hazards, particularly flooding and sea level rise. One of the most significant barriers is limited capacity for regional coordination. While each municipality has localized concerns—such as Island Park, the Hummocks, and Common Fence Point in Portsmouth, which regularly experience coastal flooding, the coordination of cross-jurisdictional efforts remains underdeveloped. Staffing limitations also present difficulties, as seen in Middletown's reliance on interim leadership in key public safety positions in 2025.

Across all three municipalities, there is a shared need to secure funding to address chronic street flooding and to improve overall public safety. Existing stormwater infrastructure is not fully equipped to handle rising seas or the increasing intensity of precipitation events. Each town recognizes the urgency of enhancing stormwater capabilities with sea level rise explicitly factored into future mitigation and infrastructure plans. As individual flooding concerns are evaluated, specific strategies will be explored and identified as each street may have slightly different needs or requirements to address flooding.

Newport, with its rich inventory of historic and cultural assets, faces additional complexity: many of its most iconic structures are directly vulnerable to storm surge and flooding. Preserving these assets while adapting to climate impacts requires both technical planning and creative funding approaches.

Collectively, these challenges emphasize the need for stronger regional collaboration, consistent investment in infrastructure resilience, and shared planning mechanisms that can scale across municipal boundaries.

State Programs

Rhode Island Coastal Resources Management Council (CRMC)

New development along coastal areas of Aquidneck Island is regulated by the Rhode Island Coastal Resources Management Council (CRMC) and the municipalities. One CRMC regulation requires a coastal buffer zone—a "land area adjacent to a Shoreline (Coastal) Feature that is, or will be, vegetated with native shoreline species and which acts as a natural transition zone between the coast and adjacent upland development,[78]" on property within 200 feet of the inland edge of a coastal feature. Coastal buffer zones protect water quality, protect coastal habitat, protect scenic and aesthetic quality, and control erosion and flooding.

The CRMC has adopted shoreline change maps that delineate shoreline rates of change, which will be applied to pertinent sections of the Council's regulatory programs to address issues including proximity of infrastructure and development to coastal features. These shoreline change maps detail erosion rates for the shoreline and are further detailed into shoreline segments for each map. There are 45 such maps for Aquidneck Island.

Qualifying projects are required to submit a Coastal Hazard Application Worksheet when submitting a standard permitting application to the CRMC. The purpose of the worksheet is to notify the applicant of potential coastal hazards, such as sea level rise, storm surge, and associated flooding and shoreline erosion. It is CRMC's goal to guide development away from these vulnerable areas.[79]

Rhode Island Department of Environmental Management (RIDEM)

- **Division of Law Enforcement**: The RIDEM Division of Law Enforcement serves to protect natural resources and ensure compliance with all environmental conservation laws through law enforcement and education.

Land Revitalization and Sustainable Materials Management

- **Recreation Trail Grants:** This program provides financial assistance to municipalities and nonprofit organizations for the development and maintenance of recreational trails and trail-related projects. This federally funded program receives its funding from a portion of federal gas taxes paid on fuel. Grant funding is dependent on Rhode Island receiving funds from the Federal Highway Administration.
- **Section 319 Nonpoint Source Grant Program**: This program's goal is to prevent, control or abate nonpoint source pollution to the waters of the state—surface waters (both freshwater and saltwater) and groundwater. The Section 319 competitive grant funds provide financial

78 Red Book (650-RICR-20-00-1) - Rhode Island Department of State.

79 CRMC Coastal Hazard Application http://www.crmc.ri.gov/coastalhazardapp.html

assistance for projects that will protect or improve water quality and aquatic habitats, thus enhancing the designated uses of the state's waters by addressing sources of nonpoint pollution, correcting hydromodification issues, and restoring habitat.

- **Urban and Community Forest Program**: This RIDEM Division of Forest Management program supports activities that lead to a more effective and efficient management of urban and community forests and improve public understanding of the benefits of preserving existing tree cover in communities.
- **Wetland Regulations:** RIDEM is responsible for regulating alterations of the freshwater wetlands throughout the state. Since many floodplains are also wetlands, appropriately managing these resources helps maintain proper floodplain function. These regulations ensure that actions in this plan that alter the physical landscape do not do so at the expense of wetlands.

Rhode Island Department of Health

Local emergency managers, police, fire, and other local responders can voluntarily enroll in the Rhode Island Department of Health's Special Needs Emergency Registry to better prepare for and respond to an individual's needs during an emergency or disaster.

Rhode Island Department of Transportation (RIDOT)

RIDOT designs, constructs, and maintains the state-owned surface transportation system. This includes not only roads and bridges but also the state's rail stations, tolling program, bike paths, and ferry service.

Rhode Island Emergency Management Agency (RIEMA)

RIEMA is the State agency assigned to reduce the loss of life and property for the whole community while ensuring that, as a State, we work together to build, sustain, and improve our capability to prepare for, protect against, respond to, recover from, and mitigate all natural, human-caused, and technological hazards. RIEMA is also the pass-through agency for FEMA mitigation funding.

Rhode Island Enhanced 9-1-1 Telephone System

Portsmouth, Middletown, and Newport use the state's E-911 system, which provides 24-hour public safety communication services from one answering point in North Scituate, RI. Each call is routed to the appropriate response team. The system processes both landline and wireless 911 calls.

Rhode Island Executive Climate Change Coordinating Council (EC4)

Established in 2014, the EC4 sets specific greenhouse gas reduction targets and incorporates climate change considerations into the powers and duties of all state agencies. The legislation emphasizes the concept of resilience, building on our collective strength to develop practical solutions that allow Rhode Island to "weather the storm." The 13-member EC4 is chaired by RIDEM.

Rhode Island Infrastructure Bank

Established in 1989, the Rhode Island Infrastructure Bank provides fundings (loans, grants, etc.) to finance municipal infrastructure improvements related to water and wastewater, roads and bridges, energy efficiency and renewable energy, and brownfield restoration. This is a potential funding source for stormwater infrastructure improvements.

Rhode Island State Building Code

All municipalities within the State of Rhode Island share a single building code (RIGL 23-27.3-100 et. al.). The Code itself (which incorporates the International Building Code) was last amended in 2018 and provides comprehensive construction requirements designed to mitigate the impacts from natural hazards, such as high wind events. The Code is enforced by the municipal building departments and provides an additional layer of regulatory control beyond the local land use regulations and hazard mitigation strategies discussed above.

The State Building Code (RIGL 23-27.3-106.0 to 106.5) covers substantial improvements and substantial damages for structures in the floodplain. If a building is damaged or improved by 50 percent of the physical value of the building, the code's requirement for flood-resistant construction for new structures applies.

Rhode Island State Fire Code Regulations

Local municipalities have adopted the Rhode Island Fire Safety Codes to safeguard life and property from the hazards of fire and explosives in accordance with safe practice. The Fire Code provides reasonable minimum requirements for fire prevention and protection. For existing structures, the Fire Code is enforced by the four fire districts for existing structures. The building officials enforce the Fire Code for new structures.

Rhode Island State Dam Safety Program

Portsmouth, Middletown, and Newport participate in the State Dam Safety Program because of the high and significant hazard dams on Aquidneck Island. The State Dam Safety Program was created to facilitate the enforcement of the primary dam inspection law (RIGL 46-19, Inspection of Dams and Reservoirs). RIGL 46-19 states that dam owners are responsible for the safe operation, maintenance, repair, and rehabilitation of a dam, which are essential to preventing dam failure; furthermore, dam owners are liable for the consequences of accidents or failures of their dams. According to the State of Rhode Island 2023 Dam Safety Program Report, the following have been identified as program limitations: unclear ownership of numerous high hazard dams, construction of buildings within inundation areas below dams, lack of funding to repair of remove privately owned dams, inadequate spillway capacities and engineering analyses, lack of emergency action plans across the state, inadequate staffing, and increase in rainstorm intensities.

Rhode Island Turnpike and Bridge Authority (RITBA)

RITBA operates and maintains the Mount Hope Bridge, which connects Bristol to Portsmouth, and the Claiborne Pell Bridge, which connects Jamestown and Newport. The RITBA was created in 1954 by the Rhode Island General Assembly as a body corporate and politic, with powers to construct, acquire, maintain, and operate applicable bridge projects. Town coordination with this agency is important during severe weather, when people may be evacuating Aquidneck Island.

Federal Programs

Community Development Block Grant (CDBG)

The United States Department of Housing and Urban Development manages the CDBG program. This program supports municipal activities to build stronger and more resilient communities. Activities may address needs such as infrastructure, economic development projects, public facilities installation, community centers, housing rehabilitation, public services, clearance/ acquisition, microenterprise assistance, code enforcement, and homeowner assistance.

Federal Emergency Management Agency (FEMA)

FEMA, an agency of the U.S. Department of Homeland Security, coordinates disaster response resources when local and state resources are at capacity or resources only available at the federal level are needed. The agency also provides grant funding for pre- and post-disaster mitigation projects, assists with damage assessment management and recovery efforts.

- **Flood Mitigation Assistance (FMA)**: This program supports projects that reduce or eliminate the risk of repetitive flood damage to buildings insured by the National Flood Insurance Program. Participating communities must have a current, FEMA-approved hazard mitigation plan to receive competitive FMA funding.
- **Hazard Mitigation Grant Program (HMGP)**: This grant program provides funding to state, local, tribal, and territorial governments so they can develop hazard mitigation plans and rebuild in a way that reduces or mitigates future disaster. This grant funding is available after a presidentially declared disaster. Participating communities must have a current, FEMA-approved hazard mitigation plan to receive competitive HMGP funding.
- **Emergency Management Performance Grant (EMPG)**: The EMPG provides funding to support local emergency management agencies in carrying out FEMA's National Preparedness Goal. The Goal's five mission areas include prevention, protection, mitigation, response, and recovery.
- **Fire Prevention & Safety Grants (FP&S)**: These annually available competitive grants provide critically needed resources to fire departments and nonprofit organizations to carry out fire prevention education and training, fire code enforcement, fire/arson investigation, firefighter safety and health programming, strategic national projects, prevention efforts, and research and development.

Local Government Funding Sources

Aquidneck Island's municipalities each allocate local resources to support hazard mitigation, climate adaptation, and emergency preparedness. While limited in scale compared to federal programs, these local funding mechanisms are critical for implementing infrastructure upgrades, maintaining emergency services, and enabling match contributions for grant-funded projects.

- **Municipal Budgets and Operating Funds**: Annual operating budgets support core services such as public works, emergency management, police and fire departments, and planning. These funds are often used for staffing maintenance of critical facilities, emergency vehicle replacement, and equipment purchases. Local funds are also applied to match federal and state grants when required.
- **Capital Improvement Programs (CIPs)**: All three municipalities maintain CIPs that outline multi-year plans for infrastructure investments. These documents identify and prioritize projects such as road reconstruction, culvert upgrades, emergency generator installations, and public facility resilience.
- **Bond Programming and Ballot Initiatives**: Major infrastructure and facility improvements are often funded through voter=approved bonds or municipal bonding authority. These funds may be directed to stormwater upgrades, critical facility retrofits, and other large-scale resilience investments.
- **Stormwater Management and Utility Coordination**: While Aquidneck Island communities do not currently charge stormwater utility fees, municipal departments maintain drainage systems using general funds and coordinate with Rhode Island Energy and RIDOT on upgrades during street paving and utility replacement projects. Future stormwater enterprise funds may be explored as part of broader climate adaptation planning.
- **Local Hazard Mitigation Matching Funds**: Communities also rely on local resources to fulfill cost-share or non-federal match requirements for programs such as FEMA's BRIC, FMA, and HMGP. Match funding is typically budgeted through a combination of in-kind labor, capital reserves, and designated line items in department budgets.

U.S. Department of Agriculture, Natural Resource Conservation Service (NRCS)

The Natural Resource Conservation Service (NRCS) provides technical and financial assistance to local governments to help communities implement conservation practices that address watershed resource concerns. NRCS supports programs that reduce soil erosion, enhance water supplies, improve water quality, increase wildlife habitat, and reduce damage caused by floods and other natural disasters.

U.S. Department of Transportation (USDOT)

- **Promoting Resilience Operations for Transformative, Efficient, and Cost-Saving Transportation Program (PROTECT):** This grant program provides funding to ensure surface transportation resilience to natural hazards including flooding, extreme weather events, and other natural disasters through support of planning activities, resilience improvements, community resilience and evacuation routes, and at-risk coastal infrastructure. As of May 2025, this program was under review by the U.S. Department of Transportation (USDOT).
- **Better Utilizing Infrastructure to Leverage Development (BUILD) Grant Program:** This program provides grants for surface transportation infrastructure projects with significant local or regional impact. Projects can include improvements to roads, rail, transit, and ports.

U.S. Environmental Protection Act (EPA) Water Infrastructure Improvements for the Nation Act

Provides funds to small, underserved, and disadvantaged communities to assist public water systems in meeting Safe Drinking Water Act requirements.

Other Local Resources

American Red Cross in Rhode Island: The American Red Cross in Rhode Island offers free programs to help children, adults, and organizations better prepare for emergencies. During a large disaster, the American Red Cross staffs regional shelters and provides additional resources.

Aquidneck Land Trust: A regional organization that preserves and stewards Aquidneck Island's open spaces while benefiting the community and connecting people with the natural lands, Aquidneck Land Trust is a key regional collaborator, assisting the island's municipalities with implementing resiliency actions.

East Bay Community Action Program: This is a community-based organization that serves the needs of residents of Rhode Island's East Bay, including East Providence, Barrington, Warren, Bristol, Little Compton, Tiverton, Portsmouth, Middletown, Newport, and Jamestown. It assesses people's needs and helps them find resources, such as food pantries, housing support, prescription assistance, and emergency services.

Eastern Rhode Island Conservation District: The Conservation District is a nonprofit agency working with people and groups who provide information and technical assistance for activities that protect natural resources, such as soil, water, and air.

Gaudet Middle School: The Gaudet Middle School in Middletown is the primary shelter for all of Aquidneck Island.

Newport Hospital: Located at 20 Powel Avenue in Newport, Newport Hospital serves the medical needs of patients in the area. Among other documented procedures, the hospital has its own ingress plan, as well as an emergency evacuation plan.

Portsmouth High School: Should Gaudet Middle School and Portsmouth Middle School not offer enough shelter space during an emergency, Portsmouth High School acts as an overflow shelter for the island. Plans are currently underway to accommodate domestic animals as well as Portsmouth residents.

Portsmouth Middle School: Portsmouth Middle School is Aquidneck Island's secondary emergency shelter, opening when the Gaudet Middle School does not offer enough capacity.

Preserve Rhode Island: A statewide non-profit dedicated to protecting historic places through advocacy, stewardship, and preservation programs, the organization's Revolving Fund supports repairs for at-risk historic properties.

Rhode Island Energy (Electricity and Natural Gas): Rhode Island Energy is the major provider of natural gas and electricity in the state. Recent projects include improved tree trimming and various gas line replacements in conjunction with local paving projects.

Salvation Army: The Salvation Army provides emergency support services, including staffing Incident Command Posts (ICPs) and participating in preparedness exercises. They assist families during crises by offering emergency housing, food assistance, and other support services throughout the community.

Save The Bay: A member-supported nonprofit organization whose mission is to protect and improve Narragansett Bay, Save The Bay is eager to continue supporting the town to strengthen the community's climate resilience by engaging diverse stakeholder groups, restoring critical habitats such as wetlands, marshes, and floodplains, and co-developing innovative solutions to the risks associated with natural disasters.

Tree City USA: All three municipalities on Aquidneck Island have been recognized by the National Arbor Day Foundation as a "Tree City USA." Portsmouth (18 years), Middletown (six years), and Newport (33 years) have proven dedication to maintaining street trees and improving how trees are integrated into long-range planning.

United Way 2-1-1: United Way 2-1-1 in Rhode Island is a free, confidential service that provides information and referrals in multiple languages. This service connects residents with community services they may need, such as childcare, housing, health insurance, and tax preparation.

van Beuren Charitable Foundation: This foundation provides funding to nonprofit organizations and public institutions for projects and activities that advance its mission of improving the quality of life and quality of place on Aquidneck Island and in the surrounding communities.

6

Mitigation Actions

Mission Statement

The communities of Portsmouth, Middletown, and Newport are building a disaster-resistant Aquidneck Island and achieving sustainable development through the commitment of state and local government and its policymakers to mitigate hazard impacts before disaster strikes. By doing so, local leaders aim to preserve and enhance the quality of life, property, and resources.

Mitigation Goals

To carry out the mission statement, the RHMC establishes the following hazard mitigation goals, toward which all action must reach:

1. Protect public health, safety, and welfare; minimize social dislocation and distress due to impacts from natural hazards
2. Prioritize underserved and disadvantaged communities, especially those in high-risk areas
3. Reduce property damages caused by natural hazards
4. Reduce economic loss and minimize disruption to local business due to natural hazards
5. Implement actions that protect Aquidneck Island's cultural, historic, and natural environments
6. Protect the ongoing operations of our lifelines, critical facilities, and infrastructure through pre- and post-storm or event mitigation efforts
7. Expedite post-disaster mitigation efforts during the recovery phase
8. Promote non-structural flood and coastal erosion measures to reduce the risk of damage to the surrounding properties and environmental habitats

Although not all of these actions are true mitigation actions, they are important steps for the region to take to improve resiliency.

Status of Prior Actions

This is a new Regional Hazard Mitigation and Flood Management Plan. For the status of each community's mitigation actions, please see **Appendix F**.

Recent Regional Actions

The following are Aquidneck Island's recent regional actions and their progress.

- Completed Easton Pond Dam and Moat Study.
- Completed Climate Change Vulnerability Assessment – design complete; advancing to preliminary engineering and permitting
- Completed Redesign of Newport Bridge approaches that were in the flood zone
- Completed Military Installation Resilience Review
- Commenced RIDOT Resiliency initiative on Aquidneck Island—ongoing
- Commenced Emergency Shelter Assessment—recently underway
- Commenced Aquidneck Island-Wide Emergency Operations Center for Disaster and Large Event Emergency Management Feasibility Assessment – recently underway

Mitigation Actions

The RHMC's proposed mitigation actions address vulnerabilities that were identified earlier in the planning process. See **Chapter 4: Risk Assessment**.

The worksheets on the following pages summarize the specific problem and proposed possible solution(s), detail the primary tasks to be undertaken, identify an appropriate leader, and identify potential funding sources.

After populating all of the worksheets, the RHMC discussed and assigned a priority level to each action, understanding that priorities can and will change. High-priority actions provide more benefits than lower-priority items. Having this discussion as a group helped the RHMC consider maximum benefits to the entire region, not just individual municipal departments or residents. This will help to prioritize needs when funding becomes available.

The RHMC has not proposed strong mitigation actions for tsunamis and solar flares at this time but has included them in hazard mitigation education and evacuation planning. The RHMC will revisit the region's vulnerability to tsunamis and solar flares at the next plan update and determine if stronger actions are needed.

The RHMC was encouraged to propose a range of mitigation actions regardless of project costs. Some of the less expensive action items, such as building a stormwater enterprise fund, may be met with political opposition but can still benefit the region. Implementing recommendations from the Easton Pond resilient projects is of high importance, yet it will require substantial funds and island-wide coordination. If costs have already been set aside for a particular mitigation action, the RHMC prioritized that action to ensure that it was completed, and funds were spent in a timely manner.

Funding and staff time will be the determining factors on when various actions are completed. The RHMC understands that implementation of many of these proposed actions requires securing external funding.

This RHMP includes actions that prevent or reduce the consequences of disaster (mitigation), planning and education (preparedness), improved response in the immediate aftermath of an event (response), and improved restoration efforts (recovery). Those actions that are true mitigation actions are noted as such.

There are necessary planning elements that need to be completed before additional mitigation actions can be considered. The RHMC has identified a range of actions below, some of which are planning activities. A mitigation action is identified for each vulnerable area, where applicable.

Mitigation actions for each individual community can be found in **Appendix F**.

Priority Level

› High: Reduces the greatest risks, is important to accomplish first, funding has already been secured
› Medium: May require other actions to be completed first, funding may need to be identified
› Low: Less of an impact on safety and property

Time Frame

From date of plan adoption:

› Short Term: Less than two years
› Medium Term: Two to three years
› Long Term: Three to five years

VULNERABILITY: Island-Wide Emergency Management

MITIGATION ACTION:	ACTION PRIORITY
1. **Partner with the University of Rhode Island to deploy RI-CHAMP advance storm modeling for Aquidneck Island.**	☒ High ☐ Medium ☐ Low
	Action Status
	New

Rationale

The RI-CHAMP project advances storm model capabilities and develops a real-time hazard and impact prediction system for hurricanes and Nor'easters in Southern New England. The system includes cascading consequences of extreme weather impacting critical infrastructure such as wastewater treatment facilities, sewer systems, airports, and seaports.

Benefits

Wind and inundation modeling for a hypothetical storm can help local planners and critical facility managers understand the level of risk and plan appropriate resilience actions.

Hazard Addressed

Hurricanes and Nor'easters.

Mitigation Type	Supporting Plans/Efforts	Alignment With Plan Goals	
☐ Prevention	☒ Local Hazard Mitigation Plans	☒ 1	☐ 5
☐ Property Protection	☐ CRB Workshop Summary of Findings	☒ 2	☒ 6
☐ Emergency Services	☐ Local Capital Improvement Plans	☒ 3	☐ 7
☒ Local Plans and Regulations	☐ Local Comprehensive Plans	☐ 4	☐ 8
☐ Structure and Infrastructure	☐ Military Installation Resilience Review		
☐ Natural Systems Protection			
☐ Education and Awareness			

Obstacles

Funding.

Lead/Champion	Support
Portsmouth EMA	RIEMA, Portsmouth EMA, Newport EMA, Middletown EMA, Naval Station Newport

Potential Funding Sources	Estimated Cost	Timeline
Federal mitigation funding administered by FEMA	☐ Less than $10,000 ☒ $10,000 to $100,000 ☐ Over $100,000	☐ Short Term (less than 2 years) ☐ Medium Term (2-3 years) ☒ Long Term (4-5 years)

Other Notes

Complete modeling before the five-year update of this Regional Hazard Mitigation Plan.

Appendix I provides additional information about RI-CHAMP and existing modeling resources.

VULNERABILITY: Drinking Water

MITIGATION ACTION:	ACTION PRIORITY
2. Advance implementation of nature-based and infrastructure resilience improvements identified in the Easton Pond Resilience Projects, including flood reduction measures and green infrastructure enhancements to protect coastal roads and community assets.	☒ High ☐ Medium ☐ Low **Action Status** New

Rationale

Portions of the dams are vulnerable to sea level rise and increased frequency and intensity of coastal storms and precipitation. At present, there is a five percent annual chance of saltwater inundation at South Easton Pond and a one percent annual chance of saltwater inundation at North Easton Pond from storm surge.

Benefits

Improve the resiliency of the embankments and spillways.

Hazard Addressed

Hurricanes, Nor'easters, flooding, and sea level rise.

Mitigation Type	Supporting Plans/Efforts	Alignment With Plan Goals	
☐ Prevention	☒ Local Hazard Mitigation Plans	☒ 1	☒ 5
☒ Property Protection	☒ CRB Workshop Summary of Findings	☐ 2	☐ 6
☐ Emergency Services	☐ Local Capital Improvement Plans	☒ 3	☐ 7
☐ Local Plans and Regulations	☒ Local Comprehensive Plans	☐ 4	☐ 8
☒ Structure and Infrastructure	☐ Military Installation Resilience Review		
☐ Natural Systems Protection			
☐ Education and Awareness			

Obstacles

Prioritizing implementation actions. Funding. Coordination with multiple towns. Scaling the projects for success.

Lead/Champion	Support
Newport Public Utilities	Aquidneck Island Land Trust, surrounding communities

Potential Funding Sources	Estimated Cost	Timeline
Grants Federal mitigation funding administered by FEMA EPA Stormwater Grants Rhode Island Infrastructure Bank Municipal Resilience Program Action Grants	☐ Less than \$10,000 ☐ \$10,000 to \$100,000 ☒ Over \$100,000 (TBD)	☐ Short Term (less than 2 years) ☐ Medium Term (2-3 years) ☒ Long Term (4-5 years)

Other Notes

The City of Newport is currently working with Woods Hole Group and Fuss & O'Neill to look at resilience improvements at Easton's Beach. RIDOT is also conducting a resilience study, which has identified Memorial Boulevard, located between Easton Pond and the beach, as a vulnerable RIDOT asset.

VULNERABILITY: Population Education

MITIGATION ACTION:	ACTION PRIORITY
3. **Develop an island-wide public education plan communicating resiliency efforts and initiatives.**	☐ High ☒ Medium ☐ Low
	Action Status
	New

Rationale
Increase the education and awareness of the public on the importance of resiliency and enhance the current collaboration between leadership, staff, residents, utilities, businesses, non-governmental organizations, and adjoining municipalities and the U.S. Navy on Aquidneck Island. Outline the problem to be addressed, messages to be conveyed, target audiences, and communication methods (social media, news article, etc.).
Benefits
Better public understanding of resiliency, local buy-in for mitigation actions, transparency.
Hazard Addressed
All hazards (such as hurricanes, Nor'easters, flooding, severe winter weather, high winds, drought, extreme temperatures, lightning, brushfires, dam failure, tornadoes, and earthquakes) that may impact Aquidneck Island.

Mitigation Type	Supporting Plans/Efforts	Alignment With Plan Goals	
☐ Prevention	☒ Local Hazard Mitigation Plans	☒ 1	☐ 5
☐ Property Protection	☒ CRB Workshop Summary of Findings	☒ 2	☐ 6
☐ Emergency Services	☐ Local Capital Improvement Plans	☒ 3	☐ 7
☐ Local Plans and Regulations	☒ Local Comprehensive Plans	☐ 4	☒ 8
☐ Structure and Infrastructure	☒ Military Installation Resilience Review		
☐ Natural Systems Protection			
☒ Education and Awareness			

Obstacles
Reaching a wide range of diverse populations.

Lead/Champion	Support
Aquidneck Island Land Trust	Portsmouth EMA

Potential Funding Sources	Estimated Cost	Timeline
NOAA Climate Resilience Regional Challenge grant funding awarded to Aquidneck Land Trust	☐ Less than \$10,000 ☒ \$10,000 to \$100,000 ☐ Over \$100,000	☐ Short Term (less than 2 years) ☒ Medium Term (2-3 years) ☐ Long Term (4-5 years)

Other Notes

Topics for consideration:

- Maintaining wetlands
- Increasing pervious surfaces
- Native, drought- or salt-tolerant plantings
- Emergency planning, solar storm, and tsunami education
- Hurricane shutters
- Home elevation
- Reducing flammable vegetation close to buildings
- Neighborhood heating/cooling centers
- Energy conservation

VULNERABILITY: Natural System Protection

MITIGATION ACTION:	ACTION PRIORITY
4. Conduct floodplain and stream restoration on local rivers and waterways to make them more efficient at carrying stormwater. › **Maidford River** › **Bailey Brook** › **Founder's Brook** › **Elizabeth Brook**	☒ High ☐ Medium ☐ Low **Action Status** New

Rationale

These areas have become infilled with silt and vegetative debris. Restoration by removing debris reestablishes the general structure, function, and dynamic, self-sustaining behavior of the ecosystem. The floodplain of a riverine or stream system provides capacity for storing storm water runoff, reducing the number and severity of floods, and minimizing non-point source pollution.

Benefits

Mitigation for erosion and flood risk, improved water quality and habitat for fish and wildlife, recreational opportunities, and erosion control.

Hazard Addressed

Flooding, hurricanes, and Nor'easters.

Mitigation Type	Supporting Plans/Efforts	Alignment With Plan Goals	
☐ Prevention	☒ Local Hazard Mitigation Plans	☐ 1	☒ 5
☐ Property Protection	☒ CRB Workshop Summary of Findings	☐ 2	☐ 6
☐ Emergency Services	☒ Local Capital Improvement Plans	☒ 3	☐ 7
☐ Local Plans and Regulations	☒ Local Comprehensive Plans	☒ 4	☒ 8
☐ Structure and Infrastructure	☐ Military Installation Resilience Review		
☒ Natural Systems Protection			
☐ Education and Awareness			

Obstacles

Funding. Private property approval to do work.

Lead/Champion	Support
Middletown DPW/Engineering	Portsmouth DPW, Newport DPW, Aquidneck Island Land Trust

Potential Funding Sources	Estimated Cost	Timeline
NRCS grants RIDEM clean water grants Volunteer groups Bonds (Newport) Rhode Island Infrastructure Bank Municipal Resilience Program Action Grants	☐ Less than \$10,000 ☐ \$10,000 to \$100,000 ☒ Over \$100,000	☒ Short Term (less than 2 years) ☐ Medium Term (2-3 years) ☐ Long Term (4-5 years)

Other Notes

Will require public education. Timeline will be long-term for final design/construction.

Portsmouth had to withdraw Municipal Resilience Program grant application for Founders Brook to focus on Riverside emergency road project.

7

Implementation and Adoption

Implementing the Plan

Aquidneck Island and the RHMC realize that successful hazard mitigation is an ongoing process that requires implementation, evaluation, and updates to this plan. The municipalities also understand the importance of integrating appropriate sections of the plan into the local Comprehensive Community Plans, Land Use Plans, Emergency Operations Plans, and site plan review processes. It is intended that this plan and the ongoing efforts of the RHMC will preserve and enhance the quality of life, property, and resources for Aquidneck Island. Local actions will also consider strategies identified in the Rhode Island Department of Transportation's *Resilient Improvement Plan*, where applicable.

Each municipality on Aquidneck Island will integrate the goals, data, and mitigation strategies identified in this RHMP into their local planning, regulatory and capital investment processes.

This plan can be integrated into local Comprehensive Community Plans, Land Use Plans, Emergency Operations Plans, Capital Improvement Plans, Zoning Ordinances and Building Code Amendments, Open Space and Recreation Plans, Stormwater Management and Drainage Plans, and Site Plan Review and Subdivision Regulations.

Each jurisdiction has designated responsibility for this integration to its local Planning Department and Emergency Management Director. These officials will coordinate annually to identify opportunities to embed hazard mitigation principles into regular municipal activities, plan updates, and funding applications.

The RHMC will provide support in identifying alignment opportunities, documenting integration activities, and promoting consistency across municipalities. During the annual plan review cycle, the RHMC will request updates from each town/city on integration actions taken during the previous year.

In addition, each community has committed to specific integration approaches:

› **Portsmouth** – will incorporate mitigation strategies into its Town Comprehensive Plan, particularly its land use, housing, and natural resource elements, and continue to reference the RHMP in emergency planning efforts.

- **Middletown** – will use the RHMP to guide updates to zoning ordinances and its stormwater/drainage strategy and identify priority mitigation projects for future Capital Improvement Plans.
- **Newport** – will incorporate the RHMP into its Comprehensive Plan updates, coastal resilience strategies, and review of development within vulnerable areas.

By weaving the RHMP into these existing mechanisms, Aquidneck Island municipalities aim to enhance long-term resilience and promote coordination between hazard mitigation and day-to-day planning, development, and governance decisions.

Adoption of this mitigation plan increases Aquidneck Island and the municipalities' eligibility for federal hazard mitigation grants. These grants originate from FEMA Pre-Disaster FMA, PDM, and post-disaster HMGPs.

Monitoring and Evaluation

The RHMC, under the leadership of the Director of Climate Resilience at the Aquidneck Land Trust, will meet annually (or more frequently if necessary) to monitor and evaluate the actions contained in this RHMP. This annual review will occur in the month the plan was adopted. During the annual evaluation process, the mitigation actions will be promoted online for public review. Comments and suggestions will be sent directly to designated representatives from each municipality as well as the Director of Resilience or brought up at the advertised annual meeting. **Table 42** identifies representatives from each community who will receive any comments.

Table 42 Designated Municipal Representatives

	Portsmouth	Middletown	Newport
Emergency Management Director	Ray Perry rperry@portsmouthri.gov	Rob McCall, Interim Fire Chief rmccall@middletownri.gov	N/A
Town/City Planner	Lea Hitchen lhitchen@portsmouthri.gov	Ron Wolanski rwolanski@middletownri.gov	Patricia Reynolds preynolds@CityofNewport.com

The RHMC will develop a tracking sheet that can be used by the island municipalities to document updates in mitigation actions. A copy of the tracking sheet will be provided to the RHMC prior to the annual meeting in the timeframe corresponding to the anniversary of this RHMP approval. At each annual meeting, the committee members will discuss the actions assigned to them to ensure continual progress with mitigation efforts. The planning process status of each mitigation action will be documented in the tracking sheet and minutes recorded. The RHMC will base its evaluation on whether the actions have met the following criteria:

- Increased public awareness/education about regional hazards
- Reduction in hazard damage potential
- Implementation of actions in the designated time frames,
- Actions staying within cost estimates and schedules.

The RHMC will document its findings and provide an annual summary report to the governing councils in Portsmouth, Middletown, and Newport.

The RHMC will also continue to re-evaluate membership on the committee to ensure effective engagement of the appropriate parties. New members may be invited to serve on the RHMC as priorities shift.

The town- and city-specific mitigation actions for Portsmouth, Middletown, or Newport will be reviewed separately by each community, either immediately before or after the annual review of the regional plan.

Revisions

Recognizing that this is a living document, the RHMC will make changes to it after a disaster, as conditions warrant. Otherwise, it is expected that a revised plan will be adopted every five years. These revisions will reflect changes to hazards, existing conditions, priorities, and funding strategies.

Eighteen months to two years before the plan is expected to expire, the Aquidneck Land Trust will begin to secure funding for a plan update.

Eighteen months before the current plan is expected to expire, the Aquidneck Island Land Trust's Director of Climate Resilience will either secure a third-party contractor to lead the update effort or identify a lead in-house. A full revision of the plan should commence at least one year in advance of the plan's expiration date to ensure the island municipalities always have an up-to-date plan. The RHMC should plan on spending nine months updating the plan before it is submitted to RIEMA and FEMA for review. The RIEMA and FEMA review is expected to take up to six months.

During the next plan revision, the breadth of the RHMC may be expanded. Potential stakeholders to invite to the planning process include RIEMA, Save the Bay, and the East Bay Community Action Program. Prior to finalizing the group, the RHMC will also consider local business leaders, relevant interest groups, and other organizations that may provide valuable insight to the plan update. If invitees cannot commit to being on the RHMC, they may be designated as a stakeholder and brought into the conversation as needed.

All future revisions will involve public input, and it is the hope of the RHMC that once the public education and outreach actions begin, public involvement and interest in the RHMP will increase and will be reflected in future revisions.

The RHMC will involve the public in the annual meeting by posting it on the website, in the local library, and in the local newspaper to encourage involvement.

Revised plans will be sent to the neighboring communities for comment.

The revised plan/update will incorporate a formalized process for prioritizing actions and weighing the cost/benefit of such actions. See FEMA's *Local Mitigation Planning Policy Guide, effective April 11, 2025*, for more information on the process. All updates or revisions to the plan will be submitted to RIEMA and FEMA.

Future RHMP updates may include deleting recommendations as projects are completed, adding recommendations as new hazard effects arise, or modifying hazard vulnerabilities as land use changes. In addition, the lists of shelters and other critical facilities should be updated as necessary or at least during each RHMP update.

Adoption

After each evaluation cycle (every five years), a FEMA-compliant Aquidneck Island Hazard Mitigation and Flood Management Plan will be presented to local town or city councils for consideration for adoption. The associated ordinance documentation will be kept as part of this plan.

Appendix A: List of Stakeholders

Group or Organization	Point of Contact
11th Hour Racing	Michelle Carnevale
Aquidneck Community Table	Bevan Linsley
Aquidneck Land Trust	Terry Sullivan
Bike Newport	Bari Freeman
Bowen's Wharf	Adrienne Krueger
Boys & Girls Clubs of Newport County	Thomas Darnowski
Church Community Housing	Christian Belden
Common Fence Point Association / Preparedness Committee	Nicole Gotovich
Common Fence Point Association / Preparedness Committee	Conley Zani
Community Member	Sarah Whitehouse
Community Member	Lola Herrera-Ximenez
Community Member & NEEC Vice Chair	Emily Conklin
Community Member / NEEC / Elizabeth Brook Working Group	Sam Whitin
Connexion Latina Newport	Rebekah Rosen-Gomez
Discover Newport	Cassandra Earle
Eastern Rhode Island Conservation District	Sara Churgin
Easton's Point Association	General email
Edward King House	Carmela Geer
FabNewport	Steve Heath
Middletown Conservation	Jim Gedney
Middletown Open Space and Fields Committee	Nick Coogan
Middletown Tree Committee	Karen Day
MLK Center	Heather Hole Strout
Newport County Chamber of Commerce	Erin Donovan-Boyle
Newport County YMCA	Mike Miller
Newport Energy & Environment Commission (NEEC)	Avery Robertson
Newport Friends of the Waterfront	via Tom Gibson
Newport HEZ / Women's Resource Center	Sydney Ormerod
Newport HEZ / Women's Resource Center	Jessica Walsh
Newport HEZ / Women's Resource Center	Makalah Chapman
Newport Housing Authority	Rhonda Mitchell
Newport Restoration Foundation	Alyssa Lozupone
Newport Tree Conservancy	Lilly Dick
Newport Utilities Dept	Rob Schultz
Norman Bird Sanctuary	Kaity Ryan
Portsmouth Conservation	Constance Harding
Portsmouth Tree Committee	Scott Wheeler
Rhode Island Marine Trades Association (RIMTA)	Brian Dursey
Rose Island Light & Fort Hamilton Trust	Sean O'Connor
Sail Newport	Jamie Haines
Salve Regina University	Jameson Chace
Salve Regina University	Mike Semenza
Salve Regina University	Mike Caruolo

Sankofa Art & Solace	Niko Merritt
Save The Bay	Topher Hamblett
Save The Bay	Wenley Ferguson
SNEP	Elizabeth Scott
State Rep	Terri Courtvriend
State Rep	Lauren Carson
State Rep	Lou DiPalma
State Rep	Michelle McGaw
State Rep	Linda Ujifusa
State Rep	Marvin Abney
State Rep	Alex Finkleman
State Rep	Susan Donovan
URI CRC / RI Sea Grant	Pam Rubinoff
vBCF	Thomas Brendler

Appendix B: Public Engagement and Outreach

B1: Survey Results

B2: Public Comments on Draft Plan

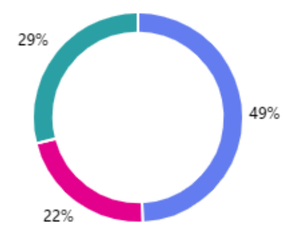
Responses Overview

Closed

Responses	Average Time	Duration
138	09:21	265 Days

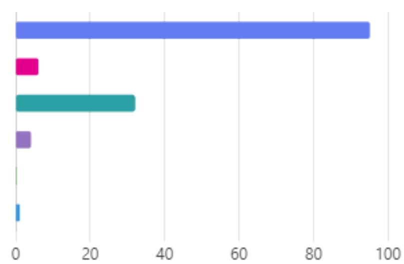
1. Which municipality do you primarily live in, work in, or visit?

Portsmouth	68
Middletown	30
Newport	40



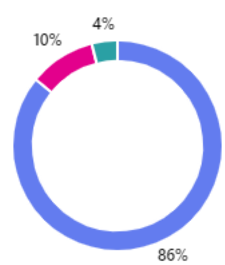
2. How are you connected to Aquidneck Island?

I live here.	95
I work here.	6
I live and work here.	32
Non-resident property or business owner.	4
Frequent visitor.	0
Other	1



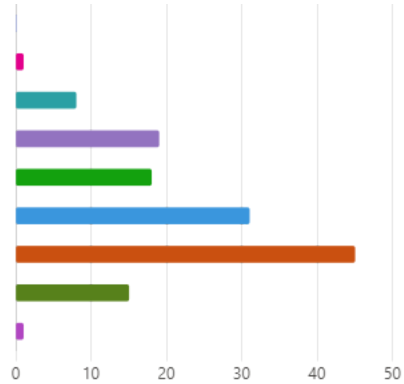
3. Which best describes you?

Year-round resident, own a home.	109
Year-round resident, rent a home.	13
Part-time resident, own a home.	5
Part-time resident, rent a home.	0



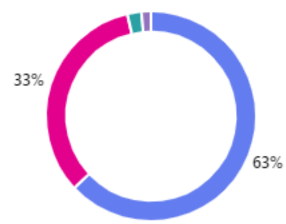
4. What is your age range?

Under 18	0
18-24	1
25-34	8
35-44	19
45-54	18
55-64	31
65-74	45
75+	15
Prefer not to say.	1



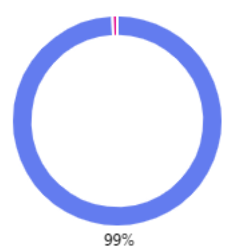
5. What is your gender?

Woman	87
Man	46
Non-binary	3
Prefer not to say	2



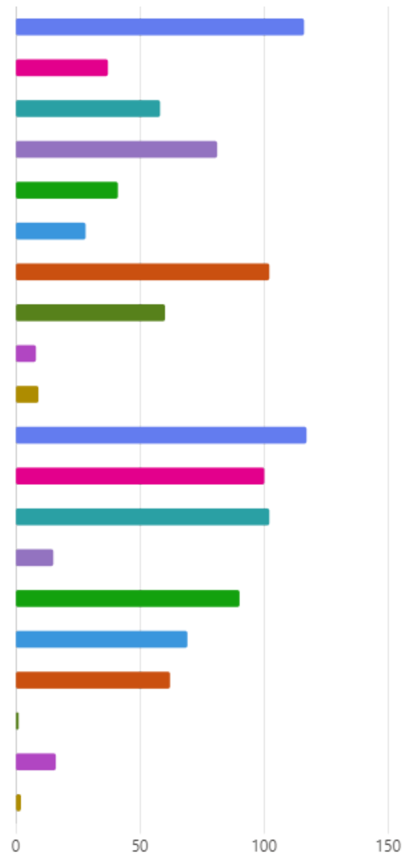
6. What is the primary language spoken in your home?

English	137
Spanish	1
Portuguese	0
Other	0



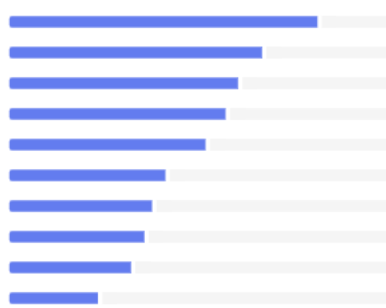
7. What types of natural hazards have you experienced on Aquidneck Island? (Check all that apply.)

High Winds	116
Lightning Strikes	37
Extreme Cold	58
Heat Wave/Extreme Heat	81
Drought	41
Earthquake	28
Winter Storms/Ice	102
Hail	60
Brushfire	8
Tornado	9
Nor'easter	117
Hurricane/Tropical Storm	100
Street Flooding from Heavy Rain	102
Riverine Flooding (when streams or rivers flood)	15
Coastal Flooding (low-lying areas submerged in sea water)	90
Flash Flooding (very rapid onset of flooding often as a result of heavy rain)	69
Sea Level Rise/Coastal Erosion	62
Dam Failure	1
Microburst (a very localized wind event where a column of air drops from rain clouds and fa...	16
None	2



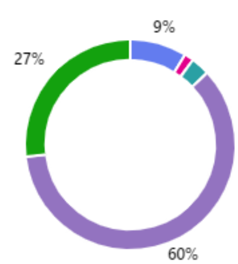
8. Please re-order the list of hazards so that the 3 you are MOST CONCERNED about are at the top. If you are completing a paper copy of t his survey, please write a 1, 2, or 3 next to your top hazards of concern.

1. Hurricane/Noreaster
2. Sea Level Rise
3. High Winds
4. Flooding
5. Snow/Blizzard
6. Drought
7. Heat Wave/Extreme Heat
8. Extreme Cold
9. Lightning
10. Ice Storm/Flash Freeze



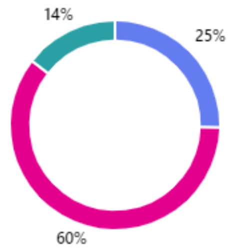
9. How prepared do you feel that YOU are for the probable impacts of natural hazards?

I'm not sure how to prepare.	12
Not Prepared- no need.	2
Not Prepared- never thought about it.	4
Somewhat prepared for some events.	83
Prepared for most events.	37



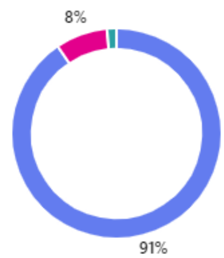
10. How many days to you prepare for when you hear of severe weather?

Just 1 day	35
2-3 days	83
4+ days	20



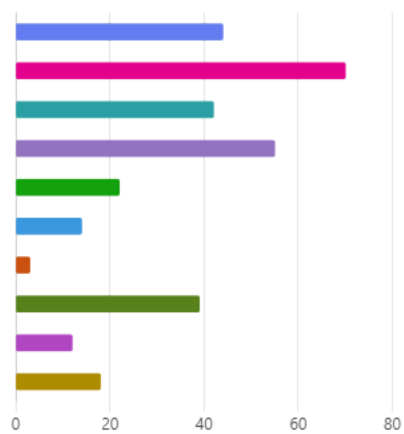
11. How would a natural disaster such as a hurricane impact your food security?

Minor: I would probably have enough food on hand to last a few days.	125
Moderate: I might not be able to get to a food bank or utilize the school lunch program.	11
Severe: I rarely have enough food to last more than a day.	2



12. If you have taken actions to make your home, business, or neighborhood more resilient to natural hazards, please give us examples. (Check all that apply).

Installed a generator	44
Trim trees	70
Plant native vegetation	42
Installed a sump pump	55
Used wind resistant building materials/techniques	22
Elevated house/mechanical equipment	14
Floodproofing (business)	3
Involved in community resilience efforts.	39
Trained employees on emergency procedures.	12
Other	18

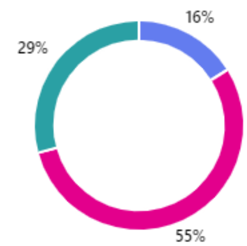


13. A quick reminder. If there are dead standing trees or hanging limbs on your property, please trim them appropriately or bring in professionals. For work near powerlines, always contact RI Energy first.

Got it!	127

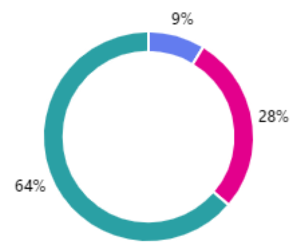
14. How prepared do you feel that your Town/City is for the probable impacts of natural hazards?

Not Prepared	22
Somewhat prepared for some events	75
Prepared for most events	40



15. Does your street flood when it rains?

Yes, always	12
Yes, sometimes	38
No	88



16. If "always" or "sometimes", please provide the street name and nearest cross street. Or tell us of a place you know floods.

48

Responses

Latest Responses

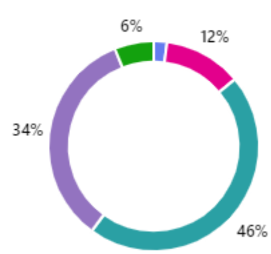
"Paradise Ave"

...

9 respondents (19%) answered Common Fence for this question.

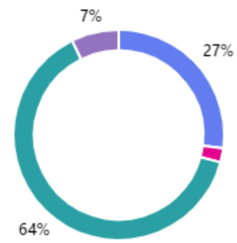
17. How many times has that street flooded in the last 12 months?

0	1
1	6
2-3	23
Over 5	17
I don't know.	3



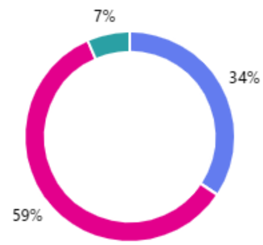
18. Is your home/business on Aquidneck Island located in a floodplain or flood zone?

Yes (home)	37
Yes (business)	3
No	87
I don't know. (Check online at msc.fema.gov)	10



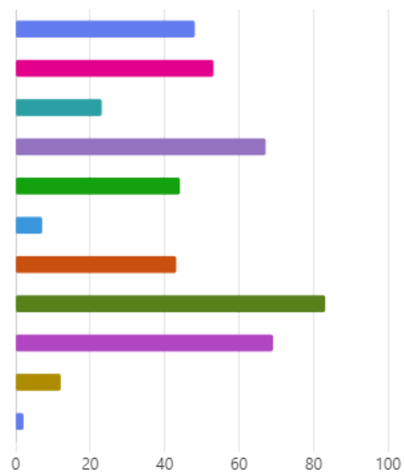
19. Do you currently have flood insurance on your home/business?

Yes	47
No	81
I don't know.	9



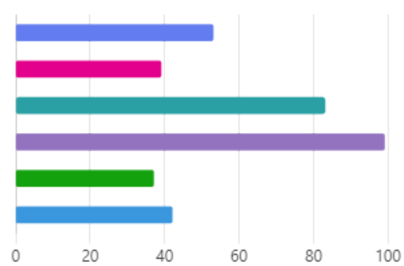
20. How do you prefer to receive educational information about how to better protect your home, business, or neighborhood? Check all that apply. (Don't worry, we aren't adding you to a list.)

Local newspaper	48
Television (news stories, public service announcements)	53
Radio	23
City website	67
Public workshops and meetings	44
School meetings and messages	7
Direct mailings	43
Email	83
Social media (Facebook, Twitter, etc.)	69
Information at the library	12
Not interested	2



21. How do you currently receive EMERGENCY alerts?

Television	53
Radio	39
CodeRED phone call	83
CodeRED text message	99
Email	37
Social Media (Facebook, Twitter, etc.)	42



22. Please share additional thoughts on how Aquidneck Island improve its resiliency and better prepare for the next natural hazard event.

61

Responses

Latest Responses

"Stop hardening the shoreline and instead do the opposite - begin retreating hard..."

"Making sure people know how to protect themselves in their homes."

"Increase revenue by pulling over the constant speeders on Paradise Avenue and ... "

...

14 respondents (23%) answered island for this question.

Page	Comment	Author
3	Park Avenue and Boyd's Lane are listed twice.	N/A
5	under "At Risk - Services and Utilities" there is no mention of Old Mill Lane's LNG facility. Also "Brewer Sakonnet" is now "Safe Harbor Sakonnet". There is also "Safe Harbor Island Park" & "Safe Harbor New England Boatworks".	N/A
6	under "Assisted Living" there is no mention of "Sakonnet View" on East Main Road. Under "Mobile Homes" there are some in Common Fence Point and Island Park.	N/A
7	under "Recreation Facilities" there is no mention of VFW Post 5390.	N/A
8	under "Ongoing Actions" - "CFP salt marsh being restored"; this project is now finished and only needs maintenance.	N/A
10	under "Public Outreach" - "Neighborhood Preparedness Committees...each meeting monthly." Might want to add something like "during development of this document each are meeting monthly."	N/A
11	last paragraph before Table 14, we state that "Owners of high and significant hazard dams are required to file a dam emergency plan. However, Portsmouth is leading the effort to update the DAM emergency Plans for Dams owned by Newport, simply because they are in my jurisdiction. I think the above may apply to private dams, and planning lead for government owned dams may be based upon the jurisdiction the dame is located, regardless of ownership.	RP
11	Roads & Bridges, recommend adding the Hurricane Escape Bridge managed by RI DOT. The bridge was created as a result of the 1938 Hurricane where Island Park residents had no escape route.	RP
12	under "Prince Island" - "public safety complex" there's two of them and not sure if this is redundant.	N/A
13	under "Mitigation Actions" there is nothing listed and is blank.	N/A
17	under "Rational" - Within the sentence it says "the Atlantic Beach Club district" is in Portsmouth but it's really in Middletown RI.	N/A
30	under "Other Notes" - There is nothing added about bringing pets to Portsmouth High School shelter.	N/A
33	under "Hazard Addressed" - The word "Flooding" is not in black ink.	N/A
34	under "Hazard Addressed" - "Rain, high wind" is not in black ink either.	N/A
43	first line of last paragraph on page titled - Storm Surge, insert an "a" before the word hurricane.	RP
45	under "History" the sentence "Most of the damage in Newport was." is an incomplete thought. Is it in fer. to Table 18 in some way?	RP
46	remove line spaces above "Probability of Future Occurrence".	RP
55	Page 55, at the second paragraph we mention the seven designated drought regions in the State, but I did not see where we mention where they are, or if Aquidneck Island areas are designated as and of them.	RP
59	under Sea Level Rise - Description, last sentence, we state "See Figure". No period or reference to a specific figure.	RP
70	Section on "Dam Failure", should it be mentioned that there is a requirement for Dam Emergency Plans, and who is responsible for them? We state who does the inspections.	RP
73	I think it is worth mentioning that Tornadoes can and are not uncommon, form during Hurricanes in the danger quadrant, which is in the Norther hemisphere the forward right quadrant relative to the storms track line.	RP
81	Section on "Space Weather", Portsmouth EMA is working with some technical experts on Space Weather Hazards. **Recommend including the warning or impact scale for these events. PEMA will provide them**. I'm not sure on the reports. We participated in a National emergency communications exercise this past fall with DOD, and because of a Solar event, communications by radio was non-existent throughout North America for more than 8 hours.	RP
87	The list is an odd mix of assets. Do we have a description of what they are looking for? Also, I'd add 1) Middletown Airport, 2) Naval Station Newport, and 3) Naval Station Docks that support USCG Cutters and NOAA vessels. These are separate as the docks are maintained by NOAA & USCG, not the Navy. Docks, for an Island can become a critical supply chain assets post event.	RP
93	shows a Fema map of part of Portsmouth. There is no legend and any indication that this is the only part of Portsmouth of concern to Fema.	DG
97	4.2 miles of island roads would cost $19 million to reconstruct. Fema promotes elevating houses. Shouldn't communities start raising roads in flood zones as well? Suggest a study to price out the cost to raise the affected roadways (1 foot??).	DG
97	Is this the only area of Portsmouth of concern to Fema?	DG

103	depicts flooding at entrance to CFP. Flooding is typically from rain, and tidal events, or both together, with water coming under rt 24 from Blue Bill Cove during highest tides. Please consider check valves on storm drain piping there and in other similar areas like Park Ave. storm drains.	DG
104	Recommend adding for Portsmouth the Vulnerability of its coastal neighborhoods due to its septic system infrastructure. The Town's low-lying septic systems are likely to be a resident's first utility impacted from sea level rise that will limit a home's ability to be safely occupied.	RP
105	state that the drainage system was to reduce the flooding "from a rain event" vice from costal inundation. We fixed the outflow "drainage" of large volumes of rain, but now higher tides now allow sea water into the area. A valve system may be needed to ensure one way flow.	RP
106	suggests an island wide EMA. Each community has an EMA person or dept. Why a dept for all three communities? Please explain rationale and if this is funding that is attainable to not burden any island community.	DG
107	of Table 39, recommend adding under line on "Population Sheltering" at Portsmouth provides the Islands secondary mass shelter at Portsmouth High School, but the generator at the shelter does not supply power to the spaces needed to have a fully functioning shelter in accordance with national standards. Portsmouth is working to rectify this, but it will likely be expensive.	RP
108	shows a "wind damaged" tree. I would present a different picture as this appears to be a carpenter ant damaged tree possibly blown over by the wind. In general, I agree that more tree trimming and/or removal is needed (together with thoughtful new tree plantings) but budgets are typically minimal for tree trimming and reactive more than proactive. This would be a great area to pursue grant money.	DG
113	Under Table 40, Emergency Management, each city/municipality say they have an EOC, but there is a distinct difference under our National Incident Management System between a 911 Dispatch Center, Emergency Operations Center, and an Incident or Area Command Post. Also, EOC's are classified as Cold, Warm or Hot depending upon their set up and upon level of staffing which is event dependent. This is important that we designate them as per NIMS because during a disaster we will be relying upon numerous external support responders, and we need to use common terminology and resource designations. If resource representatives expect an EOC and go into a 911 dispatch, it will impact the IMT's ability to manage and the resources' ability to integrate into the response. Portsmouth is creating (not there yet) a small EOC, and unless something has changed recently, Middletown and Newport have dispatch centers and would stand up an Incident Command Post, like we did in the Newport Gas Outage. We are talking about creating an Island Wide EOC as one of our RHMP action items, but that needs to be done with all municipalities involved in the planning, and I think we need to be clear on what an EOC/ICP should be in both space, equipment, staffing positions, etc. You do not want Dispatch in the EOC. They can be located adjacent to each other (a good model) but it is not good to have them located in the same space. With Newport moving forward on the Aquidneck Island Wide EOC concept, close collaboration will be needed before design work gets too far along. (Note, I'll send this comment to the Middletown and Newport Chiefs).	RP
113	Under Police Depts. Consider having Middletown's input like Nwpts'. and Ports'. with respect to staffing / equip.	RP
116	speaks of securing funding to reduce street flooding and improve public safety. How do we reduce street flooding? How is this done?	DG
120	under description of FEMA change it to read as follows: The Federal Emergency Management Agency (FEMA), an agency of the U.S. Department of Homeland Security, coordinates disaster response resources when local and state resources are at capacity or resources only available at the federal level are needed. The agency also provides grant funding for pre-and post-disaster mitigation projects, assists with damage assessment management and recovery efforts.	RP
121	Add the word Local so the section title reads "Other Local Resources". Also add the Salvation Army to the list of local resources. They will actually staff an ICP and have participate in exercises. They help support families in time of crisis, assisting with emergency housing, emergency food and other support services.	RP

123	under Mitigation Goal 6. include Lifelines, so it would read as follows: "Protect the ongoing operations of our Lifelines and critical facilities and infrastructure through pre- and post-storm or event mitigation efforts." Mitigation efforts in the context of this plan would only take place pre and post event, not during an event.)	RP
124	reformat Recent Regional Actions as follows simply for ease of assessing status. Also added the last action on EOC initiative. - Completed Easton Pond Dam and Moat Study - Commenced Climate Change...... - Completed Redesign of Newport Bridge approaches........ - Completed Military Installation Resilience Review. - Commenced RIDOT Resiliency on Aquidneck Island (ongoing). - Commenced recently Emergency Shelter Assessment. - Commenced recently Aquidneck Island wide Emergency Operations Center for Disaster and Large Event Emergency Management Feasibility Assessment.	RP
127	Consider adding as an "Obstacle" the following: "Raising awareness and understanding of interdependencies with mitigation action 1 on page 126 and need to align with State and federal standards and best practices." As a side note, Newport had a lot of difficulty with this after they tried to organize for disaster preparedness and response management after the Gas Outage incident. No fault of their own by any means. They were given bad advice by an authority that should have known better.	RP
133	2nd paragraph under Rational should include Portsmouth and recommend adding Safe Room for Prudence Island. Recommend it read as follows: "The shelter currently used by Middletown, Newport and Portsmouth to include Prudence Island is the Gaudet School in Middletown. It is being demolished and rebuilt. The new facility (high school and middle school combined) will have sheltering capabilities. Ther is no emergency shelter on Prudence Island (Portsmouth). A Safe Room approach is being considered for the island."	RP
134	The last sentence under Other Notes should include "....... Riverside emergency road project." To highlight the MRP change in focus was due to an emergency situation.	RP
137	Regarding Monitoring and Evaluation, include that a designated representative(s) from each municipality should receive all comments throughout the life of the plan directly, as that is where the Authority and Jurisdiction lies with respect to any changes. I'd list them, and they can be by position, i.e. the Town Planner, Emergency Manager.... The Contractor or the Director of Climate Resilience I do not believe has any decision-making authority with respect to the municipalities policy making. We take their valuable expertise and recommendations into consideration. Delaying receipt of comments to the representatives with actual authority and Jurisdiction would be less effective.	RP
137	last paragraph we mention the "Tracking Sheet". Recommend including a copy of it in the plan and reference its location (an appendix?) in the plan in this paragraph. In general, we should mention for consideration the development of a "Strategic Mitigation Plan" or an annex. This is where we consider and have ready as much as is practical whet we would like to see with respect to mitigations should something get destroyed. These types of mitigation planning positions us to be ready to build back better something we know may be at risk at just do not have the funding/will to make it more resilient, but should it be destroyed in an event we are ready, better positioned to build it back to the standards we want when funding is more likely available and there is greater political will to invest post an event. Examples: Raise a bridge, raise a road, construct a berm, improve a Dams outflow path, improve an antenna tower's resiliency	RP
138	Municipalities should be given a copy of the evaluation sheet mentioned in the first paragraph to facilitate meeting standards and reporting. Maybe include such an evaluation sheet in the plan itself.	RP
138	at third paragraph down, add the word "months" after the first word "eighteen.	RP
139	under Adoption, I'd reword the last part of the sentence to read as follows: ".......Flood Management Plan will be presented to the local town or city councils for consideration for adoption. We shouldn't tell them to adopt it.	RP
139	recommend the ordinance document be included as an annex and its location referenced here.	RP
250	Explore the benefit and risks of reopening the salt marsh along Boyds Lane to flushing from the Sakonnet River.	Unknown
24-25	add "Sakonnet View" from East Main Rd because it's a facility for vulnerable and elderly populations.	N/A
Appendix A	Add other resources from pages 121 and 122. Also add the NERR.	RP

Appendix G	Under Critical Hazard Response Facilities at 01351 Narragansett Ave, add that it is Dept. Public Works, Prudence Island...	RP
Appendix G	For the Natural Mitigation Actions G Appendix Portsmouth RI I noticed that there were actions for assisted living but no mention of Group Homes for individuals with special needs. There's 1 on Willow Ln that I know of but I'm sure there are more within the town. Another place to consider is Boys Town were state children are placed.	N/A
G-11	re Stone Bridge. What division of the state owns this? RIDOT as suggested? Please clarify in report.	D. Gleason
G-14	discusses Town Council support (or non-support?) may be an obstacle to flood prone streets. Please explain what is meant. Where are the vacant and/or undeveloped parcels in flood-prone areas to consider purchasing?	D. Gleason
G-17	re Atlantic Beach District being THE main commercial area. Where is this? I only know of Atlantic Beach in Middletown.	D. Gleason
G-19	Yes please promote tree trimming but may be underfunded in Estimated Cost.	D. Gleason
G-28	Why is managed retreat a high priority? What exactly is managed retreat? Please explain.	D. Gleason
G-30	re "old" High School gym for Red Cross shelter. Why not the "new" gym and are there other buildings in Portsmouth that could be used?	D. Gleason
G-31	re RWU BayPoint repurposing. Repurpose to what?	D. Gleason
G-33	Pipe under Boyd's lane has been blocked/clogged for many years leading to stagnant water and mosquitos. Please get grant money to repair under-road pipe and consider adding additional pipes	D. Gleason
G-4	re a sewer line from Jefferson Lane (Jepson?) from Lawton Valley to Middletown. I believe you have misidentified the street and that this is probably a water supply line from the water treatment plant back to Newport. Please verify. Also, emergency water line is under the Sakonnet River near, but not over, the bridge.	D. Gleason
G-4	As a member of the PI Community Wildfire Protection Plan working group I submitted a number of recommended edits to the brushfire content which were adopted. I also submitted recommended edits to Appendix A (now G-4) regarding Prudence Island's Water Supply Systems, which were not incorporated. As I also serve as Moderator on the PIWD Board, I would like to resubmit the following edits/additions on their behalf (and with their permission). Prudence Island Water District - 3 public wells, 2 are functioning, 1 is emergency (note that this is a change from the current HMP). Add to hazard: salt water intrusion. Add to Mitigation Actions: develop one or more additional PIWD wells to increase system redundancy and prevent catastrophic failure of the water supply.	N/A
G-5	Please explain mitigation actions to promote coastal resiliency considerations for OSW projects. Should this project occur, the contractor is responsible for proper installation of high voltage cables. Please explain intentions.	D. Gleason
G-5	What are the thoughts behind requiring back up generators at both Portsmouth transfer stations?	D. Gleason
G-6	re Mobile homes, there are at least 2 additional mobile home locations in Portsmouth not mentioned.	D. Gleason
G-7	What are the structural improvements needed at the (old) High School gym? What is the repurposing of the RWU BayPoint Facility? Repurpose to what (in the flood zone?)	D. Gleason
G-7	Add Prudence Island school	D. Gleason
G-7	For the asset matrix G-7, I would like more adaptation options to be added to the "ongoing actions" because Glen Park is flooding with every rain event. Stormwater management needs to be addressed along the road so that our sports field, trees and historical resources aren't lost. also on page G-30 "Complete structural improvements to High School Gymnasium and get it certified as a Red Cross shelter", there needs to be a plan to consider how school can remain operational, if a shelter is set up.	N/A
G-8	Spelling (Gardner Seveney, Green Valley, Carnegie Abbey, Butts Hill Fort, Southermost School, Red Cross House changed to "official Name Etc)	D. Gleason
G-9	What are non-structural flood and coastal erosion measures? Shrubbery vs riprap? Please explain.	D. Gleason
N/A	A community communications system should be in place for when cell service and land lines are not available . A GMRS radio repeater for people to use could be set up for a couple thousand dollars , at a high point on land , to cover island wide with the little handheld radios widely available for very low cost. The state police location on East Main or St Mary's church are both good coverage locations	Unknown
N/A	Prudence Island population is underrepresented on p. 93. Year round population is a bit higher (~160), but summer (hurricane season) population rises significant 2000-3000?	N/A
N/A	Table 21 Wind events end in early 2021. It seems there have been a number of significant wind events at the locations cited in the table in the past 4 years.	N/A

N/A	While roads and bridges are discussed as critical infrastructure, the Prudence Ferry, which provides lifeline service to the island, is not. Loss of use of either of the ferry docks (Bristol or Prudence) or the ferries themselves due to any number of the hazards enumerated in the report would have a significant impact on this lifeline service.	N/A
N/A	Thank you for citing the space weather phenomenon. The draft asserts that RI has never experienced ill impacts from space weather. Members of the Newport County Radio Club received at least one report from a ride-share driver having severe GPS issues during a week-long, severe solar storm in 2024. Also, this writer participated in a 2024 multi-day communications drill whose scenario included a solar storm. Perversely, participants were unable to successfully transmit messages using the global Winlink HF message system because of intense solar noise. Exercise planners were forced to extend the exercise one week until the solar storm abated.	N/A
N/A	(1) Recommend some reference to our island at least acknowledging FEMA's "Whole Community Framework" to assist with response and recovery efforts. It's described at https://www.fema.gov/sites/default/files/2020-07/whole_community_dec2011__2.pdf While Newport mentions a desire to re-establish a Community Emergency Response Team (CERT) is there broader consideration at the island level to establish a "COAD" or locally-based "Community Organizations Active In Disasters"? (It appears that most state-level VOAD groups have disappeared). https://lccoad.org/index.php/voad-vs-coad/	N/A
N/A	Thank you for the opportunity to respond to this report. It has potential but needs a little work and buy in from the Portsmouth Town Council and the citizens of Portsmouth. The report is tedious at best to read and to understand, requiring many hours to do so. I hope that other citizens and Councilors have found the time to read it, as well. I did not read the Middletown and Newport Appendices. Good Luck.	D. Gleason
N/A	How might a post-DOGE, smaller FEMA evaluate Aquidneck Island's draft regional Hazard Mitigation Plan? Well, they just might have an AI-research tool like Google's Gemini take five minutes to review and score the plan. Want to see a sample review along with 20 potential improvements to the draft plan? (I'm not a hazard mitigation expert, but here's the quickly-drafted prompt that I submitted to Google Gemini: "Read the following documents as background: (1) https://www.newportthisweek.com/articles/island-communities-collaborate-for-climate-resilience/ and (2) https://www.portsmouthri.gov/DocumentCenter/View/6487 . Then, provide up to 20 recommendations to improve the probability that FEMA will both accept the plan and will view it as an exceptional contender for future federal grants focused on the improving the island's collective resiliency." You can read the AI tool's 15 page researched response, including its 20 recommendations, at: https://docs.google.com/document/d/1XkL30wqKJkm26J-OXSIhX250CkP71Oxrexg8YUOxrf4/view? Can anyone use this AI tool? Yes. You can task the Google Gemini research engine to work on 10 projects each month for free. Visit: https://gemini.google.com/ Which publicly available AI-tools been tasked to review the draft and to make constructive suggestions to boost odds of successful funding?	N/A
	The report, in general, should be reviewed for spelling and grammatical errors.	DG
	I did not read through the 367 pages of the Aquidneck Island Regional Hazard Mitigation and Flood Management plan draft but I did read the Natural Hazard Mitigation Actions for G Appendix Portsmouth, RI.	N/A

113	Also, under Local Departments - Table 41 on page 113 please change the Portsmouth Police Dept. staff from 38 to 41. Thanks, ray	RP

Appendix C: National Risk Index

National Risk Index

August 09, 2024

Newport County, Rhode Island

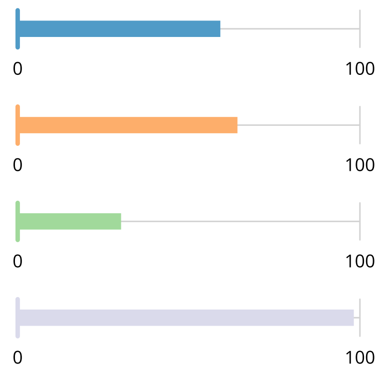
Summary

Risk Index is **Relatively Low** Score **59.9**

Expected Annual Loss is **Relatively Low** Score **65.0**

Social Vulnerability is **Relatively Low** Score **30.3**

Community Resilience is **Very High** Score **98.4**

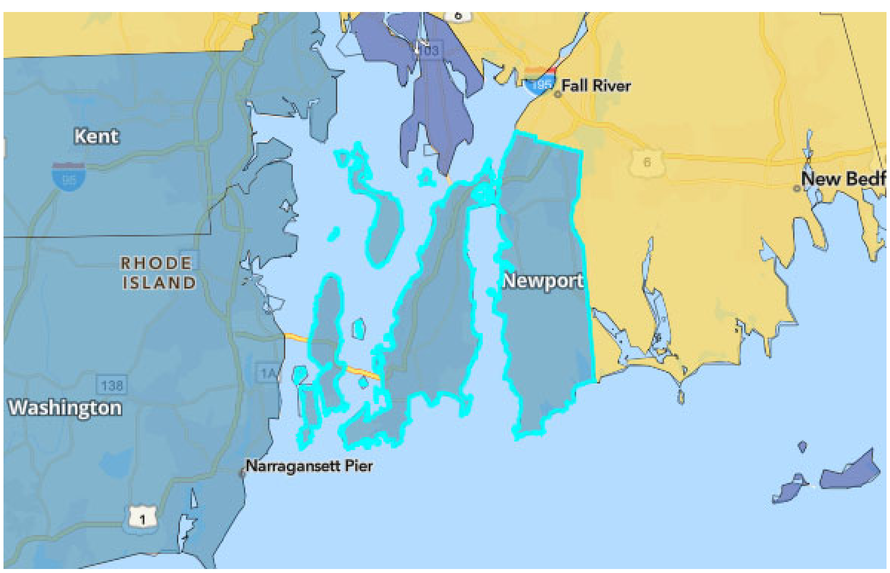


While reviewing this report, keep in mind that low risk is driven by lower loss due to natural hazards, lower social vulnerability, and higher community resilience.

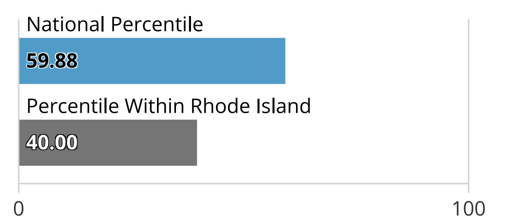
For more information about the National Risk Index, its data, and how to interpret the information it provides, please review the **About the National Risk Index** and **How to Take Action** sections at the end of this report. Or, visit the National Risk Index website at hazards.fema.gov/nri/learn-more to access supporting documentation and links.

Risk Index

The Risk Index rating is **Relatively Low** for **Newport County, RI** when compared to the rest of the U.S.



Score **59.88**



60% of U.S. counties have a lower Risk Index

40% of counties in Rhode Island have a lower Risk Index

Risk Index Legend

Very High · Relatively High · Relatively Moderate · Relatively Low · Very Low

No Rating · Not Applicable · Insufficient Data

Hazard Type Risk Index

Hazard type Risk Index scores are calculated using data for only a single hazard type, and reflect a community's Expected Annual Loss value, community risk factors, and the adjustment factor used to calculate the risk value.

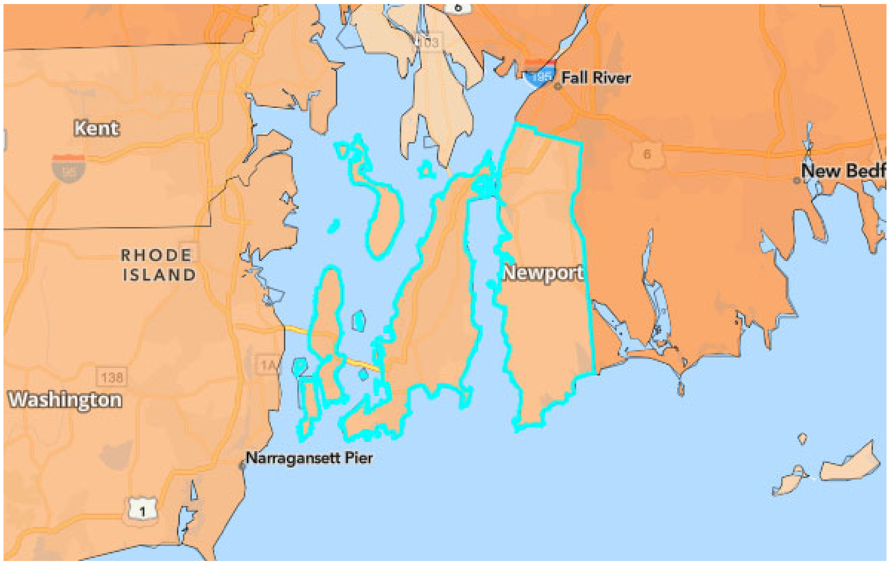
Hazard Type	Risk Index Rating	Risk Index Score	National Percentile
Avalanche	Not Applicable	--	
Coastal Flooding	Relatively Low	66.4	0 100
Cold Wave	Very Low	31.5	0 100
Drought	Relatively Low	68.7	0 100
Earthquake	Very Low	47.7	0 100
Hail	Very Low	4	0 100
Heat Wave	Very Low	23	0 100
Hurricane	Relatively Low	84.3	0 100
Ice Storm	Relatively Low	37.6	0 100
Landslide	Relatively Low	19.9	0 100
Lightning	Relatively Low	47	0 100
Riverine Flooding	Relatively Low	50.9	0 100
Strong Wind	Very Low	18.1	0 100
Tornado	Very Low	17.5	0 100
Tsunami	Insufficient Data	--	
Volcanic Activity	Not Applicable	--	
Wildfire	Very Low	31.8	0 100
Winter Weather	Very Low	4.7	0 100

Risk Factor Breakdown

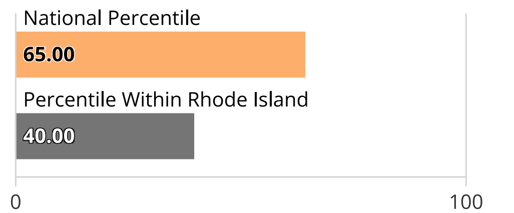
Hazard Type	EAL Value	Social Vulnerability	Community Resilience	CRF	Risk Value	Risk Index Score
Hurricane	$7,138,906	Relatively Low	Very High	0.94	$6,727,371	84.3
Coastal Flooding	$597,490	Relatively Low	Very High	0.94	$548,242	66.4
Riverine Flooding	$517,979	Relatively Low	Very High	0.94	$487,728	50.9
Tornado	$188,414	Relatively Low	Very High	0.94	$178,287	17.5
Earthquake	$139,298	Relatively Low	Very High	0.94	$135,099	47.7
Drought	$144,915	Relatively Low	Very High	0.94	$121,228	68.7
Lightning	$100,642	Relatively Low	Very High	0.94	$96,153	47
Strong Wind	$97,501	Relatively Low	Very High	0.94	$93,205	18.1
Ice Storm	$36,786	Relatively Low	Very High	0.94	$34,800	37.6
Landslide	$21,900	Relatively Low	Very High	0.94	$20,034	19.9
Wildfire	$15,492	Relatively Low	Very High	0.94	$13,819	31.8
Heat Wave	$8,442	Relatively Low	Very High	0.94	$8,043	23
Cold Wave	$5,366	Relatively Low	Very High	0.94	$5,088	31.5
Winter Weather	$3,124	Relatively Low	Very High	0.94	$2,952	4.7
Hail	$3,079	Relatively Low	Very High	0.94	$2,739	4
Avalanche	--	Relatively Low	Very High	0.94	--	--
Tsunami	--	Relatively Low	Very High	0.94	--	--
Volcanic Activity	--	Relatively Low	Very High	0.94	--	--

Expected Annual Loss

In **Newport County, RI**, expected loss each year due to natural hazards is **Relatively Low** when compared to the rest of the U.S.



Score	65



65% of U.S. counties have a lower Expected Annual Loss

40% of counties in Rhode Island have a lower Expected Annual Loss

Expected Annual Loss Legend

Very High Relatively High Relatively Moderate Relatively Low Very Low

No Expected Annual Losses Not Applicable Insufficient Data

Composite Expected Annual Loss	**$9,019,334.12**
Composite Expected Annual Loss Rate National Percentile	**30.9**

Building EAL	**$8,217,069.16**	Population EAL	**0.05** fatalities
Building EAL Rate	**$1 per $2.30K of building value**	Population EAL Rate	**1 per 1.71M people**
Agriculture EAL	**$223,190.07**	Population Equivalence EAL	**$579,074.89**
Agriculture EAL Rate	**$1 per $99.08 of agriculture value**		

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.

15 of 18 hazard types contribute to the expected annual loss for **Newport County, RI**.

Hazard Type	Expected Annual Loss Rating	EAL Value	Score
Hurricane	Relatively Low	$7,138,907	83.5
Coastal Flooding	Relatively Low	$597,490	69.4

Hazard Type	Expected Annual Loss Rating	EAL Value	Score
Riverine Flooding	Relatively Low	$517,979	55.7
Tornado	Very Low	$188,414	22.1
Drought	Relatively Low	$144,916	73.6
Earthquake	Very Low	$139,298	50.7
Lightning	Relatively Low	$100,642	53.9
Strong Wind	Relatively Low	$97,501	23.6
Ice Storm	Relatively Low	$36,786	41.8
Landslide	Relatively Low	$21,900	50.5
Wildfire	Very Low	$15,492	35.3
Heat Wave	Very Low	$8,442	26.0
Cold Wave	Relatively Low	$5,366	33.5
Winter Weather	Very Low	$3,124	8.9
Hail	Very Low	$3,079	7.2
Avalanche	Not Applicable	--	--
Tsunami	Insufficient Data	--	--
Volcanic Activity	Not Applicable	--	--

Expected Annual Loss Values

Hazard Type	Total	Building Value	Population Equivalence	Population	Agriculture Value
Avalanche	--	--	--	--	--
Coastal Flooding	$597,490	$595,226	$2,264	0.00	n/a
Cold Wave	$5,366	$187	$4,706	0.00	$473
Drought	$144,915	n/a	n/a	n/a	$144,915
Earthquake	$139,298	$118,531	$20,767	0.00	n/a
Hail	$3,079	$676	$762	0.00	$1,641
Heat Wave	$8,442	$0	$7,962	0.00	$481
Hurricane	$7,138,906	$6,938,856	$125,778	0.01	$74,273
Ice Storm	$36,786	$33,665	$3,121	0.00	n/a
Landslide	$21,900	$4,500	$17,400	0.00	n/a
Lightning	$100,642	$6,012	$94,630	0.01	n/a
Riverine Flooding	$517,979	$327,965	$188,734	0.02	$1,280

Hazard Type	Total	Building Value	Population Equivalence	Population	Agriculture Value
Strong Wind	$97,501	$21,494	$76,004	0.01	$2
Tornado	$188,414	$152,661	$35,634	0.00	$120
Tsunami	n/a	n/a	n/a	n/a	n/a
Volcanic Activity	--	--	--	--	--
Wildfire	$15,492	$14,509	$982	0.00	$1
Winter Weather	$3,124	$2,786	$333	0.00	$5

Exposure Values

Hazard Type	Total	Building Value	Population Equivalence	Population	Agriculture Value
Avalanche	--	--	--	--	--
Coastal Flooding	$107,340,795,197	$2,686,877,360	$104,653,917,837	9,021.89	n/a
Cold Wave	$1,011,125,379,918	$18,919,891,305	$992,183,374,985	85,533.05	$22,113,628
Drought	$12,460,782	n/a	n/a	n/a	$12,460,782
Earthquake	$1,012,384,742,000	$18,925,942,000	$993,458,800,000	85,643.00	n/a
Hail	$1,011,490,745,620	$18,926,231,992	$992,542,400,000	85,564.00	$22,113,628
Heat Wave	$1,011,490,565,703	$18,926,229,312	$992,542,222,763	85,563.98	$22,113,628
Hurricane	$1,011,099,475,660	$18,922,448,624	$992,154,913,408	85,530.60	$22,113,628
Ice Storm	$1,005,095,914,881	$18,738,391,725	$986,357,523,156	85,030.82	n/a
Landslide	$262,941,054,340	$4,512,746,641	$258,428,307,700	22,278.30	n/a
Lightning	$1,011,468,631,992	$18,926,231,992	$992,542,400,000	85,564.00	n/a
Riverine Flooding	$59,147,649,459	$1,585,613,166	$57,561,319,981	4,962.18	$716,312
Strong Wind	$1,011,490,745,620	$18,926,231,992	$992,542,400,000	85,564.00	$22,113,628
Tornado	$1,011,490,745,620	$18,926,231,992	$992,542,400,000	85,564.00	$22,113,628
Tsunami	n/a	n/a	n/a	n/a	n/a
Volcanic Activity	--	--	--	--	--
Wildfire	$165,455,636,622	$3,616,085,945	$161,832,377,351	13,951.07	$7,173,327
Winter Weather	$1,011,490,565,703	$18,926,229,312	$992,542,222,763	85,563.98	$22,113,628

Annualized Frequency Values

Hazard Type	Annualized Frequency	Events on Record	Period of Record
Avalanche	--	--	--

Hazard Type	Annualized Frequency	Events on Record	Period of Record
Coastal Flooding	3.7 events per year	n/a	Various (see documentation)
Cold Wave	0.1 events per year	1	2005-2021 (16 years)
Drought	1 event per year	49	2000-2021 (22 years)
Earthquake	0.058% chance per year	n/a	2021 dataset
Hail	1.4 events per year	17	1986-2021 (34 years)
Heat Wave	0.4 events per year	2	2005-2021 (16 years)
Hurricane	0.2 events per year	25	East 1851-2021 (171 years) / West 1949-2021 (73 years)
Ice Storm	0.3 events per year	7	1946-2014 (67 years)
Landslide	0 events per year	0	2010-2021 (12 years)
Lightning	13.6 events per year	105	1991-2012 (22 years)
Riverine Flooding	0.5 events per year	11	1996-2019 (24 years)
Strong Wind	0.9 events per year	11	1986-2021 (34 years)
Tornado	0 events per year	1	1950-2021 (72 years)
Tsunami	n/a	n/a	1800-2021 (222 years)
Volcanic Activity	--	--	--
Wildfire	0.001% chance per year	n/a	2021 dataset
Winter Weather	3.6 events per year	20	2005-2021 (16 years)

Historic Loss Ratios

Hazard Type	Overall Rating
Avalanche	--
Coastal Flooding	Very Low
Cold Wave	Very Low
Drought	Very High
Earthquake	Very Low
Hail	Very Low
Heat Wave	Very Low
Hurricane	Relatively Moderate
Ice Storm	Very Low
Landslide	Very Low
Lightning	Relatively Moderate

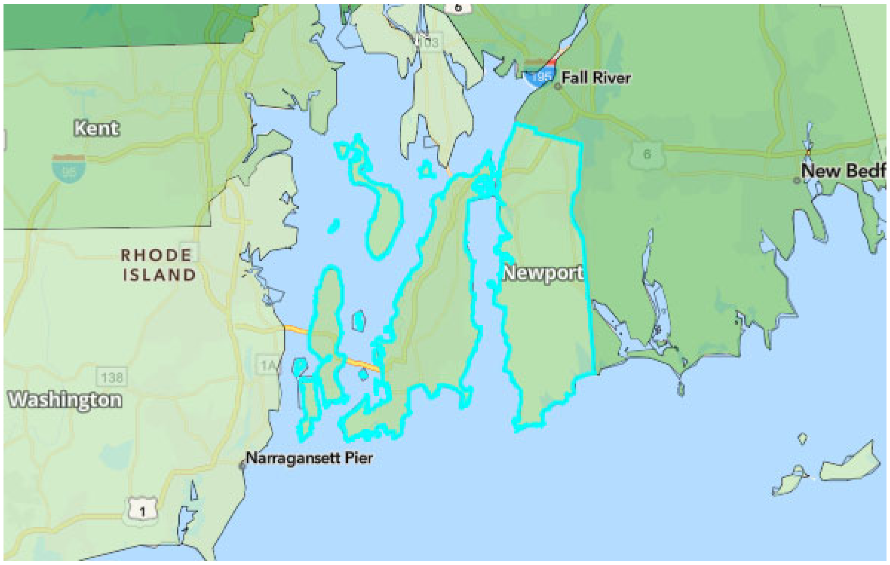
Hazard Type	Overall Rating
Riverine Flooding	Very Low
Strong Wind	Very Low
Tornado	Relatively Moderate
Tsunami	Insufficient Data
Volcanic Activity	--
Wildfire	Relatively Moderate
Winter Weather	Very Low

Expected Annual Loss Rate

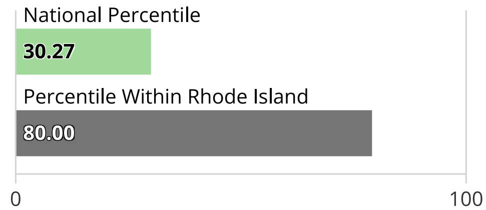
Hazard Type	Building EAL Rate (per building value)	Population EAL Rate (per population)	Agriculture EAL Rate (per agriculture value)
Avalanche	--	--	--
Coastal Flooding	$1 per $31.80K	1 per 438.40M	--
Cold Wave	$1 per $101.29M	1 per 210.90M	$1 per $46.79K
Drought	--	--	$1 per $152.60
Earthquake	$1 per $159.67K	1 per 47.80M	--
Hail	$1 per $27.98M	1 per 1.30B	$1 per $13.47K
Heat Wave	$1 per $132.80B	1 per 124.67M	$1 per $46.01K
Hurricane	$1 per $2.73K	1 per 7.89M	$1 per $297.73
Ice Storm	$1 per $562.19K	1 per 318.06M	--
Landslide	$1 per $4.21M	1 per 57.04M	--
Lightning	$1 per $3.15M	1 per 10.49M	--
Riverine Flooding	$1 per $57.71K	1 per 5.26M	$1 per $17.28K
Strong Wind	$1 per $880.52K	1 per 13.06M	$1 per $12.10M
Tornado	$1 per $123.98K	1 per 27.85M	$1 per $184.93K
Tsunami	--	--	--
Volcanic Activity	--	--	--
Wildfire	$1 per $1.30M	1 per 1.01B	$1 per $22.66M
Winter Weather	$1 per $6.79M	1 per 2.98B	$1 per $4.32M

Social Vulnerability

Social groups in **Newport County, RI** have a **Relatively Low** susceptibility to the adverse impacts of natural hazards when compared to the rest of the U.S.



Score	30.27



30% of U.S. counties have a lower Social Vulnerability

80% of counties in Rhode Island have a lower Social Vulnerability

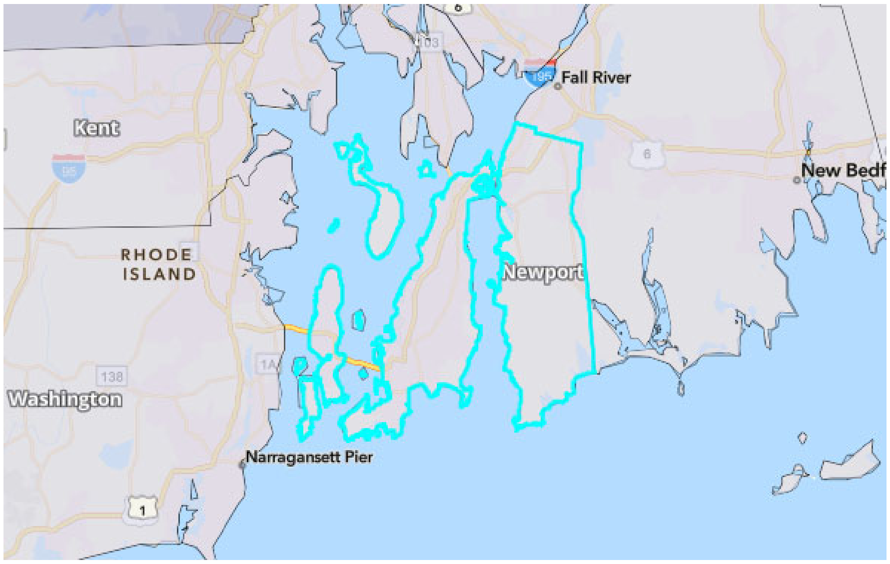
Social Vulnerability Legend

Very High · Relatively High · Relatively Moderate · Relatively Low · Very Low

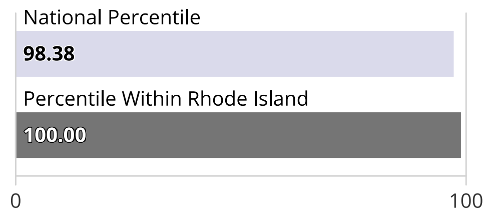
Data Unavailable

Community Resilience

Communities in **Newport County, RI** have a **Very High** ability to prepare for anticipated natural hazards, adapt to changing conditions, and withstand and recover rapidly from disruptions when compared to the rest of the U.S.



Score	**98.38**



2% of U.S. counties have a higher Community Resilience

0% of counties in Rhode Island have a higher Community Resilience

Community Resilience Legend

Very High | Relatively High | Relatively Moderate | Relatively Low | Very Low | Data Unavailable

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.

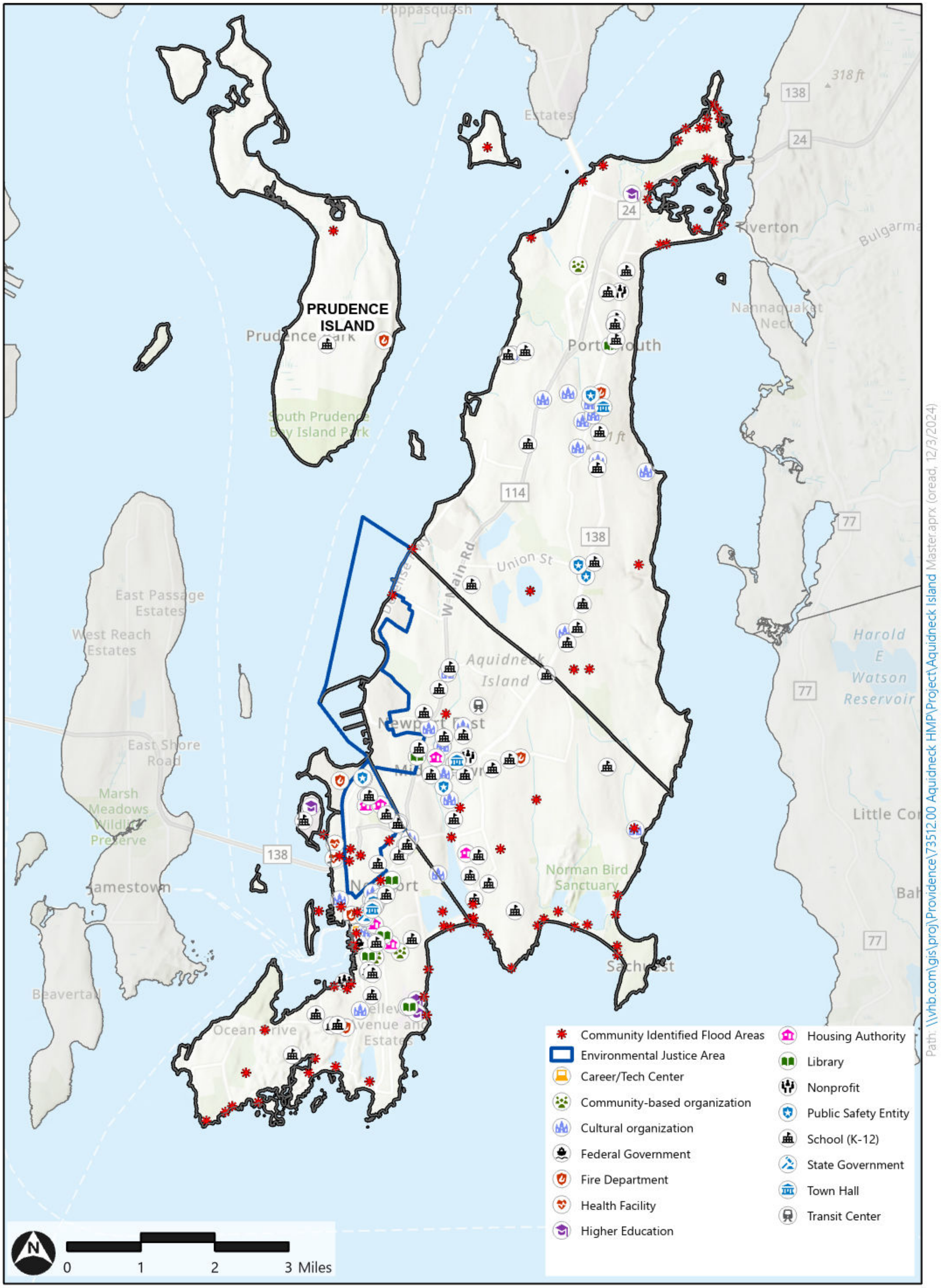
Nationwide data available for some risk factors are rudimentary at this time. The National Risk Index will be continuously updated as new data become available and improved methodologies are identified.

The National Risk Index Contact Us page is available at **hazards.fema.gov/nri/contact-us**.

Appendix D: Community Assets Map

Figure 5: Appendix E Community Assets

Aquidneck Island Risk Maps



Appendix E: HAZUS Reports

Hazus: Hurricane Global Risk Report

Region Name: Aquid

Hurricane Scenario: Probabilistic 100-year Return Period

Print Date: Thursday, November 7, 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 42.47 square miles and contains 17 census tracts. There are over 25 thousand households in the region and a total population of 60,109 people. The distribution of population by State and County is provided in Appendix B.

There are an estimated 23 thousand buildings in the region with a total building replacement value (excluding contents) of 13,030 million dollars. Approximately 85% of the buildings (and 65% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 23,242 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 prov distribution of the building value by State and County.

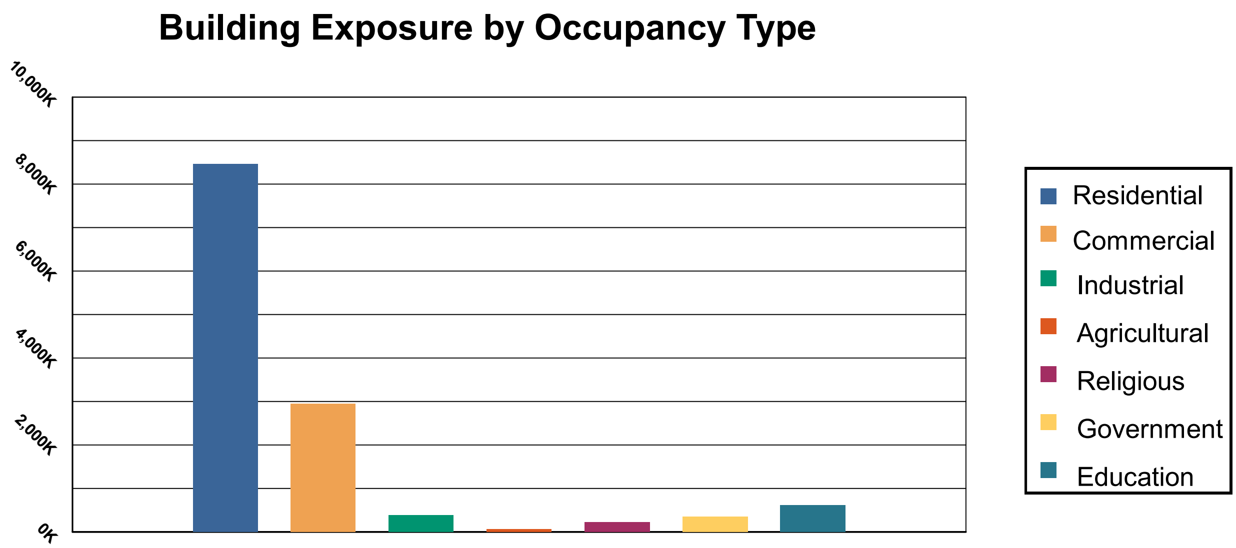


Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure ($1000)	Percent of Tot
Residential	8,454,070	64.88 %
Commercial	2,947,216	22.62%
Industrial	388,590	2.98%
Agricultural	56,088	0.43%
Religious	225,310	1.73%
Government	348,109	2.67%
Education	610,807	4.69%
Total	**13,030,190**	**100.00%**

Essential Facility Inventory

For essential facilities, there are 3 hospitals in the region with a total bed capacity of 129 beds. There are 23 schools, 6 fire stations, 5 police stations and 4 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 1,221 buildings will be at least moderately damaged. This is over 5% of the total number of buildings in the region. There are an estimated 121 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.

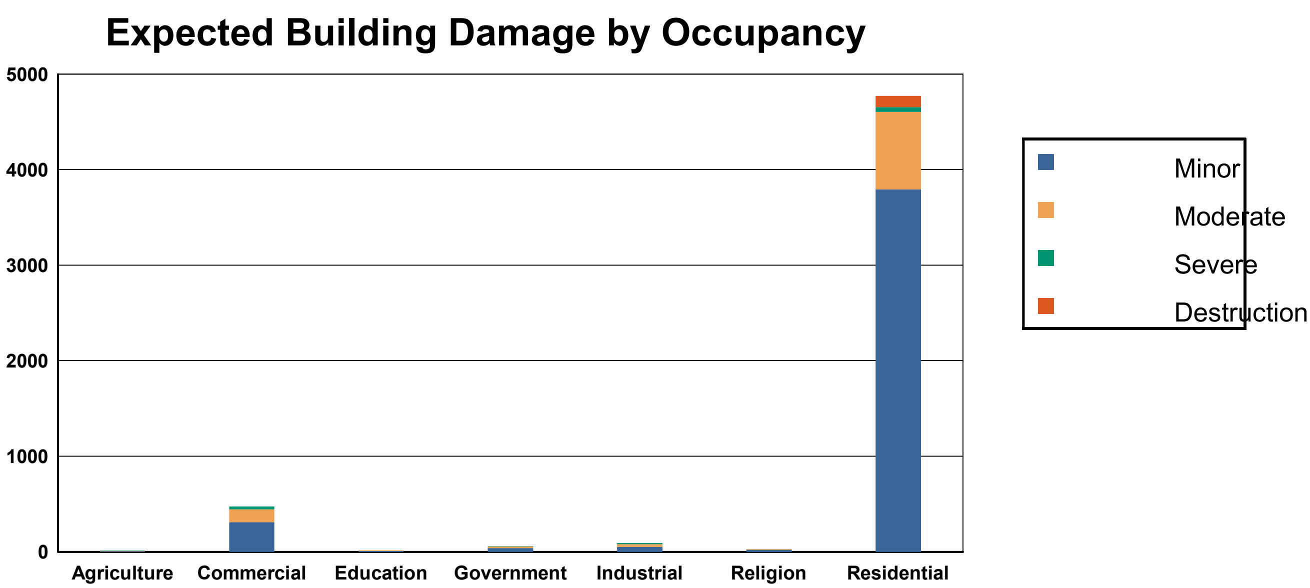


Table 2: Expected Building Damage by Occupancy : 100 - year Event

	None		Minor		Moderate		Severe		Destruction	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	50	80.14	7	10.84	3	5.31	2	3.35	0	0.36
Commercial	1,936	80.35	310	12.87	135	5.59	28	1.18	0	0.01
Education	46	74.29	10	15.46	6	9.80	0	0.46	0	0.00
Government	197	77.18	39	15.43	17	6.58	2	0.81	0	0.00
Industrial	355	79.54	53	11.94	27	6.10	10	2.35	0	0.06
Religion	127	80.76	21	13.44	8	5.14	1	0.66	0	0.00
Residential	15,077	75.96	3,793	19.11	809	4.08	50	0.25	120	0.60
Total	**17,788**		**4,233**		**1,005**		**95**		**121**	

Table 3: Expected Building Damage by Building Type : 100 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	121	76.29	25	15.96	11	6.85	1	0.90	0	0.00
Masonry	1,114	75.96	243	16.55	94	6.39	13	0.90	3	0.20
MH	63	89.96	4	5.02	2	3.12	0	0.09	1	1.80
Steel	904	68.19	208	15.69	183	13.79	31	2.31	0	0.01
Wood	15,948	78.88	3,546	17.54	574	2.84	44	0.22	106	0.53

Essential Facility Damage

Before the hurricane, the region had 129 hospital beds available for use. On the day of the hurricane, the model estimates that 129 hospital beds (100%) are available for use by patients already in the hospital and those injured by the hurricane. After one week, 100% of the beds will be in service. By 30 days, 100% will be operational.

Thematic Map of Essential Facilities

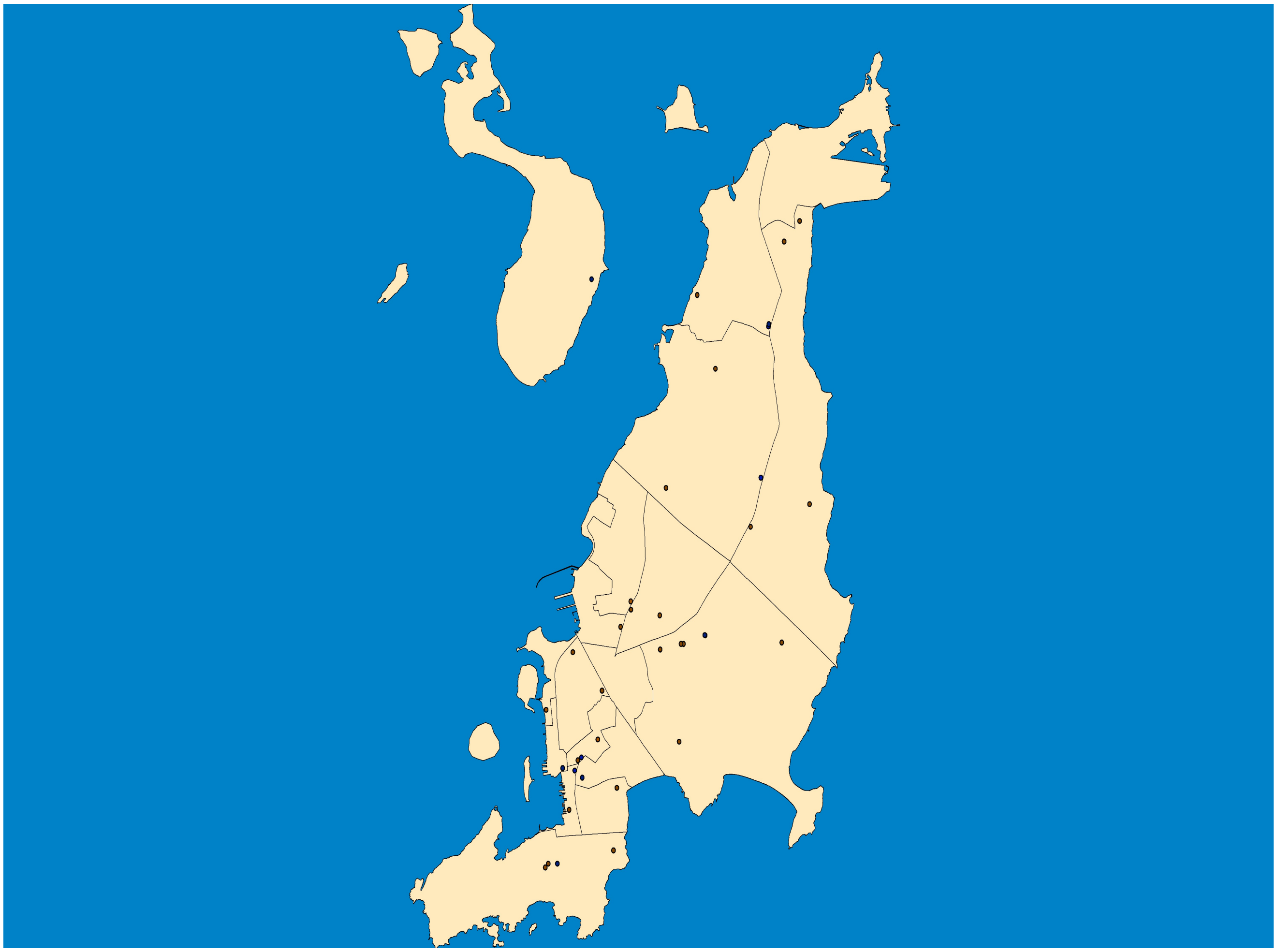
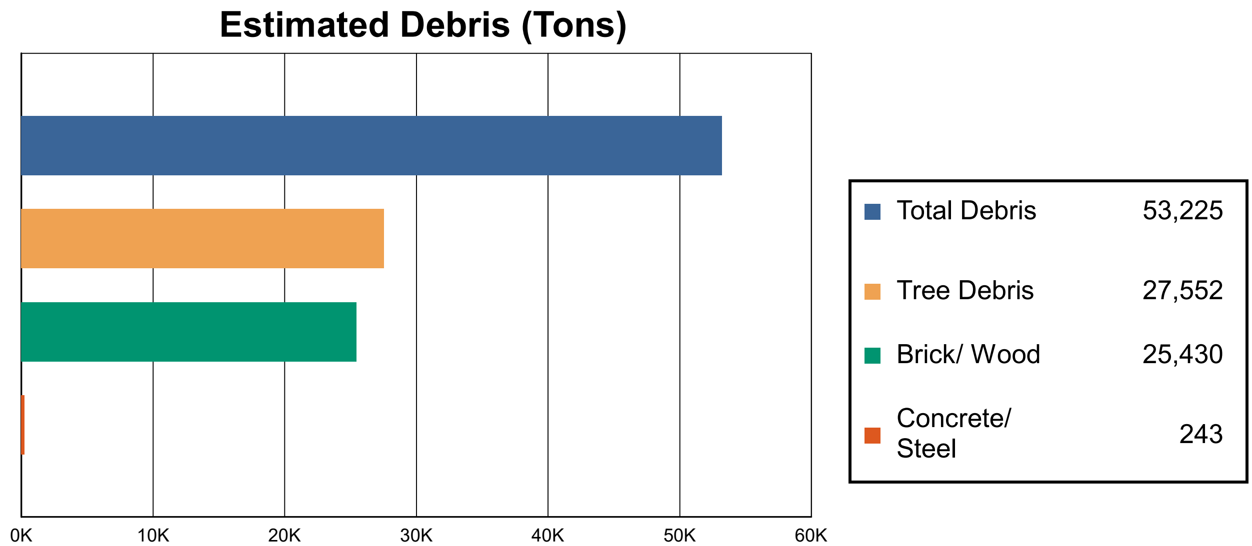


Table 4: Expected Damage to Essential Facilities

		# Facilities		
Classification	**Total**	**Probability of at Least Moderate Damage > 50%**	**Probability of Complete Damage > 50%**	**Expected Loss of Use < 1 day**
EOCs	4	0	0	4
Fire Stations	6	0	0	6
Hospitals	3	0	0	2
Police Stations	5	0	0	5
Schools	23	1	0	0

Induced Hurricane Damage

Debris Generation

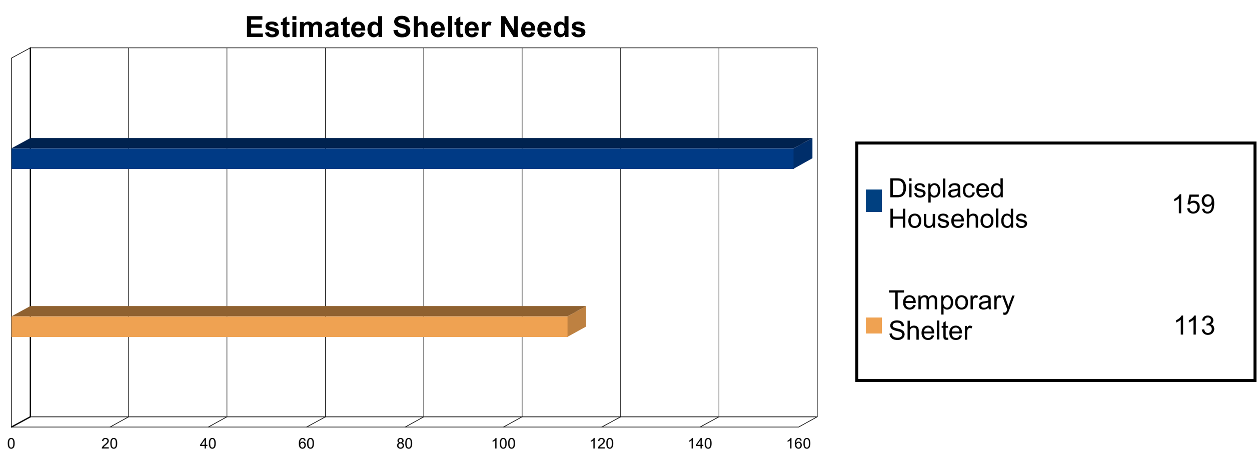


Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 53,225 tons of debris will be generated. Of the total amount, 12,173 tons (23%) is Other Tree Debris. Of the remaining 41,052 tons, Brick/Wood comprises 62% 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 1027 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 15,379 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 159 households to be displaced due to the hurricane. Of these, 113 people (out of a total population of 60,109) will seek temporary shelter in public shelters.

Economic Loss

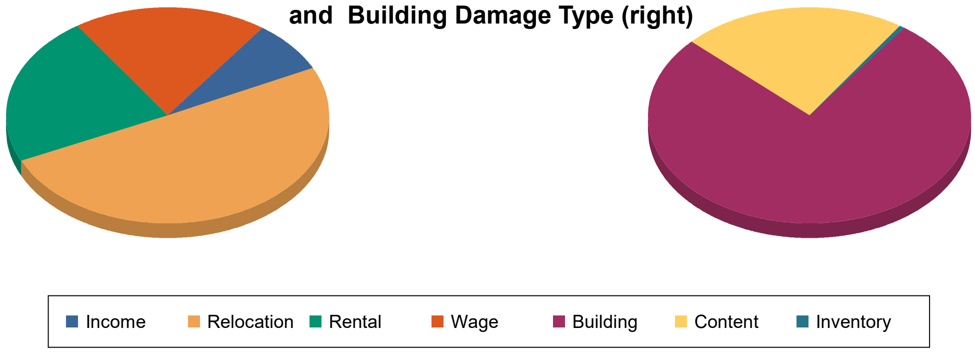
The total economic loss estimated for the hurricane is 352.0 million dollars, which represents 2.70 % of the total replacement value of the region’s buildings.

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 352 million 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 77% 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

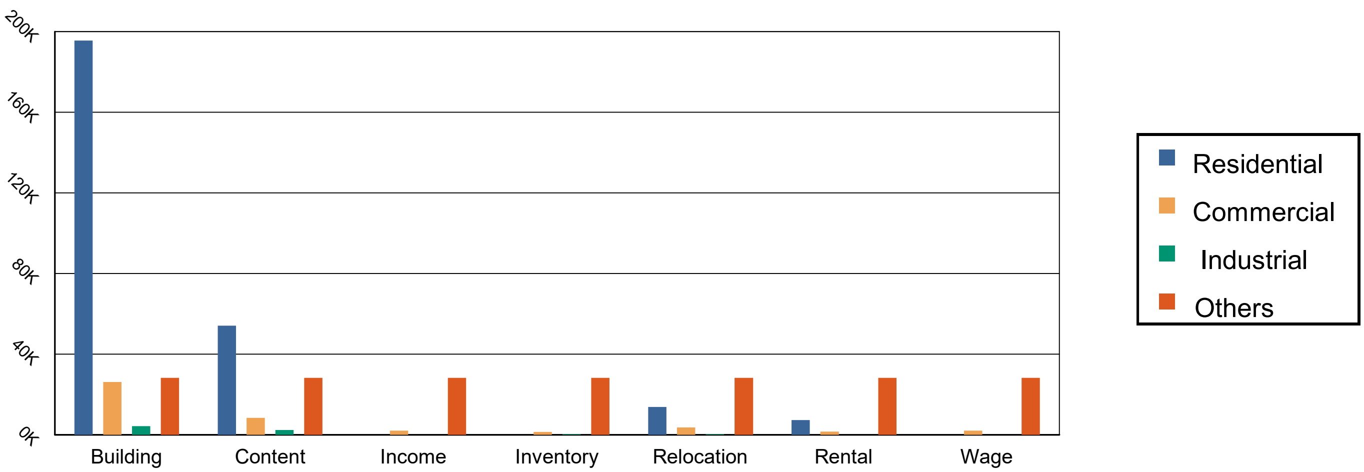


Table 5: Building-Related Economic Loss Estimates

(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Property Damage						
	Building	195,512.91	26,283.37	4,322.87	13,159.77	239,278.92
	Content	54,102.62	8,425.72	2,367.60	5,128.46	70,024.40
	Inventory	0.00	1,416.04	316.60	325.12	2,057.76
	Subtotal	**249,615.53**	**36,125.12**	**7,007.07**	**18,613.35**	**311,361.07**
Business Interruption Loss						
	Income	1.67	2,081.61	41.07	999.99	3,124.33
	Relocation	13,824.70	3,605.46	328.71	2,666.24	20,425.11
	Rental	7,290.03	1,534.77	35.19	298.31	9,158.30
	Wage	3.92	2,133.20	69.48	5,723.35	7,929.96
	Subtotal	**21,120.32**	**9,355.05**	**474.45**	**9,687.89**	**40,637.70**

Total

Total	**270,735.84**	**45,480.17**	**7,481.52**	**28,301.24**	**351,998.78**

Appendix A: County Listing for the Region

Rhode Island
- Newport

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Rhode Island				
Newport	60,109	8,454,070	4,576,120	13,030,190
Total	**60,109**	**8,454,070**	**4,576,120**	**13,030,190**
Study Region Total	**60,109**	**8,454,070**	**4,576,120**	**13,030,190**

HAZUS™

FEMA

RiskMAP
Increasing Resilience Together

Hazus: Hurricane Global Risk Report

Region Name: Aquidneck

Hurricane Scenario: 1954-CAROL

Print Date: Tuesday, November 5, 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 42.47 square miles and contains 17 census tracts. There are over 25 thousand households in the region and a total population of 60,109 people. The distribution of population by State and County is provided in Appendix B.

There are an estimated 23 thousand buildings in the region with a total building replacement value (excluding contents) of 13,030 million dollars. Approximately 85% of the buildings (and 65% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 23,242 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 prov distribution of the building value by State and County.

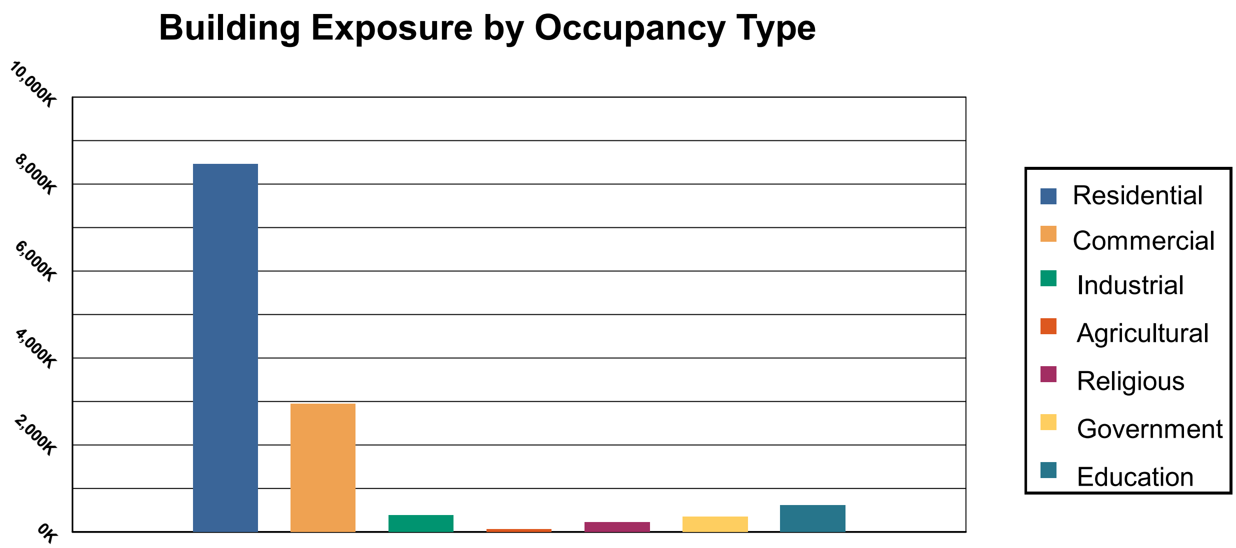


Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure ($1000)	Percent of Tot
Residential	8,454,070	64.88 %
Commercial	2,947,216	22.62%
Industrial	388,590	2.98%
Agricultural	56,088	0.43%
Religious	225,310	1.73%
Government	348,109	2.67%
Education	610,807	4.69%
Total	**13,030,190**	**100.00%**

Essential Facility Inventory

For essential facilities, there are 3 hospitals in the region with a total bed capacity of 129 beds. There are 23 schools, 6 fire stations, 5 police stations and 4 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:	1954-CAROL
Type:	Historic
Max Peak Gust in Study Region:	110 mph

Building Damage

General Building Stock Damage

Hazus estimates that about 1,735 buildings will be at least moderately damaged. This is over 7% of the total number of buildings in the region. There are an estimated 214 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.

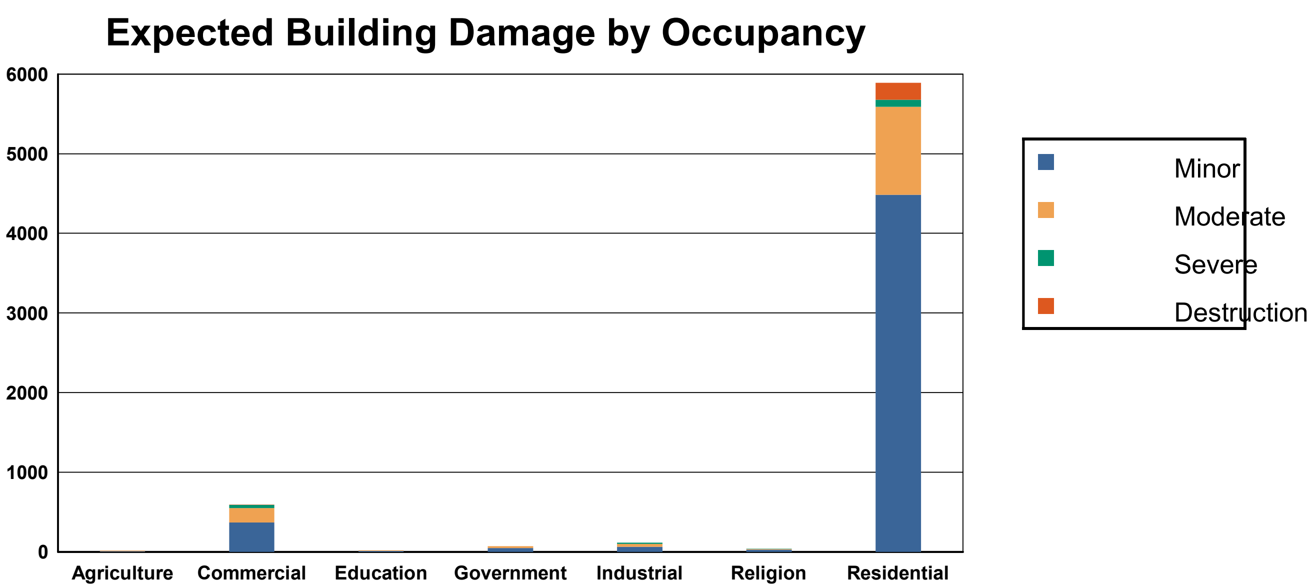


Table 2: Expected Building Damage by Occupancy

	None		Minor		Moderate		Severe		Destruction	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	47	74.88	8	13.25	4	6.76	3	4.55	0	0.56
Commercial	1,817	75.44	370	15.34	180	7.48	41	1.72	1	0.02
Education	43	68.74	11	17.59	8	12.84	1	0.83	0	0.00
Government	182	71.49	46	17.99	23	9.18	3	1.34	0	0.00
Industrial	332	74.45	64	14.29	35	7.94	14	3.22	0	0.10
Religion	119	76.10	25	15.97	11	6.89	2	1.04	0	0.00
Residential	13,958	70.32	4,484	22.59	1,105	5.57	90	0.45	213	1.07
Total	**16,499**		**5,008**		**1,367**		**154**		**214**	

Table 3: Expected Building Damage by Building Type

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	111	70.51	29	18.41	15	9.58	2	1.51	0	0.00
Masonry	1,028	70.14	280	19.08	131	8.93	22	1.50	5	0.35
MH	60	85.44	5	6.63	3	4.84	0	0.19	2	2.90
Steel	821	61.89	232	17.48	230	17.32	44	3.28	0	0.02
Wood	14,895	73.67	4,247	21.00	812	4.02	76	0.37	189	0.93

Essential Facility Damage

Before the hurricane, the region had 129 hospital beds available for use. On the day of the hurricane, the model estimates that 129 hospital beds (100%) are available for use by patients already in the hospital and those injured by the hurricane. After one week, 100% of the beds will be in service. By 30 days, 100% will be operational.

Thematic Map of Essential Facilities

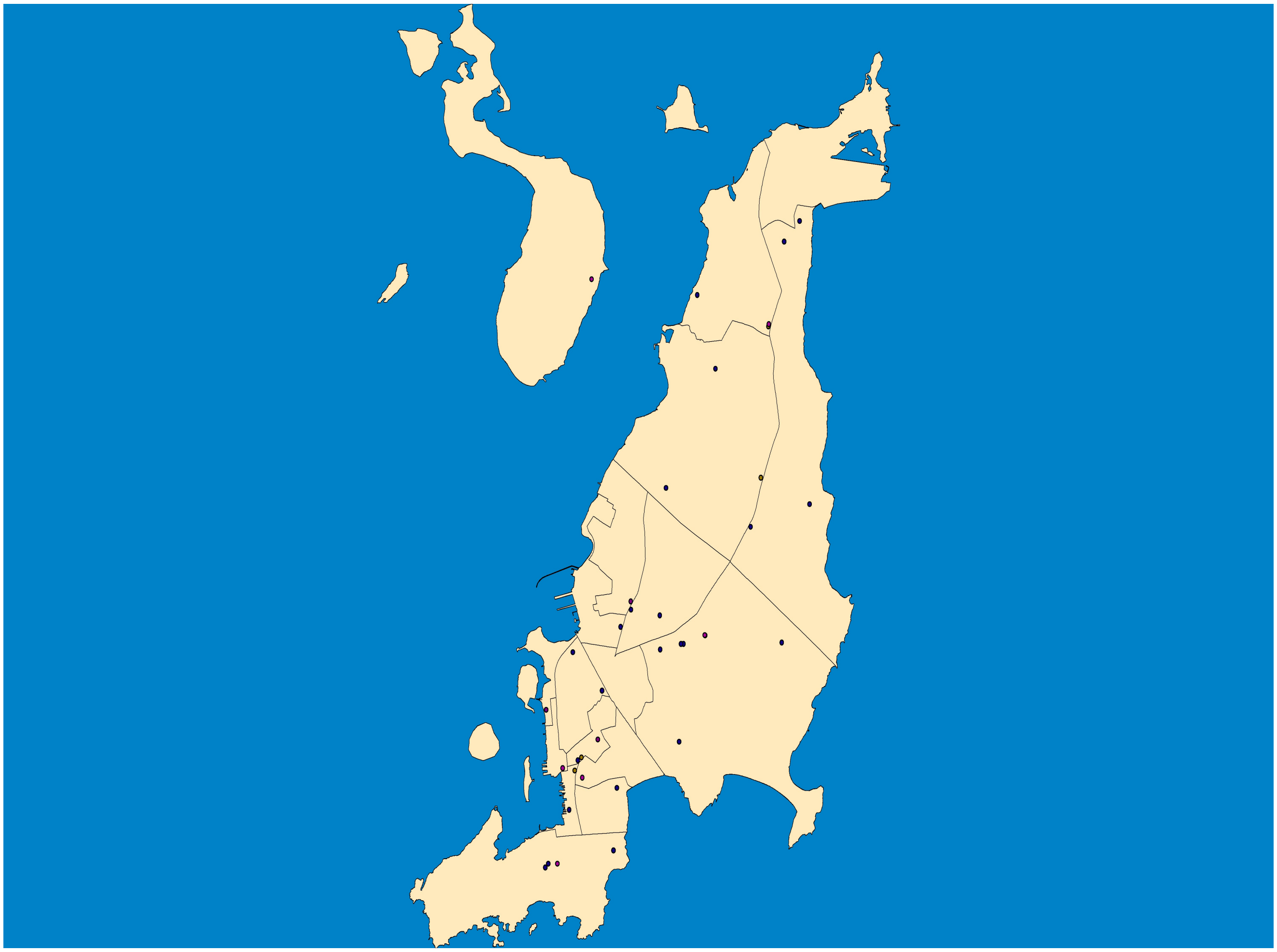
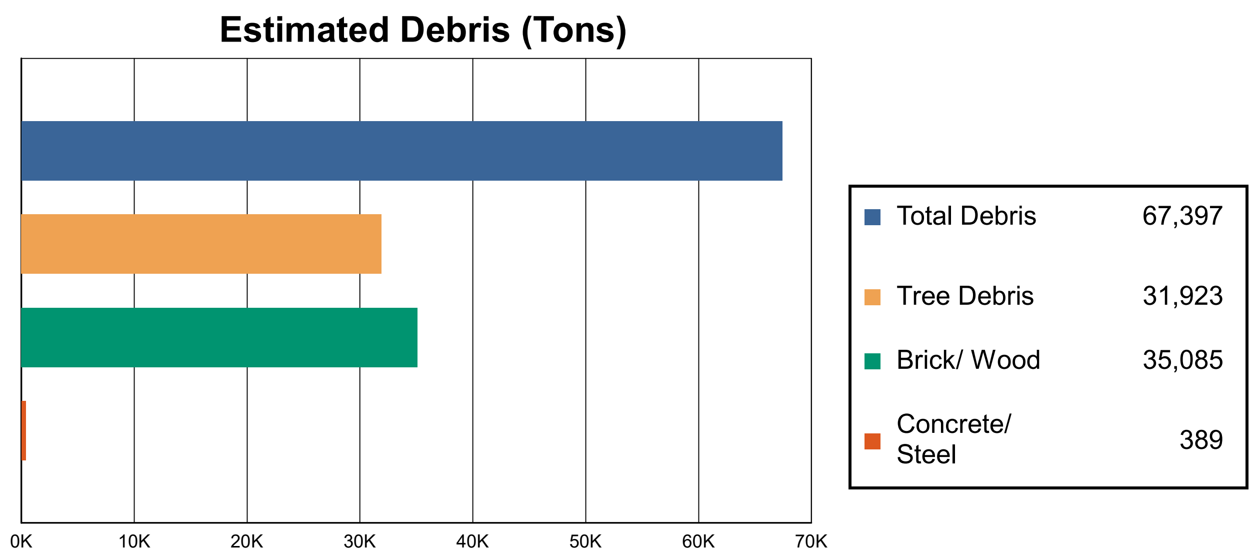


Table 4: Expected Damage to Essential Facilities

Classification	Total	# Facilities: Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
EOCs	4	0	0	4
Fire Stations	6	0	0	6
Hospitals	3	0	0	2
Police Stations	5	0	0	5
Schools	23	1	0	0

Induced Hurricane Damage

Debris Generation

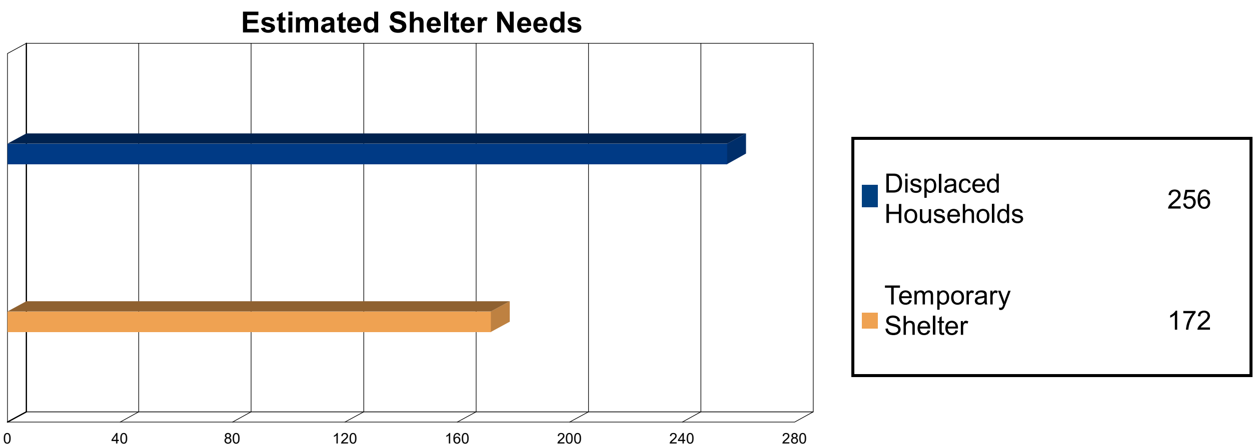


Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 67,397 tons of debris will be generated. Of the total amount, 13,981 tons (21%) is Other Tree Debris. Of the remaining 53,416 tons, Brick/Wood comprises 66% 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 1419 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 17,942 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 256 households to be displaced due to the hurricane. Of these, 172 people (out of a total population of 60,109) will seek temporary shelter in public shelters.

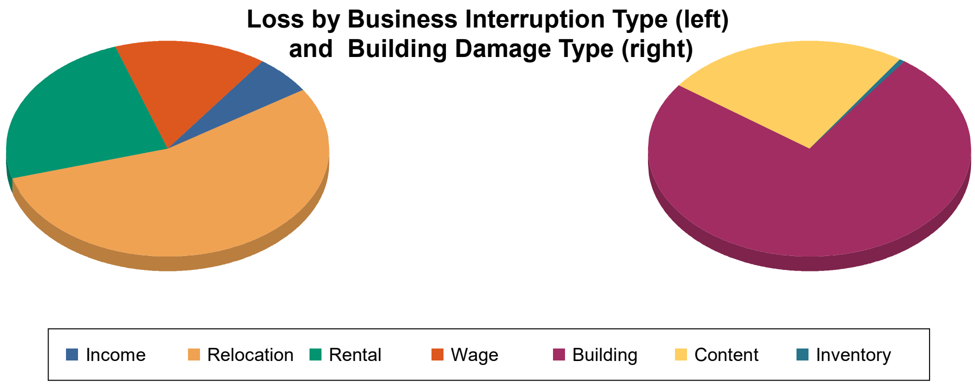
Economic Loss

The total economic loss estimated for the hurricane is 503.1 million dollars, which represents 3.86 % 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 503 million 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 78% of the total loss. Table 5 below provides a summary of the losses associated with the building damage.



Loss Type by General Occupancy

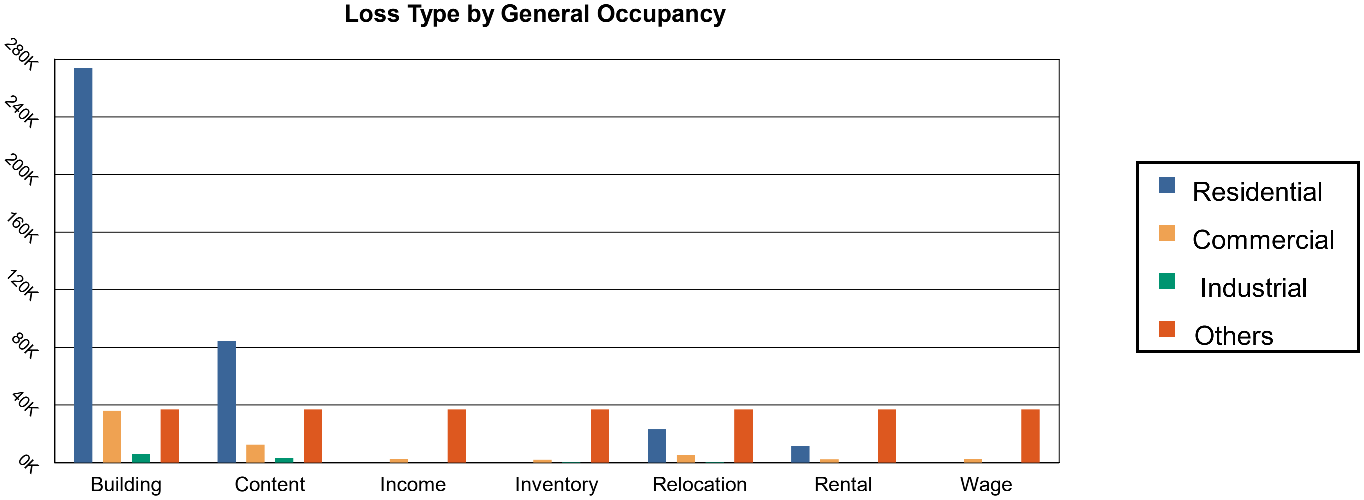


Table 5: Building-Related Economic Loss Estimates

(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Property Damage						
	Building	273,953.09	35,940.65	5,763.24	17,690.59	333,347.57
	Content	84,559.49	12,426.34	3,295.49	7,453.81	107,735.13
	Inventory	0.00	2,123.35	441.89	486.83	3,052.08
	Subtotal	**358,512.59**	**50,490.34**	**9,500.62**	**25,631.23**	**444,134.79**
Business Interruption Loss						
	Income	6.27	2,478.31	53.45	961.58	3,499.61
	Relocation	23,075.08	5,046.50	431.58	3,597.05	32,150.20
	Rental	11,544.22	2,241.38	48.92	416.25	14,250.77
	Wage	14.77	2,567.82	90.18	6,367.75	9,040.52
	Subtotal	**34,640.33**	**12,334.02**	**624.12**	**11,342.63**	**58,941.10**

Total

Total	**393,152.92**	**62,824.37**	**10,124.74**	**36,973.86**	**503,075.89**

Appendix A: County Listing for the Region

Rhode Island
- Newport

Appendix B: Regional Population and Building Value Data

		Building Value (thousands of dollars)		
	Population	Residential	Non-Residential	Total
Rhode Island				
Newport	60,109	8,454,070	4,576,120	13,030,190
Total	**60,109**	**8,454,070**	**4,576,120**	**13,030,190**
Study Region Total	**60,109**	**8,454,070**	**4,576,120**	**13,030,190**

Appendix F: Municipal Hazard Mitigation Action Plans

F1: Portsmouth, RI

F2: Middletown, RI

F3: Newport, RI

F

Appendix F1 Portsmouth, Rhode Island

Community Infrastructure/Assets Matrix

The Critical Infrastructure/Community Assets Matrix represents the culmination of the risk assessment process. It compiles key findings in a single, accessible format to support discussion and prioritization of mitigation actions. The matrix identifies specific areas of concern, provides location details, outlines associated hazards, and problems, and highlights the potential benefits of mitigation.

At Risk	Location	Hazard/Problem	Ongoing Actions	Mitigation Actions
Flood Prone Streets and Infrastructure	Park Avenue Seawall - protects evacuation route Park Avenue Boyd's Lane Old Colony Railroad underpass Bramans Lane Defense Highway West end of Cedar Avenue West Shore Road/Hall Road Mussel Bed Shoal Road Riverside Street Frank Coello at Glen Road McCory at Windstone Glen Road at Glen Farm Road Common Fence Blvd Berkley Avenue/Attleboro Avenue Island Road Sakonnet Drive Mill Creek Narragansett Road Nagg's Pond on Prudence Island Neck Farm Road Old Mill Lane Melville neighborhood Point Road Narragansett Ave. Neck Farm Road State Highway 24 Northbound (and on-ramp) State Highway 24 Southbound State Highway 24 Northbound - Exit 2 Boyd Lane/Island Park/ Mount Hope Bridge Railroad Ave. Anthony Road	**Hazards:** Flooding Storm Surge Hurricanes/Nor'easters **Problems:** Flooding due to ground saturation Coastal flooding via storm surge and sea level rise	Maintain stormwater conveyance systems. Maintain soil and sediment control ordinance.	1. Create an open space acquisition program. a. Create and prioritize an internal list of vacant or underdeveloped parcels in flood-prone areas for the town to consider purchasing as open space. b. Explore resident interest in voluntary home acquisition program. c. Acquire priority properties. 2. Install signage showing high-water lines from past storm surge events along Park Avenue. 3. Create resiliency guidelines or ordinances for development, incorporating green infrastructure, stormwater infrastructure, protecting environmental assets, and promoting low-impact development. 4. Initiate steps toward participation in FEMA's CRS to improve flood resilience and reduce flood insurance premiums. a. Review current floodplain management practices. b. Assess CRS eligibility criteria, coordinate with the State NFIP Coordinator, and develop a timeline for formal application. 5. Assess risk of debris, such as fallen trees and ice, from storms which may impact the natural drainage of local systems. a. Conduct field inspections of known problem areas to identify blockages.

At Risk	Location	Hazard/Problem	Ongoing Actions	Mitigation Actions
				b. Develop mapping of watercourses and drainage infrastructure most susceptible to clogging from storm debris. c. Work with DPW and local conservation commissions to gather insights and examine historical data of past flooding events and drainage issues. d. Support debris managements protocols, stream corridor maintenance programs, and culver upgrade priorities.
Bridges	Sakonnet River Bridge - operated by the Rhode Island Turnpike and Bridge Authority (RITBA) The Cove Bridge (also known as the Escape Bridge) - operated by RIDOT Mount Hope Bridge - operated by RITBA Boyds Lane Northbound and Southbound	**Hazards:** Storm Surge Sea Level Rise High Winds		No new actions at this time.
Wastewater	On-site septic Individual Sewage Disposal Systems (ISDS); Municipal Sewer Service: Sewer lines from Newport that service the island's west side, including Melville and U.S. Navy housing. These lines go to the sewage treatment plant in Newport Carnegie Abbey sewage treatment plant The U.S. Navy has expressed interest in self-sustaining wastewater infrastructure. A Sewer line runs along Jepson Lane from the Lawton Valley water treatment plant to Middletown, RI	**Hazards:** Hurricanes/Nor'easters **Problems:** Loss of power from severe storms	Distribute information regarding proper management of ISDS systems.	No new actions at this time.

At Risk	Location	Hazard/Problem	Ongoing Actions	Mitigation Actions
Water Supply Systems	Main water source from Newport Emergency main line over Sakonnet River Bridge Portsmouth Water and Fire Lawton Valley Water Treatment Plant in Portsmouth, jurisdiction of Newport U.S. Navy waterlines Prudence Island Water District - three public wells, two are functioning, one is emergency Hog Island private wells and septic systems	**Hazards:** Drought Hazardous material contamination Extreme temperatures **Problems:** Loss of power from other hazards Saltwater intrusion		No new actions at this time.
Services/Utilities	Transfer Station - 305 Hedly Street Transfer station on Prudence Island Streetlights - not town owned yet Turbine safety - next to the water department, owned by Green Energy, feeds into the Town, on Town land Tank farms on U.S. Navy property Gas mains Electric power lines Portsmouth Water Department operates four water tanks, including one located in Newport	**Hazards:** High winds Hurricanes/Nor'easters	Maintain all town-owned facilities and infrastructure.	6. Purchase and install backup generators at the Prudence Island and Hedley Street transfer stations to ensure continued waste management operations during hazard events.
Communication Facilities	Police/Fire Station - Town Access Crown Castle State Police Barracks (800Mhz) Cell Towers - town wide	**Hazards:** High winds Lightning	Maintain equipment and redundancy.	No new actions at this time.
Dams	Lawton Valley (High) - owned by the City of Newport Sisson (High) - owned by the City of Newport St. Mary's (High) - owned by the City of Newport Melville #1 (Significant) - owned by the Town of Portsmouth Four low hazard dams	**Hazards:** Flooding (Upstream and downstream flooding) Hurricanes/Nor'easters	Continue to update dam hazard mitigation plans and review annually with emergency management staff from Portsmouth	No new actions at this time.

At Risk	Location	Hazard/Problem	Ongoing Actions	Mitigation Actions
			and adjoining municipalities. Recent action at Melville: trees removed which could cause structural damage.	
Marinas/Docks	Ferry Docks (two for Prudence Island) Brewer Sakonnet Marina New England Boatworks Pirate Cove Marina Hinckley Yacht Services Public Safety vessels at Carnegie Abbey	**Hazards:** Coastal Flooding Erosion Sea level rise Storm surge	Stage boats/docks pre-storm as necessary.	No new actions at this time.
Critical Municipal Hazard Response Facilities	Police Station • 2270 East Main Road • 838 East Main Road (State Police) Fire Station • 2300 East Main Road • 0292 Narragansett Avenue, Prudence Island (volunteer) Town Hall - 2200 E. Main Road Public Works - 143 Hedley Street Dept. of Public Works - Prudence Island 01351 Narragansett Ave. Portsmouth Canvassing Authority 2200 E. Main Road	**Hazards:** All hazards	Annual inspection of all town-owned, non-school buildings. Promoting participation in Code Red.	No new actions at this time.
Populations	All residents Elderly and infants Island Park Common Fence Point <u>Assisted Living</u> Atria Aquidneck Place - 125 Quaker Hill Lane Anthony House Group homes and facilities like Boys Town are also considered based on registries, facility type, and resident needs.	**Hazards:** All hazards	Fire department does wellness checks before and after a destructive event. Provide public information regarding post-disaster rebuilding regulations. Distribute information regarding proper	7. Conduct inspections of all senior housing facilities to evaluate compliance with building codes and resilience to natural hazards. 8. Improve public education on the town's website. a. Preparation for extreme weather events and climate change. b. Stormwater runoff. c. Evacuation vs shelter in place, heating and cooling centers.

At Risk	Location	Hazard/Problem	Ongoing Actions	Mitigation Actions
	Public Housing Quaker Estates Mobile Homes Melville Trailer Park Melville Campground Sunny Acres Davey Lane Maggie Lane Oliveira's Park Portsmouth Naval Park Riverview Associates Education Roger Williams dormitories Portsmouth Abbey resident students Shelters Portsmouth High School (primary local, secondary regional) - 120 Education Lane Portsmouth Middle School (secondary local) - 120 Jepson Lane No designated Prudence Island Shelter Gaudet Middle School (primary Red Cross Regional Shelter) - 113 Aquidneck Avenue, Middletown, RI Special Needs Registry 100 people on the registry		management of ISDS systems.	d. Tie-down methods for mobile homes. e. Special needs registry promotion.
Businesses	Raytheon Marina District Melville Clements Market CVS Pharmacy Town gas stations State highway garage - fuel facility for this section of the state. Private farms	**Hazards:** Hurricanes/Nor'easters Blizzards High winds		No new actions at this time.

At Risk	Location	Hazard/Problem	Ongoing Actions	Mitigation Actions
Schools	Portsmouth High School (primary shelter) - 120 Education Lane Portsmouth Middle School (secondary shelter) - 120 Jepson Lane Hathaway Elementary Melville Elementary Penn Field St. Philomena's Portsmouth Abby Bradley School School Administration Building Prudence Island School	**Hazards:** Severe storms Hurricanes/Nor'easters Blizzards High Winds Extreme Heat	Verify all public and private schools have up to date emergency response plans.	No new actions at this time.
Recreation Facilities	Island Park beach (Teddy's Beach, State Beach) Town Beach at Sandy Point Sand Point beach on Prudence Island McCorrie Point Glen Farm Stables Glen Park Melville Ponds Campground Portsmouth Senior Center- 110 Bristol Ferry Road Founders Brook Dog park on Smith Road Common Fence Point Community Center Elmhurst Park Bristol Ferry Town Commons Gardner Seveny Sports Complex Brown House Library Newport National Golf Green Valley Montaup Sandy Point Stables Carnegie Abbey Golf Club	**Hazards:** Erosion Severe storms	Install sand fencing annually at Town Beach.	No new actions at this time.
Natural Resources	Salt marshes Tidal marshes Coastal waters Fresh water Groundwater	**Hazards:** Erosion	Common Fence Point salt marsh being restored. Ferry Landing purchased by Aquidneck Land trust	9. Advance salt marsh restoration in priority areas of Portsmouth (Bertha K. Russell Preserve, the shoreline between Ferry Landing and Common Fence

At Risk	Location	Hazard/Problem	Ongoing Actions	Mitigation Actions
	Wildlife and habitat areas National Estuarine Sanctuary Open space		and given to Portsmouth, where it has since been converted into a park. As part of the improvements, the seawall was reinforced. Continue to support Prudence Island Community Wildfire Protection Plan.	Point, the Park Avenue/beach area, and NBNERR property on Prudence Island. a. Synthesize and map existing salt marsh studies. b. Conduct on-site assessments of marsh condition and migration potential. c. Coordinate with landowners and resource agencies. d. Identify and initiate one or more pilot restoration projects. e. Develop a long-term island-wide marsh restoration and adaptation strategy.
Historic/Cultural Resources	Battle of Rhode Island Historic District Butts Hill Fort Prudence Island Lighthouse Portsmouth Friends Meeting house Lawton-Almy-Hall Farm Greenvale Farm Hog Island Lighthouse Pine Hill Archeological Site Christian Union Church (Portsmouth Historic Society) Southermost Schoolhouse Julia Ward Howe's Oak Glen Glen Manor House Green Animals Phelps house Library Sandy Point Stables	**Hazards:** High winds Severe Storms Hurricanes/Nor'easters	Continue to support historical society.	No new actions at this time.

Mission Statement

The Town of Portsmouth is building a disaster resistant community and achieving sustainable development through the commitment of state and local government and its policymakers to mitigate hazard impacts before disaster strikes. By doing so, local leaders aim to preserve and enhance quality of life, property, and resources.

Mitigation Goals

To effectuate the mission statement, the Town of Portsmouth establishes the following hazard mitigation goals, toward which all action must reach:

1. Protect public health, safety, and welfare; minimize social dislocation and distress due to impacts from natural hazards.
2. Prioritize underserved and disadvantaged communities, especially those in high-risk areas.
3. Reduce property damages caused by natural hazards.
4. Reduce economic loss and minimize disruption to local business due to natural hazards.
5. Implement actions which protect Aquidneck Island's cultural, historic, and natural environments.
6. Protect the ongoing operations of critical facilities and infrastructure during and after a storm or event.
7. Expedite post-disaster mitigation efforts during the recovery phase.
8. Promote non-structural flood and coastal erosion measures, such as planting vegetation, preserving natural buffers, or restoring dunes and wetlands, to reduce the risk of damage to the surrounding properties and environmental habitats without solely relying on hard infrastructure like seawalls or ripraps.

Status of Prior Actions

Action	Status	Notes
Amend zoning ordinance to incorporate multiple hazards. Keeping existing rules and regulations up to date with the appropriate best management practices for natural hazard-prone areas enhances public health and safety as well as improves local government responsiveness to community needs.	Ongoing	Zoning ordinances have been amended for the purposes of floodplain management and state building code compliance. Continue to monitor proposed changes and implement as necessary.
Develop flood information program for neighborhood preservation. Distribute information on the National Flood Insurance Program to all households in the floodplain area. Public outreach to residents and business owners in the most vulnerable areas: Island Park, Common Fence Point, Melville business district.	Ongoing	This has been ongoing monthly for approximately four years with established and active preparedness neighborhood committees.
Ask RIDOT to do a structural evaluation on the Common Fence Point railroad underpass. This area is a significant bottleneck.	Complete	Conducted in July 2024 – Fair Condition.
Install an inground stormwater injection system along Riverside Street. This is a low-lying flood area with frequent standing water.	Complete	Completed in May 2025.
Install riprap on the north side of Common Fence Point Boulevard to reduce erosion of the residential area exposed to Mount Hope Bay.	Complete	
Repair cement roadway on Prudence Island that leads to the dock. The cement at the end of the roadway leads into the dock—there is no other way to access the Sand Point Dock.	Complete	
Communicate with RI Turnpike and Bridge Authority about storm-time operations of Sakonnet River Bridge and Mount Hope Bridge.	Complete	
Purchase a second generator for Prudence Island pump stations. Loss of power to stations could limit availability of fresh water and firefighting.	Ongoing	A generator was purchased with ARPA funds. The PIWD has two pump houses for its two primary (and one backup) wells and another generator at the Broadway booster station ensuring high pressure. Each of these locations has a generator. None of the 3 generators have backup generators on site.
Improve communications with Newport Water. Portsmouth relies on drinking	Ongoing	Communication has improved. Newport and Portsmouth

Action	Status	Notes
water from Newport. Lawton Valley Water Treatment Plan is owned by Newport.		participated in a joint Dam Emergency Exercise in 2024.
On file all dam emergency action plans as required by the State's Dam Safety Program.	Ongoing	These plans are close to completion. Newport will need to review and provide input.
Codify orders of succession during an emergency. The current Charter does not allow legal transfer of authority if the designated person is unavailable.	Complete	
Adopt Continuity of Operations Plan (COOP) for each Town agency to ensure services continue during emergencies.	Ongoing	Action is addressed under COOP Planning.
Back-up power for pharmacy, grocery, and north and south gas stations. Conduct a power needs assessment (generator needs study) for each site.	Complete	
Dredge Founders' Brook near Old Boyd's Lane to reduce flooding at Founders' Brook Park and Boyd's Lane.	Ongoing	Dredging to be performed. Ongoing coordination with RIDOT to locate and clean out state outfalls.

Mitigation Actions

The Regional Hazard Mitigation Committee (RHMC) decided to propose actions that addressed certain vulnerabilities that were identified earlier in the planning process. See **Chapter 4**.

The worksheets below summarize each specific problem and proposed solution, outline the primary tasks, identify an appropriate lead agency, and suggest potential funding sources.

After all the Portsmouth action details were completed, the representatives from Portsmouth were given an anonymous survey to rank the priority of each action on the city. Each action was rated as a high, medium, or low priority for the city. This helps to prioritize needs when funding becomes available or budgeted. In the case where the survey results showed a tie, the higher priority was assigned. When an equal number of respondents prioritized an action as low and high, the medium priority was assigned. All rankings were reviewed by the Portsmouth representatives during the draft plan review stage.

The Portsmouth group was encouraged to propose a range of mitigation actions regardless of project costs. If costs have already been set aside for a particular mitigation action, the Portsmouth group prioritized that action to ensure that it was completed, and funds were spent in a timely manner.

Funding and staff time will be the determining factors on when various actions are completed. The Portsmouth group understands that implementation of many of these proposed actions requires the securing of external funding.

These actions include wants to prevent or reduce the consequences of disaster (mitigation), planning and education (preparedness), improved response in the immediate aftermath of an event (response), and improved restoration efforts (recovery). Those which are true mitigation actions are noted as such.

Certain planning elements must be completed before additional mitigation actions can be implemented. The Middletown group has identified a range of actions, including several planning activities; however, a mitigation action has been proposed for each vulnerable area where applicable.

Priority Level

- **High:** Reduces the greatest risks; is important to accomplish first; funding has already been secured.
- **Medium:** May require other actions to be completed first; funding may need to be identified.
- **Low:** Less of an impact on safety and property.

Time Frame (from date of plan adoption)

- **Short Term:** less than 2 years
- **Medium Term:** 2-3 years
- **Long Term:** 3-5 years

Mitigation Actions

The following section identifies specific vulnerabilities and outlines 21 mitigation actions to address each vulnerability category.

VULNERABILITY: Flood Prone Streets and Infrastructure

MITIGATION ACTION:	ACTION PRIORITY
1. Create an open space acquisition program. a. Create and prioritize an internal list of vacant or underdeveloped parcels in flood-prone areas for the town to consider purchasing as open space. b. Explore resident interest in voluntary home acquisition program. c. Acquire priority properties.	☐ High ☒ Medium ☐ Low **Action Status** 2018

Rationale

One of the best ways to prevent flood damage is to keep flood-prone areas undeveloped. The town needs to develop a process to maintain open space and to create more open floodplain.

Benefits

Enhanced natural floodplain may lessen flooding of the built infrastructure. Fewer flood insurance claims.

Hazard Addressed

Flooding

Mitigation Type	Supporting Plans/Efforts	Alignment With Plan Goals	
☐ Prevention	☒ Local Hazard Mitigation Plans	☐ 1	☒ 5
☒ Property Protection	☐ CRB Workshop Summary of Findings	☐ 2	☐ 6
☐ Emergency Services	☐ Local Capital Improvement Plans	☐ 3	☐ 7
☐ Local Plans and Regulations	☐ Local Comprehensive Plans	☐ 4	☒ 8
☐ Structure and Infrastructure	☐ Military Installation Resilience Review		
☐ Natural Systems Protection			
☐ Education and Awareness			

Obstacles

Support from Town Council.

If there is strong interest from residents, the Town may need additional Technical Assistance to manage a robust program.

Lead/Champion	Support
Planning Department	Town Planning Board, Town Council, Aquidneck Land Trust, the Rhode Island Emergency Management Agency (RIEMA) and FEMA

Potential Funding Sources	Estimated Cost	Timeline
RI Municipal Resiliency Program (MRP) action grants FEMA Building Resilient Infrastructure and Communities (BRIC) grants FEMA Flood Mitigation Assistance (FMA) grants	☐ less than $10,000 ☐ $10,000 to $100,000 ☒ Over $100,000	☒ Short Term (less than 2 years) ☐ Medium Term (2-3 years) ☐ Long Term (3-5 years)

Other Notes

Special consideration should be given to parcels that experience repeated flooding and those that provide public access to the shoreline.

With assistance from the MRP action grant, the town was recently able to acquire property on Riverside Street and install green infrastructure to alleviate drainage flooding.

VULNERABILITY: Flood Prone Streets and Infrastructure

MITIGATION ACTION:

2. **Install signage showing the high-water line from past storm surge events along Park Avenue.**

ACTION PRIORITY

☐ High
☒ Medium
☐ Low

Action Status

2018

Rationale

Public awareness of past storm damage is important in guiding future mitigation activities.

Benefits

More informed decision making by residents and visitors.

Hazard Addressed

Flooding

Mitigation Type	Supporting Plans/Efforts	Alignment With Plan Goals	
☐ Prevention	☒ Local Hazard Mitigation Plans	☐ 1	☒ 5
☐ Property Protection	☐ CRB Workshop Summary of Findings	☐ 2	☐ 6
☐ Emergency Services	☐ Local Capital Improvement Plans	☐ 3	☐ 7
☐ Local Plans and Regulations	☐ Local Comprehensive Plans	☐ 4	☐ 8
☐ Structure and Infrastructure	☐ Military Installation Resilience Review		
☐ Natural Systems Protection			
☒ Education and Awareness			

Obstacles

Accurately calculating the high-water mark.

Lead/Champion	Support
Planning Department	Portsmouth Department of Public Works (DPW)

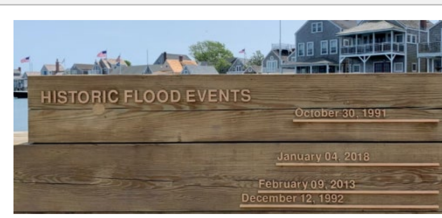
Potential Funding Sources	Estimated Cost	Timeline
Aquidneck Land Trust	☒ less than $10,000	☒ Short Term (less than 2 years)
	☐ $10,000 to $100,000	☐ Medium Term (2-3 years)
	☐ Over $100,000	☐ Long Term (3-5 years)

Other Notes

This signage should include information about past storm damage in the area, as it has been some time since significant damage has been recorded.

Common Fence Point and Island Park/Hummocks are already designing signage for their neighborhoods.

See Nantucket example here: https://coastalengineeringcompany.com/portfolio/easy-street-park



VULNERABILITY: Flood Prone Streets and Infrastructure

MITIGATION ACTION:	ACTION PRIORITY
3. **Create resiliency guidelines or ordinances for development, incorporating green infrastructure, stormwater infrastructure, protecting environmental assets, and promoting low impact development.**	☒ High ☐ Medium ☐ Low **Action Status** New

Rationale

The Town wants to ensure that projects are in line with climate change projections and municipal goals. .

Benefits

Improve capacity to convey, retain and store stormwater runoff. Improve water quality. Reduce floods caused by heavy rains.

Hazard Addressed

Flooding

Mitigation Type	Supporting Plans/Efforts	Alignment With Plan Goals	
☐ Prevention	☐ Local Hazard Mitigation Plans	☐ 1	☒ 5
☐ Property Protection	☒ CRB Workshop Summary of Findings	☐ 2	☐ 6
☐ Emergency Services	☐ Local Capital Improvement Plans	☐ 3	☐ 7
☒ Local Plans and Regulations	☐ Local Comprehensive Plans	☐ 4	☒ 8
☐ Structure and Infrastructure	☐ Military Installation Resilience Review		
☐ Natural Systems Protection			
☐ Education and Awareness			

Obstacles

Legal.

Lead/Champion	Support
Planning Department	Town Council, Town Administration

Potential Funding Sources	Estimated Cost	Timeline
Planning Department operating budget Technical Assistance Grants	☐ less than $10,000 ☒ $10,000 to $100,000 ☐ Over $100,000	☒ Short Term (less than 2 years) ☐ Medium Term (2-3 years) ☐ Long Term (3-5 years)

Other Notes

Build on 2021 Southeast New England Program Resilience Capital Improvement Plan to create resiliency guidelines for development that can be turned into regional resilience municipal policies.

VULNERABILITY: Flood Prone Streets and Infrastructure

Mitigation action:	ACTION PRIORITY
4. **Initiate steps toward participation in FEMA's CRS to improve flood resilience and reduce flood insurance premiums.** **a. Review current floodplain management practices.** **b. Assess CRS eligibility criteria, coordinate with the State NFIP Coordinator, and develop a timeline for formal application.**	☐ High ☒ Medium ☐ Low **Action Status** 2018

Rationale

Going above and beyond the standard flood insurance program requirements may improve the town's resilience to recover from a disaster.

Benefits

Lower flood insurance premiums for residents, reduced disaster costs, and improved post-disaster recovery.

Hazard Addressed

Flooding

Mitigation Type	Supporting Plans/Efforts	Alignment With Plan Goals	
☐ Prevention	☐ Local Hazard Mitigation Plans	☐ 1	☒ 5
☐ Property Protection	☒ CRB Workshop Summary of Findings	☐ 2	☐ 6
☐ Emergency Services	☐ Local Capital Improvement Plans	☒ 3	☒ 7
☒ Local Plans and Regulations	☐ Local Comprehensive Plans	☐ 4	☐ 8
☐ Structure and Infrastructure	☐ Military Installation Resilience Review		
☐ Natural Systems Protection			
☐ Education and Awareness			

Obstacles

The Town does not currently have the capacity to manage this program or participate in it. Technical Assistance from RIEMA would be appreciated.

Lead/Champion	Support
Planning Department	Building Official, RIEMA

Potential Funding Sources	Estimated Cost	Timeline
FEMA BRIC grant Technical Assistance grants	☒ less than $10,000 ☐ $10,000 to $100,000 ☐ Over $100,000	☐ Short Term (less than 2 years) ☒ Medium Term (2-3 years) ☐ Long Term (3-5 years)

Other Notes

Planning Department is currently exploring program feasibility and will be reporting progress and recommendations to the Portsmouth Administrator. There are over 1,000 structures in the Special Flood Hazard Area and 521 flood insurance policies in town.

VULNERABILITY: Flood Prone Streets and Infrastructure

MITIGATION ACTION:	ACTION PRIORITY
5. Assess risk of debris, such as fallen trees and ice, from storms which may impact the natural drainage of local streams. **a. Conduct field inspections of known problem areas to identify blockages.** **b. Develop mapping of watercourses and drainage infrastructure most susceptible to clogging from storm debris.** **c. Work with DPW and local conservation commissions to gather insights and examine historical data of past flooding events and drainage issues.** **d. Support debris management protocols, stream corridor maintenance programs, and culver upgrade priorities.**	☐ High ☒ Medium ☐ Low **Action Status** New

Rationale

Although natural woody debris may stabilize stream beds and reduce flooding, large obstructions such as storm-generated tree debris or ice in culverts and streams can cause localized flooding. The Town is proposing to assess the potential for ice to build up in narrow stream segments and remove potentially hazardous branches near flood prone areas, though ongoing tree trimming may be underfunded relative to need.

Benefits

Reduce local flood risk.

Hazard Addressed

Flooding

Mitigation Type	Supporting Plans/Efforts	Alignment With Plan Goals	
☒ Prevention	☐ Local Hazard Mitigation Plans	☒ 1	☐ 5
☐ Property Protection	☒ CRB Workshop Summary of Findings	☐ 2	☐ 6
☐ Emergency Services	☐ Local Capital Improvement Plans	☒ 3	☐ 7
☐ Local Plans and Regulations	☐ Local Comprehensive Plans	☐ 4	☐ 8
☐ Structure and Infrastructure	☐ Military Installation Resilience Review		
☐ Natural Systems Protection			
☐ Education and Awareness			

Obstacles

Other town priorities.

Lead/Champion	Support
Portsmouth DPW	Portsmouth EMA

Potential Funding Sources	Estimated Cost	Timeline
DPW Department funding	☒ less than $10,000 ☐ $10,000 to $100,000 ☐ Over $100,000	☐ Short Term (less than 2 years) ☒ Medium Term (2-3 years) ☐ Long Term (3-5 years)

Other Notes

VULNERABILITY: Services/Utilities

MITIGATION ACTION:	ACTION PRIORITY
6. **Purchase and install backup generators at the Prudence Island and Hedley Street transfer stations to ensure continued waste management operations during hazard events.**	☐ High ☒ Medium ☐ Low
	Action Status
	2018

Rationale

During a long-term power outage, back-up power is necessary at both transfer stations to maintain Town operations. The Prudence Island facility requires generator capacity to run compactors and continue handling waste, which is critical given limited island access during storms or ferry disruptions. The Hedley Street transfer station in Portsmouth requires a larger generator to sustain waste management services for the wider community. These facilities are considered critical because they protect public health and safety by ensuring uninterrupted waste collection and transfer, thereby reducing risks of environmental contamination, pest infestation, and degradation of living conditions following disasters.

Benefits

Business continuity

Hazard Addressed

Extreme storms, wind

Mitigation Type	Supporting Plans/Efforts	Alignment With Plan Goals	
☐ Prevention	☒ Local Hazard Mitigation Plans	☒ 1	☐ 5
☐ Property Protection	☐ CRB Workshop Summary of Findings	☒ 2	☒ 6
☒ Emergency Services	☒ Local Capital Improvement Plans	☐ 3	☐ 7
☐ Local Plans and Regulations	☐ Local Comprehensive Plans	☐ 4	☐ 8
☐ Structure and Infrastructure	☐ Military Installation Resilience Review		
☐ Natural Systems Protection			
☐ Education and Awareness			

Obstacles

Installation on Prudence Island

Lead/Champion	Support
Prudence Island DPW and Portsmouth DPW	

Potential Funding Sources	Estimated Cost	Timeline
FEMA BRIC grant	☐ less than $10,000 ☒ $10,000 to $100,000 ☐ Over $100,000	☐ Short Term (less than 2 years) ☒ Medium Term (2-3 years) ☐ Long Term (3-5 years)

Other Notes

Capital Improvement Plan (CIP) estimated cost is $54,322

VULNERABILITY: Populations

MITIGATION ACTION:	ACTION PRIORITY
7. **Conduct inspections of all senior housing facilities to evaluate compliance with building codes and resilience to natural hazards.**	☐ High ☒ Medium ☐ Low
	Action Status
	2018

Rationale

Senior housing facilities are considered critical because they house vulnerable populations who may have limited mobility and higher risk during emergencies. Inspections will assess structural integrity, emergency access/egress, and resilience to hazards such as hurricanes, flooding, extreme heat, and severe weather. Findings will help the Town prioritize retrofits or preparedness, upgrades that protect residents and ensure safe sheltering during disasters.

Benefits

Improved safety for the older population.

Hazard Addressed

Hurricanes, High Winds, Flooding, Extreme Heat, Nor'easters, Severe Winter Weather.

Mitigation Type	Supporting Plans/Efforts	Alignment With Plan Goals	
☐ Prevention	☒ Local Hazard Mitigation Plans	☒ 1	☐ 5
☐ Property Protection	☐ CRB Workshop Summary of Findings	☒ 2	☐ 6
☐ Emergency Services	☐ Local Capital Improvement Plans	☒ 3	☐ 7
☐ Local Plans and Regulations	☐ Local Comprehensive Plans	☐ 4	☐ 8
☒ Structure and Infrastructure	☐ Military Installation Resilience Review		
☐ Natural Systems Protection			
☐ Education and Awareness			

Obstacles

Staff time, permission to enter private buildings.

Lead/Champion	Support
Building Department and Fire Department	

Potential Funding Sources	Estimated Cost	Timeline
Building Department and Fire Department Operating budgets	☒ less than $10,000 ☐ $10,000 to $100,000 ☐ Over $100,000	☒ Short Term (less than 2 years) ☐ Medium Term (2-3 years) ☐ Long Term (3-5 years)

Other Notes

Portsmouth Housing Authority runs Quaker Manor.

Atria Aquidneck Place is privately run.

VULNERABILITY: Populations

MITIGATION ACTION:	ACTION PRIORITY
8. Improve public education on the Town's website. **a. Preparation for extreme weather events and climate change.** **b. Stormwater runoff.** **c. Evacuation vs shelter in place, heating and cooling centers.** **d. Tie-down methods for mobile homes.** **e. Special needs registry promotion.**	☒ High ☐ Medium ☐ Low **Action Status** 2018

Rationale

Education can encourage changes in behavior and help people make informed decisions.

Benefits

Fewer drivers are getting stranded in floodwaters, more informed building decisions, reducing damages from rising sea levels.

Hazard Addressed

All hazards.

Mitigation Type	Supporting Plans/Efforts	Alignment With Plan Goals	
☐ Prevention	☐ Local Hazard Mitigation Plans	☒ 1	☒ 5
☐ Property Protection	☒ CRB Workshop Summary of Findings	☐ 2	☐ 6
☐ Emergency Services	☐ Local Capital Improvement Plans	☒ 3	☐ 7
☐ Local Plans and Regulations	☐ Local Comprehensive Plans	☐ 4	☒ 8
☐ Structure and Infrastructure	☐ Military Installation Resilience Review		
☐ Natural Systems Protection			
☒ Education and Awareness			

Obstacles

Funding

Lead/Champion	Support
Emergency Management	Planning Department

Potential Funding Sources	Estimated Cost	Timeline
Emergency Management Operating budgets	☐ less than $10,000 ☒ $10,000 to $100,000 ☐ Over $100,000	☒ Short Term (less than 2 years) ☐ Medium Term (2-3 years) ☐ Long Term (3-5 years)

Other Notes

The town is currently updating the website with new topics of interest for residents and business communities.

VULNERABILITY: Natural Resources

MITIGATION ACTION:	ACTION PRIORITY
9. **Advance salt marsh restoration in priority areas of Portsmouth (Bertha K. Russell Preserve, the shoreline between Ferry Landing and Common Fence Point, the Park Avenue/beach area, and NBNERR property on Prudence Island.)** **a. Synthesize and map existing salt marsh studies** **b. Conduct on-site assessments of marsh condition and migration potential.** **c. Coordinate with landowners and resource agencies.** **d. Identify and initiate one or more pilot restoration projects.** **e. Develop a long-term, island-wide marsh restoration and adaptation strategy.**	☐ High ☒ Medium ☐ Low **Action Status** New

Rationale

Salt marshes provide critical flood protection, storm surge buffering, and habitat benefits. Portsmouth's marshes are threatened by sea level rise and erosion, and proactive restoration will strengthen community resilience while preserving valuable coastal resources.

Benefits

Natural resource protection.

Hazard Addressed

Flooding.

Mitigation Type	Supporting Plans/Efforts	Alignment With Plan Goals	
☐ Prevention	☐ Local Hazard Mitigation Plans	☐ 1	☒ 5
☐ Property Protection	☒ CRB Workshop Summary of Findings	☐ 2	☐ 6
☐ Emergency Services	☐ Local Capital Improvement Plans	☐ 3	☐ 7
☐ Local Plans and Regulations	☐ Local Comprehensive Plans	☐ 4	☐ 8
☐ Structure and Infrastructure	☐ Military Installation Resilience Review		
☒ Natural Systems Protection			
☐ Education and Awareness			

Obstacles

Coordination among all parties involved. Funding.

Lead/Champion	Support
Planning Department	Eastern Rhode Island Conservation District (ERICD), RIDEM, CRMC, ALT

Potential Funding Sources	Estimated Cost	Timeline
RIDEM Narragansett Bay Research Reserve FEMA BRIC • Natural resilience grants • Technical Assistance grants	☐ less than $10,000 ☐ $10,000 to $100,000 ☒ Over $100,000	☒ Short Term (less than 2 years) ☐ Medium Term (2-3 years) ☐ Long Term (3-5 years)

Other Notes

See Martha's Vineyard dune planting project at South Beach.

The salt marsh has been restored and maintained at Common Fence Point. Additional improvements need to be made to resolve water flow issues.

Narragansett Bay National Estuarine Research Reserve is beginning a salt marsh restoration project on some of their land on Prudence Island. The salt marshes within the Reserve are still exhibiting signs of degradation due to increased rates of sea level rise, such as accelerated creek bank erosion, vegetation die-off, and expansion of surface water areas on the marsh platform.
Salt marsh re-openings will be considered and explored as needed.

Appendix F2 Middletown, Rhode Island

Community Infrastructure/Assets Matrix

The Critical Infrastructure/Community Assets Matrix represents the culmination of the risk assessment process. It compiles key findings in a single, accessible format to support discussion and prioritization of mitigation actions. The matrix identifies specific areas of concern, provides location details, outlines associated hazards, and problems, and highlights the potential benefits of mitigation.

At Risk	Location	Hazard/Problem	Ongoing Actions	Mitigation Actions
Flood Prone Streets and Infrastructure	**Flood Prone Areas** Berkely Ave. Champlin Terrace Forest Ave. Green End Ave. Oliphant Ln. Third Beach Rd. Wave Ave. Wood Rd. E. Main Rd./Bailey Brook (State) E. Main/Wyatt Rd. (State) Sachuest Pt. Rd. (State) Atlantic Beach District: South of Newport Ave. and Aquidneck Ave. **Evacuation Route Intersections** East Main Rd. at Forest Ave., Valley Rd. West Main Rd. at Forest Ave., Valley Rd., Admiral Kalbfus, Coddington Hwy, and East Main Rd. Green End Ave at Valley Rd., Aquidneck Ave. **Recent Development Project Stormwater BMP's** Island Drive Overlea Farm Valley View Windover Farm Wave Ave Aquidneck Highlands (Julie Ct.) Saltwood Farm Bay Ridge **Shoreline Property** All shoreline property along the Atlantic Ocean and Narragansett Bay	**Hazards:** Hurricanes/Nor'easters Storm Surge Erosion Flooding **Problems:** Property damage. Economic and tourism disruption. Evacuation and emergency services hindered. Property, infrastructure and lives at risk. Potential loss of traffic signals. Overtopping of runoff storage areas. Property loss due to shoreline erosion	Maintain safe roads. Regulate development in the Maidford River and Bailey Brook Watersheds. Supported through Watershed Protection Ordinance, Special Flood Hazard Area (SFHA) Building Code requirements, plan reviews, and compliance with a Stormwater Wastewater Plan (SWWP). Clear debris from Maidford River. Open Space Preservation. Enforce property owners/homeowners associations to maintain drainage features.	1. Increase culvert size, raise roadbeds, clear brooks, add guiderails, and make stormwater and drainage improvements to Town roads. a. Maidford River/Berkley Avenue culverts b. Bailey Brook/Green End Avenue culverts 2. Retrofit roadside swales focusing on Bailey Brook stormwater management improvements in public rights of way. 3. Implement new stormwater Best Management Practices (BMPs) along Turner Road, Green End Avenue, Paradise Avenue, and Berkley Avenue to reduce impervious surface coverage, improve drainage, and mitigate localized flooding. . 4. Create resiliency guidelines or ordinances for development, incorporating green infrastructure, stormwater infrastructure, protecting environmental assets, and promoting low impact development.
Bridges	None	N/A	N/A	N/A

At Risk	Location	Hazard/Problem	Ongoing Actions	Mitigation Actions
Wastewater	Wave Ave. Sewage Pump Station – Wave Ave. and Memorial Blvd. Paradise Ave. Sewage and Pump Station – Paradise Ave. at Sachuest Pt. Rd.	**Hazards:** Flooding Severe Weather Hurricanes/Nor'easters **Problems:** Overflow and pollution impact the sensitive coastal environment around Easton's Bay, including First Beach and adjacent streets. Overflow and pollution affecting wetlands and swimming inlets near Second Beach, posing environmental and public health risks.	Identifying and eliminating illegal sump pump connections to the municipal sewer or stormwater system.	5. Improve pump stations a. Floodproof Paradise Avenue Pump Station. b. Upgrade Coddington pump station and re-direct wastewater from Wave Avenue pump station by diverting West Side sewage directly to the sewage treatment plant.
Water Supply Systems	Easton Pond	**Hazards:** Hurricanes/Nor'easters Flooding Winter Storms Tornados Earthquakes **Problems:** Loss of water supply.	Involved in an island--wide resilience effort for Easton Pond.	None at this time.
Services/Utilities	**Propane** B.J.'s Newport Propane Taylor Rental	**Hazards:** Hazardous Material Incident **Problems:** An explosion could result in property damage, serious injury, or loss of life; a leak may lead to respiratory issues, including the risk of suffocation.	A tree trimming program is being implemented in coordination with Rhode Island Energy to manage vegetation around power lines.	None at this time.

At Risk	Location	Hazard/Problem	Ongoing Actions	Mitigation Actions
Communication Facilities	Town-wide	**Hazards:** Severe weather Hurricanes/Nor'easters High winds **Problems:** Downed utility lines and the loss of power and communications.	Maintain town-owned communication equipment.	None at this time.
Dams	Gardiner Pond Dam and surrounding retaining wall – Emergency Action Plan (EAP) on file Nelson Pond Dam and surrounding retaining wall – EAP on file North Easton's Pond Dam – EAP on file South Easton's Pond Dam – EAP on file	**Hazards:** Flooding Hurricanes/Nor'easters **Problems:** Loss of water supply. Flooding of local roads, sensitive wetlands, and the Second Beach area.	Working with dam owners to encourage proper maintenance.	None at this time.
Marinas/Docks	None	NA	NA	NA
Critical Municipal Hazard Response Facilities	Fire Department at 239 Wyatt Road Police Department at 123 Valley Road Public Works Garage at 239 Wyatt Road/Berkeley Town Hall at 350 East Main Road Potter League for Animals at 87 Oliphant Lane State Airport **American Red Cross Mass Care Facilities:** Gaudet Middle School (primary) at 1113 Aquidneck Avenue Middletown High School (secondary) at 130 Valley Road	**Hazards:** Hurricanes/Nor'easters High winds Severe Weather **Problems:** Downed utility lines leading to loss of power, and communications. Blocked evacuation routes and roadways. Limited capacity to engage in coordinated planning with neighboring towns.	The new school building, which will include middle school and high school, will handle emergency sheltering.	None at this time.
Populations	Low Income: Oxbow Commodore Perry	**Hazards:** Severe weather High winds	Maintain roads during snow/ice events.	6. Provide educational resources to help property owners in flood zones understand and implement

At Risk	Location	Hazard/Problem	Ongoing Actions	Mitigation Actions
	Disabled: Unity Dr. Group homes: Anita Jackson House Jepson Ln. Beacon St. Green End Ave. Beagle Dr. William Dr. Toni Lynn Ter. Day Programs: Maher Center Forest Farm Adult Day Services Nursing homes & assisted living Daycare & schools Rhode Island Special Needs Emergency Registry (RISNER)	Hurricanes/Nor'easters Flooding **Problems:** Lack of access to vehicles for evacuation. Inability to evacuate without assistance. Isolation during power outages or when roads are impassable. Health risks from medical equipment failure during power loss.	Emergency Preparedness information is readily available online.	floodproofing measures for their buildings.
Businesses	Commercial properties along Route 114 and Route 138. Atlantic Beach District	**Hazards:** Flooding Hurricanes Nor'easters Sea Level Rise Erosion	The Atlantic Beach District Development Plan.	None at this time.
Schools	Aquidneck School – 70 Reservoir Avenue Forest Avenue School – 315 Forest Avenue Gaudet Learning Academy and Middle School – 1113 Aquidneck Avenue Middletown High School – 130 Valley Road St. Georges School – 372 Purgatory Road All Saints STEAM Academy – 915 W Main Road	**Hazards:** Hurricanes/Nor'easters Flooding Winter Storms Tornadoes Earthquakes	The clearing of snow and ice on sidewalks and parking lots.	None at this time.
Recreation Facilities	St. Georges School Ice Rink Sachuest Pt. Campground Forest Ave. Trailer Park Mello Trailer Park Prospect Ave. Trailer Park	**Hazards:** Flooding Erosion High winds **Problems:** Campers that are not properly anchored	Provide education on properly anchoring and securing mobile homes and recreational vehicles to reduce damage during high wind and flood events.	7. Reinforce the shoreline at Dunlap Wheeler Park. 8. Install new stormwater Best Management Practices (BMPs) at Wyatt Field to reduce surface runoff and improve drainage capacity.

At Risk	Location	Hazard/Problem	Ongoing Actions	Mitigation Actions
Natural Resources	Maidford River Bailey Brook Sachuest Point Norman Bird Sanctuary Albro Woods	**Hazards:** Flooding Erosion Wildfire **Problems:** Flooding of evacuation routes and sensitive wetlands. Pollution of the water supply during flood events. Habitat loss resulting from accidental wildfires during drought conditions.	Maintain an active tree trimming program. Regularly update and manage the public tree database for the Town's GIS system. Continue routine debris removal from the Maidford River. Support the Tree Commission in overseeing the planning, planting, and maintenance of trees on Town-owned property, as well as reviewing landscape plans for commercial development projects.	9. Install stormwater Best Management Practices (BMPs), such as tree box filters, in residential neighborhoods near the Maidford River to manage runoff and reduce pollutant loads entering the river. 10. Partner with the Aquidneck Land Trust to identify and prioritize parcels for open space acquisition that provide co-benefits for hazard mitigation. a. Map high risk areas, evaluate land conservation opportunities, and jointly pursue funding to protect vulnerable parcels.
Historic/Cultural Resources	Stonybrook Estate Historic District Smith-Gardiner-Norman Farm Historic District (SFHA) Whitehall/Bishop George Berkeley House Taylor-Chase-Smythe House Witherbee School Paradise School (SFHA) Boyd's Windmill St. Georges School Clambake Club of Newport (SFHA) St. Columba's Bailey Farm (SFHA) Middletown Historical Society Building (SFHA)	**Hazards:** Flooding Erosion Hurricanes/Nor'easters High winds Severe weather	Maintain support for the Middletown Historical Society, an active all-volunteer nonprofit dedicated to preserving and promoting local history through educational programs and initiatives.	No new actions at this time.

Mission Statement

The Town of Middletown is building a disaster resistant community and achieving sustainable development through the commitment of state and local government and its policymakers to mitigate hazard impacts before disaster strikes. By doing so, local leaders aim to preserve and enhance quality of life, property, and resources.

Mitigation Goals

To effectuate the mission statement, the Town of Middletown establishes the following hazard mitigation goals, toward which all action must reach:

1. Protect public health, safety and welfare; minimize social dislocation and distress due to impacts from natural hazards.
2. Prioritize underserved and disadvantaged communities, especially those in high-risk areas.
3. Reduce property damages caused by natural hazards.
4. Reduce economic loss and minimize disruption to local business due to natural hazards.
5. Implement actions which protect Aquidneck Island’s cultural, historic, and natural environments.
6. Protect the ongoing operations of critical facilities and infrastructure during and after a storm or event.
7. Expedite post-disaster mitigation efforts during the recovery phase.
8. Promote non-structural flood and coastal erosion measures, such as planting vegetation, preserving natural buffers, or restoring dunes and wetlands, to reduce the risk of damage to the surrounding properties and environmental habitats without solely relying on hard infrastructure like seawalls or ripraps.

Status of Prior Actions

Action	Status	Notes
Evaluate the possibility of expanding the number of emergency shelter beds available during an evacuation event by coordinating with the Rhode Island Red Cross, Town agencies, the school department, and private facilities.	Ongoing	The current shelter at Gaudet Middle School is to be replaced with a new shelter in the new Middle/High School currently under construction.
Offer technical assistance on business continuity plans to local businesses in the Atlantic Beach District, particularly those in the 100-year flood zone. Coordinate with RIEMA to offer local workshops and planning support.	No longer active.	No longer a town function.
Reduce inflow and infiltration in the main sewer line leading to the Wave Avenue pump station by slip lining pipes to prevent groundwater seepage. Helps reduce sewage discharge into Easton Bay.	Complete	
Upgrade Wave Avenue pump station by adding a pump, increasing backup power, and flood-proofing the building to handle overflow conditions from heavy rain.	Complete	
Inspect and disconnect illegal sump pump connections to the sanitary sewer system to prevent overflows at the Wave Avenue pump station. Includes public education and long-term program support.	Ongoing	Sump pump connections are actively monitored.
Reduce inflow and infiltration at Paradise Avenue pump station to prevent sewage discharge into sensitive wetland areas and swimming beaches.	Complete	
Install OptiCom sensors on traffic signals along major evacuation routes to allow emergency vehicles to control signals during evacuation events.	Complete	
Acquire temporary stop signs for intersections to assist public safety during power outages affecting traffic signals.	Complete	
Continue a town-wide tree trimming program to reduce damage and debris from storms, high winds, and hurricanes.	Ongoing	Tree trimming program still in effect.
Create a GIS layer of all public trees to assist with the tree trimming program and identify downed trees post-disaster.	Complete	
Maintain efficient snow removal on Town streets to keep roadways clear during snow and ice events.	Ongoing	Snow removal occurring during snow and ice events.

Action	Status	Notes
Assess how the increase in population from Navy housing and land under Town jurisdiction will impact municipal services	Complete	
Annually clear debris from the Maidford River culverts to reduce flooding and protect water quality.	Ongoing	Debris clearing efforts continuing annually.
Limit development through land use regulations to preserve the watershed and reduce runoff to Bailey Brook.	Ongoing	Land use regulations are assisting in limiting development to preserve the watershed and reduce runoff.
Complete watershed analysis and update FEMA floodplain maps to identify vulnerable flood areas.	Complete	
Extend Buck Road to serve as a secondary evacuation route for residents of Commodore Perry Village.	Complete	
Work with dam owners to encourage regular inspection, maintenance, and repair to ensure safety and reduce flooding risk.	Complete	
Properly anchor mobile homes in local campgrounds and trailer parks to prevent property damage from high wind events. Also includes evacuation procedures for transient campers.	Complete	
Enforce that new subdivisions and HOAs maintain stormwater BMPs and retention ponds to prevent flooding and drainage backups.	Ongoing	Stormwater BMPs and retention ponds are routinely maintained.
Evaluate which shoreline properties face erosion risk from coastal surge and wave action during storms and establish a baseline for future mitigation actions.	No longer active	
Identify forested areas at wildfire risk and evaluate protection strategies such as brush clearing and fire suppression planning.	No longer active	No longer a significant concern due to limited forested areas.
Monitor drought-impacted fire risk areas and enforce outside burn restrictions to prevent wildfire spread.	Ongoing	Fire risk areas are continuously monitored and burn restrictions are implemented as needed.

Mitigation Actions

The Regional Hazard Mitigation Committee (RHMC) decided to propose actions that addressed certain vulnerabilities that were identified earlier in the planning process. See **Chapter 4**.

The worksheets below summarize each specific problem and proposed solution, outline the primary tasks, identify an appropriate lead agency and suggest potential funding sources.

After all the Middletown action details were completed, the representatives from Middletown were given an anonymous survey to rank the priority of each action on the town. Each action was rated as a high, medium, or low priority for the town. This helps to generally prioritize needs when funding becomes available or budgeted. In the case where the survey results showed a tie, the higher priority was assigned. When an equal number of respondents prioritized an action as low and high, the medium priority was assigned. All rankings were reviewed by the Middletown representatives during the draft plan review stage.

The Middletown group was encouraged to propose a range of mitigation actions regardless of project costs. If costs have already been set aside for a particular mitigation action, the RHMC prioritized that action to ensure that it was completed, and funds were spent in a timely manner.

Funding and staff time will be the determining factors on when various actions are completed. The Middletown group understands that implementation of many of these proposed actions requires the securing of external funding.

These actions encompass efforts to prevent or reduce the impacts of disasters (mitigation), enhance planning and public education (preparedness), improve immediate response capabilities (response), and support efficient and effective restoration following an event (recovery). Actions that specifically qualify as mitigation measures are identified accordingly.

Certain planning elements must be completed before additional mitigation actions can be implemented. The Middletown group has identified a range of actions, including several planning activities; however, a mitigation action has been proposed for each vulnerable area where applicable.

Priority Level

- **High:** Reduces the greatest risks; is important to accomplish first; funding has already been secured.
- **Medium:** May require other actions to be completed first; funding may need to be identified.
- **Low:** Less of an impact on safety and property.

Time Frame (from date of plan adoption)

- **Short Term:** less than 2 years
- **Medium Term:** 2-3 years
- **Long Term:** 3-5 years

Mitigation Actions

The following section identifies specific vulnerabilities and outlines 21 mitigation actions to address each vulnerability category.

VULNERABILITY: Flood Prone Streets or Infrastructure

MITIGATION ACTION:	Action Priority
1. Increase culvert size, raise roadbeds, clear brooks, add guiderails, and make stormwater and drainage improvements to Town roads. **a. Maidford River/Berkley Avenue culverts** **b. Bailey Brook/Green End Avenue culverts**	☒ High ☐ Medium ☐ Low **Action Status** 2019

Rationale

Many major roads, including designated evacuation routes, are prone to flooding, making them impassable for emergency responders and evacuees. This flooding also threatens property, infrastructure, and public safety.

Benefits

Increasing culvert size, raising roadbeds, clearing brooks of debris, adding guiderails, and making stormwater and drainage improvements will help prevent roadway flooding. This will enhance public safety and reduce damage to structures and infrastructure.

Hazard Addressed

Flooding

Mitigation Type	Supporting Plans/Efforts	Alignment With Plan Goals	
☐ Prevention	☒ Local Hazard Mitigation Plans	☐ 1	☐ 5
☒ Property Protection	☐ CRB Workshop Summary of Findings	☐ 2	☒ 6
☐ Emergency Services	☐ Local Capital Improvement Plans	☒ 3	☐ 7
☐ Local Plans and Regulations	☐ Local Comprehensive Plans	☐ 4	☐ 8
☒ Structure and Infrastructure	☐ Military Installation Resilience Review		
☐ Natural Systems Protection			
☐ Education and Awareness			

Obstacles

Timeline to use grant funding.

Lead/Champion	Support
Middletown Public Works	Middletown Engineering

Potential Funding Sources	Estimated Cost	Timeline
Narragansett Bay and Watershed Restoration Fund Grant	☐ less than $10,000 ☐ $10,000 to $100,000 ☒ Over $100,000	☐ Short Term (less than 2 years) ☐ Medium Term (2-3 years) ☒ Long Term (3-5 years)

Other Notes

a. This project would install new stormwater BMPs to intercept and treat runoff from Miantonomi Avenue before it discharges into North Easton Pond – a critical component of the Newport Drinking Water Supply System. It will also replace an undersized culvert at Green End Avenue that has contributed to decades of localized flooding. Estimated Cost: $400,000
b. This project would replace an undersized culvert on Berkeley Avenue with a larger structure designed to improve watercourse continuity, enhance aquatic habitat, better manage peak stormwater flows, and strengthen resiliency of inland ecosystems and nearby infrastructure. Estimated Cost: $400,000
c. September 2024: $750,000 RIIB Action Grants awarded: May need to be completed by 2025.

VULNERABILITY: Flood Prone Streets or Infrastructure

MITIGATION ACTION:	Action Priority
2. Retrofit roadside swales focusing on Bailey Brook stormwater management improvements in public rights-of-way.	☒ High ☐ Medium ☐ Low
	Action Status
	New

Rationale

Bailey Brook is a flood prone and impaired waterbody.

Benefits

Green infrastructure projects within the Bailey Brook sub watershed will reduce nuisance street flooding.

Hazard Addressed

Flooding

Mitigation Type	Supporting Plans/Efforts	Alignment With Plan Goals	
☐ Prevention	☐ Local Hazard Mitigation Plans	☐ 1	☒ 5
☒ Property Protection	☐ CRB Workshop Summary of Findings	☐ 2	☐ 6
☐ Emergency Services	☒ Local Capital Improvement Plans	☒ 3	☐ 7
☐ Local Plans and Regulations	☐ Local Comprehensive Plans	☐ 4	☐ 8
☒ Structure and Infrastructure	☐ Military Installation Resilience Review		
☐ Natural Systems Protection			
☐ Education and Awareness			

Obstacles

Lead/Champion	Support	
Middletown Public Works	Middletown Engineering	
Potential Funding Sources	**Estimated Cost**	**Timeline**
Southeast New England Program (SNEP) Network	☐ less than $10,000 ☐ $10,000 to $100,000 ☒ Over $100,000	☐ Short Term (less than 2 years) ☒ Medium Term (2-3 years) ☐ Long Term (3-5 years)

Other Notes

See the SNEP/RCIP Report and the Berger Report for additional information.
Estimate $86,000-$190,000 per location.

VULNERABILITY: Flood Prone Streets or Infrastructure

MITIGATION ACTION:	Action Priority
3. Implement new stormwater Best Management Practices (BMPs) along Turner Road, Green End Avenue, Paradise Avenue, and Berkley Avenue to reduce impervious surface coverage, improve drainage, and mitigate localized flooding.	☐ High ☒ Medium ☐ Low
	Action Status
	New

Rationale

There is a history of repeated flooding at these locations.

Benefits

Reduced flooding at key crossings along the Maidford River and Paradise Brook.

Enhanced water quality through improved stormwater management.

Hazard Addressed

Flooding

Mitigation Type	Supporting Plans/Efforts	Alignment With Plan Goals	
☐ Prevention	☐ Local Hazard Mitigation Plans	☐ 1	☒ 5
☒ Property Protection	☐ CRB Workshop Summary of Findings	☐ 2	☐ 6
☐ Emergency Services	☒ Local Capital Improvement Plans	☒ 3	☐ 7
☐ Local Plans and Regulations	☐ Local Comprehensive Plans	☐ 4	☐ 8
☒ Structure and Infrastructure	☐ Military Installation Resilience Review		
☐ Natural Systems Protection			
☐ Education and Awareness			

Obstacles

Traffic calming activities.

Lead/Champion	Support
Middletown Public Works	Middletown Engineering

Potential Funding Sources	Estimated Cost	Timeline
Southeast New England Program (SNEP) Network	☐ less than $10,000 ☐ $10,000 to $100,000 ☒ Over $100,000	☐ Short Term (less than 2 years) ☒ Medium Term (2-3 years) ☐ Long Term (3-5 years)

Other Notes

See the SNEP/RCIP Report for additional information.

Estimated costs are $86,000-$190,000 per location.

VULNERABILITY: Flood Prone Streets or Infrastructure

MITIGATION ACTION:	Action Priority
4. Create resiliency guidelines or ordinances for development incorporating green infrastructure, stormwater infrastructure, protecting environmental assets, and promoting low impact development.	☒ High ☐ Medium ☐ Low
	Action Status
	New

Rationale
The Town wants to ensure that projects are in line with climate change projections and municipal goals. The Atlantic Beach District, which is the main commercial area in Middletown, may benefit from elevation guidelines.
Benefits
Improve capacity to convey and retain stormwater runoff, improve water quality, and reduce floods caused by heavy rains.
Hazard Addressed
Flooding

Mitigation Type	Supporting Plans/Efforts	Alignment With Plan Goals	
☐ Prevention	☐ Local Hazard Mitigation Plans	☐ 1	☒ 5
☐ Property Protection	☒ CRB Workshop Summary of Findings	☐ 2	☒ 6
☐ Emergency Services	☐ Local Capital Improvement Plans	☐ 3	☐ 7
☒ Local Plans and Regulations	☐ Local Comprehensive Plans	☐ 4	☐ 8
☐ Structure and Infrastructure	☐ Military Installation Resilience Review		
☐ Natural Systems Protection			
☐ Education and Awareness			

Obstacles

Lead/Champion	Support	
Middletown Planning Department	ALT, other municipalities	
Potential Funding Sources	**Estimated Cost**	**Timeline**
Staff time	☐ less than $10,000 ☒ $10,000 to $100,000 ☐ Over $100,000	☒ Short Term (less than 2 years) ☐ Medium Term (2-3 years) ☐ Long Term (3-5 years)

Other Notes

VULNERABILITY: Wastewater

MITIGATION ACTION:	Action Priority
5. Pump station improvements. **a. Paradise Avenue Pump Station floodproofing** **b. Upgrade Coddington pump station and re-direct wastewater from Wave Avenue pump station by diverting West Side sewage directly to the sewage treatment plant.**	☒ High ☐ Medium ☐ Low **Action Status** New

Rationale

The Town has seen an increase in severe flooding. The Paradise Pump Station is vulnerable to the 0.2 percent (500-year) chance flood, which if inundated, could result in sewage discharges into sensitive wetlands areas around Second Beach and nearby swimming inlets. This would also place additional strain on the Wave Avenue pump station.

Benefits

Clean water, wetland protection, and continuity of operations of critical infrastructure.

Hazard Addressed

Flooding

Mitigation Type	Supporting Plans/Efforts	Alignment With Plan Goals	
☐ Prevention	☒ Local Hazard Mitigation Plans	☐ 1	☐ 5
☒ Property Protection	☐ CRB Workshop Summary of Findings	☐ 2	☒ 6
☐ Emergency Services	☒ Local Capital Improvement Plans	☐ 3	☐ 7
☐ Local Plans and Regulations	☐ Local Comprehensive Plans	☐ 4	☐ 8
☒ Structure and Infrastructure	☐ Military Installation Resilience Review		
☐ Natural Systems Protection			
☐ Education and Awareness			

Obstacles

Lead/Champion	Support	
Middletown DPW	Middletown Engineering	
Potential Funding Sources	**Estimated Cost**	**Timeline**
Clean Water State Revolving Fund Town Capital funds	☐ less than $10,000 ☐ $10,000 to $100,000 ☒ Over $100,000	☒ Short Term (less than 2 years) ☐ Medium Term (2-3 years) ☐ Long Term (3-5 years)

Other Notes

Inflow and Infiltration (I&I) investigations and repairs were made in 2012. The Municipal Resilience Program (MRP) has awarded funding for the Paradise Avenue Pump Station floodproofing ($69,600). The CIP also has a line item to replace the Paradise Avenue Pump Station generator ($78,000).

Seeking funding for Redirect and Coddington.

VULNERABILITY: Populations

MITIGATION ACTION:	Action Priority
6. Provide educational resources for property owners with properties in the flood zone to floodproof their structures.	☐ High ☒ Medium ☐ Low
	Action Status
	2019

Rationale

Many properties in the Atlantic Beach District are within the 100-year flood zone. Further, most of the existing structures on these properties are of older stock and vulnerable to flooding. Until each property is redeveloped, these properties will not be required to comply with FEMA standards. To mitigate the impact of flooding in this area, the Town should develop incentives that encourage property owners in the Atlantic Beach District to floodproof their properties.

Benefits

Decrease structural damage during floods. Improve business continuity post-hazard.

Hazard Addressed

All severe weather events.

Mitigation Type	Supporting Plans/Efforts	Alignment With Plan Goals	
☐ Prevention	☒ Local Hazard Mitigation Plans	☒ 1	☐ 5
☐ Property Protection	☐ CRB Workshop Summary of Findings	☐ 2	☐ 6
☐ Emergency Services	☐ Local Capital Improvement Plans	☒ 3	☐ 7
☐ Local Plans and Regulations	☐ Local Comprehensive Plans	☒ 4	☐ 8
☐ Structure and Infrastructure	☐ Military Installation Resilience Review		
☐ Natural Systems Protection			
☒ Education and Awareness			

Obstacles

Lead/Champion	Support	
Planning Department	Town Council, Building Department	
Potential Funding Sources	**Estimated Cost**	**Timeline**
Town Planning Department budget	☒ less than $10,000 ☐ $10,000 to $100,000 ☐ Over $100,000	☒ Short Term (less than 2 years) ☐ Medium Term (2-3 years) ☐ Long Term (3-5 years)

Other Notes

VULNERABILITY: Recreation Facilities

MITIGATION ACTION:	Action Priority
7. Reinforce the shoreline at Dunlap Wheeler Park.	☒ High ☐ Medium ☐ Low
	Action Status
	2019

Rationale

The parking lot associated with Dunlap Wheeler Park and the CRMC right-of-way provides public access to Easton's Bay floods regularly. Tidal flooding occurs during extreme high tides. Storm surge flooding occurs during storms that strike during a high-tide cycle. During Hurricane Sandy, flooding reached Aquidneck Avenue north of the parking lot. The shoreline should be reinforced between Dunlap Wheeler Park and the seawall at the Newport Beach House (3 Aquidneck Ave) to prevent tidal flooding and mitigate the impact of storm surge from lesser storms.

Benefits

Make the park more resilient. Reduce debris and damage to the parking lot and right-of-way.

Hazard Addressed

Coastal storms, flooding, sea level rise.

Mitigation Type	Supporting Plans/Efforts	Alignment With Plan Goals	
☐ Prevention	☒ Local Hazard Mitigation Plans	☐ 1	☒ 5
☐ Property Protection	☐ CRB Workshop Summary of Findings	☐ 2	☐ 6
☐ Emergency Services	☐ Local Capital Improvement Plans	☐ 3	☐ 7
☐ Local Plans and Regulations	☐ Local Comprehensive Plans	☐ 4	☐ 8
☒ Structure and Infrastructure	☐ Military Installation Resilience Review		
☐ Natural Systems Protection			
☐ Education and Awareness			

Obstacles

Lead/Champion	Support	
Middletown Public Works	Open Space and Fields Committee, Planning Department	
Potential Funding Sources	**Estimated Cost**	**Timeline**
Town funds to design the park FEMA HMA Grants	☐ less than $10,000 ☐ $10,000 to $100,000 ☒ Over $100,000	☒ Short Term (less than 2 years) ☐ Medium Term (2-3 years) ☐ Long Term (3-5 years)

Other Notes

BETA Group has been hired to design the park. The Town has previously applied for and failed to receive grant funding for this project.

VULNERABILITY: Recreation Facilities

MITIGATION ACTION:	Action Priority
8. Install new stormwater Best Management Practices (BMPs) at Wyatt Field to reduce surface runoff and improve drainage capacity.	☐ High ☐ Medium ☒ Low
	Action Status
	New

Rationale

The Maidford River Watershed Assessment identified elevated levels of fecal indicator bacteria and nutrients in the Maidford River, exceeding Rhode Island Department of Environmental Management (RIDEM) water quality standards for recreational contact and drinking water supply.

To help address this issue, bioretention areas should be constructed between the parking lot and the soccer fields, upgradient of existing catch basins. Overflow from these bioretention areas would be directed into the current storm drainage system. This project offers strong public demonstration value due to its visibility at the soccer fields, and ongoing maintenance could be incorporated into the Town's routine field maintenance schedule.

Benefits

Improved water quality, reduced flooding.

Hazard Addressed

Flooding.

Mitigation Type	Supporting Plans/Efforts	Alignment With Plan Goals	
☐ Prevention	☐ Local Hazard Mitigation Plans	☐ 1	☒ 5
☐ Property Protection	☐ CRB Workshop Summary of Findings	☐ 2	☐ 6
☐ Emergency Services	☒ Local Capital Improvement Plans	☐ 3	☐ 7
☐ Local Plans and Regulations	☐ Local Comprehensive Plans	☐ 4	☒ 8
☒ Structure and Infrastructure	☐ Military Installation Resilience Review		
☐ Natural Systems Protection			
☐ Education and Awareness			

Obstacles

Nearby expansion of golf course may impact drainage but may come out as no significant impact.

Lead/Champion	Support
Middletown Public Works	Planning Department

Potential Funding Sources	Estimated Cost	Timeline
Town Capital funds	☐ less than $10,000	☒ Short Term (less than 2 years)
FEMA HMA Grants	☒ $10,000 to $100,000	☐ Medium Term (2-3 years)
	☐ Over $100,000	☐ Long Term (3-5 years)

Other Notes

CIP estimates are $30,000.

VULNERABILITY: Natural Resources

MITIGATION ACTION:	Action Priority
9. Install stormwater Best Management Practices (BMPs), such as tree box filters, in residential neighborhoods near the Maidford River to manage runoff and reduce pollutant loads entering the river.	☐ High ☐ Medium ☒ Low
	Action Status
	New

Rationale

As identified in the Maidford River Watershed Assessment, the Maidford River has elevated concentrations of fecal indicator bacteria and nutrients. The elevated concentrations exceed the RIDEM Water Quality Standards for human contact and drinking water supply. Tree boxes between the sidewalk and curb on Windham Hill Ave, Beagle Dr, Tally Ho Ct, Trout Dr, Lighthouse View Drive, River Run Road, Maidford River Road – proposed neighborhoods have a sidewalk on at least one side of the road – avoids projects on residential 'front lawns' by using the tree belt will be more acceptable to homeowners – provides public shade trees that have additional benefits – low cost to install and maintain – provides similar benefits to bioretention areas – overflow can connect directly to existing drainage system.

Benefits

Improved water quality, increased shade, stormwater retention.

Hazard Addressed

Flooding, extreme heat.

Mitigation Type	Supporting Plans/Efforts	Alignment With Plan Goals	
☐ Prevention	☒ Local Hazard Mitigation Plans	☐ 1	☐ 5
☐ Property Protection	☐ CRB Workshop Summary of Findings	☐ 2	☒ 6
☐ Emergency Services	☒ Local Capital Improvement Plans	☒ 3	☐ 7
☐ Local Plans and Regulations	☐ Local Comprehensive Plans	☐ 4	☒ 8
☐ Structure and Infrastructure	☐ Military Installation Resilience Review		
☒ Natural Systems Protection			
☐ Education and Awareness			

Obstacles

Lead/Champion	Support
Middletown DPW	

Potential Funding Sources	Estimated Cost	Timeline
Town capital funds RIDEM Forestry	☐ less than $10,000 ☒ $10,000 to $100,000 ☐ Over $100,000	☐ Short Term (less than 2 years) ☐ Medium Term (2-3 years) ☒ Long Term (3-5 years)

Other Notes

CIP estimates $30,000.

VULNERABILITY: Natural Resources

MITIGATION ACTION:	Action Priority
10. Partner with the Aquidneck Land Trust to identify and prioritize parcels for open space acquisition that provide co-benefits for hazard mitigation. **a. MAP HIGH RISK AREAS, EVALUATE LAND CONSERVATION OPPORTUNITIES, AND JOINTLY PURSUE FUNDING TO PROTECT VULNERABLE PARCELS.**	☒ High ☐ Medium ☐ Low **Action Status** New

Rationale

Help increase their efforts to purchase and manage open space critical for watershed resilience and public health via passive recreation.

Benefits

More green space, better stormwater infiltration, improved water quality, habitat restoration,

Hazard Addressed

Flooding, Sea Level Rise, Extreme Heat, Coastal Erosion

Mitigation Type	Supporting Plans/Efforts	Alignment With Plan Goals	
☐ Prevention	☐ Local Hazard Mitigation Plans	☐ 1	☒ 5
☐ Property Protection	☒ CRB Workshop Summary of Findings	☐ 2	☐ 6
☐ Emergency Services	☐ Local Capital Improvement Plans	☐ 3	☐ 7
☐ Local Plans and Regulations	☐ Local Comprehensive Plans	☐ 4	☐ 8
☐ Structure and Infrastructure	☐ Military Installation Resilience Review		
☒ Natural Systems Protection			
☐ Education and Awareness			

Obstacles

Lead/Champion	Support	
Aquidneck Land Trust	Middletown Open Space and Fields Committee	
Potential Funding Sources	**Estimated Cost**	**Timeline**
Aquidneck Land Trust	☐ less than $10,000 ☒ $10,000 to $100,000 ☐ Over $100,000	☒ Short Term (less than 2 years) ☐ Medium Term (2-3 years) ☐ Long Term (3-5 years)

Other Notes

Develop a strategy and become more proactive in determining if a parcel should be acquired for resilience benefits by using a scoring process.

Appendix F3 Newport, Rhode Island

Community Infrastructure/Assets Matrix

The Critical Infrastructure/Community Assets Matrix represents the culmination of the risk assessment process. It compiles key findings in a single, accessible format to support discussion and prioritization of mitigation actions. The matrix identifies specific areas of concern, provides location details, outlines associated hazards, and problems, and highlights the potential benefits of mitigation.

At Risk	Location	Hazard/Problem	Ongoing Actions	Mitigation Actions
Flood Prone Streets and Infrastructure	› Whitwell Ave. (development on natural drainage) › Harrison Ave. › Ellery at Gibbs; Eustice; and Kay › Marchant › Bedlow at Hillside (development on natural drainage) › Broadway at Ayrault; Marlborough › The rotary- JT Connell area › Prescott neighborhood › The Point/Bridge Street › Third Street › Wellington Ave. › Thames Street › Memorial Blvd at First Beach › Cliff Walk seawall › Ocean Drive at Harrison › Ocean Avenue/Brenton Point › Hazard Road › America's Cup Ave. and wharfs › West Marlborough St. (tied to Marsh Street- 1 drainpipe gets backed up when tide is over outfall (42inch diameter)) › Bridge Street/Elm Street › Garfield Street/Halsey Street › Goat Island Causeway › Causeway (Luce Ave.) to Naval War College	**Hazards:** Hurricanes/Nor'easters Sea Level Rise Flooding Storm Surge **Problems:** King tides cover outfalls + rain event. Erosion Over wash during king tide event. Development in natural drainage areas. The system cannot handle intense short rainfall, especially during high tides. Soil is poor for infiltration (clay). Incremental infill (such as driveways) slowly increases the impervious surfaces.	New tide gates were implemented on Bridge St., Marsh St., and Wellington Ave. Conducting drainage studies on riverine flooding using a Southeast New England Program (SNEP) grant to improve the area. The Utility Department has been pro-actively floodproofing city buildings. A zoning update was passed for the North End that takes into account resiliency (North End Urban Plan). Catch basin capacity improvements were made at Whitwell Avenue. State-level efforts, led by the Rhode Island Executive Climate Change Coordinating Council (RI EC4), are underway to develop a standardized	1. Create A Stormwater Management Overlay District. 2. Create a high-water table limitations overlay district. 3. Improve Elizabeth Brook floodproofing. a. Complete feasibility and hydrologic assessments, coordinate with property owners and identify priority segments. b. Create deep stormwater storage green areas along the brook. c. Coordinate with RIDOT to address chronic flooding where Elizabeth Brook flows into Coasters Harbor, with local roles in documenting impacts, sharing storm data, and pursuing opportunities for additional mitigation measures such as flood gates. 4. Improve stormwater education. a. Continue the "Adopt-a-Catch Basin" initiative which encourages residents to help keep the city's storm drains

At Risk	Location	Hazard/Problem	Ongoing Actions	Mitigation Actions
			statewide property buyout program. (Re)development plan review ordinance for large-scale projects. A robust catch basin cleaning program. Prioritization of SNEP Grant projects. Hired a full-time Resiliency and Sustainability Director Ongoing wastewater and stormwater asset management.	and catch basins clear of leaves and other debris. b. Continue public education on how tide gates and tides interact during a storm. Teach adaptation – let the waters recede. c. Educate residents and builders on the effects of buildout, sea level rise, and stormwater connections. Promote adaptation to rising sea levels. d. Educate residents on the damaging effects of phosphorus loading. 5. Require the use of the CRMC coastal hazards analysis worksheet for all development and redevelopment. 6. Improve the resilience of seawalls and associated structures at: Storer Park and Causeway seawall, Long Wharf seawall, Battery Park, Washington St., Van Zandt Pier, Elm St. Pier, and Ocean Avenue.
Bridges (ownership)	› Newport Claiborne Pell Bridge (State) › Goat Island Causeway (State/City, in STIP) › Van Zandt bridge (City)- access to evacuation route, in dire need of repair.	**Hazards:** Hurricanes/Nor'easters Flooding Winter Storms	Pell Bridge ramps were re-designed and pulled out of flood zones (RIDOT).	None at this time.

At Risk	Location	Hazard/Problem	Ongoing Actions	Mitigation Actions
	› Green Bridge (City) › Memorial Blvd culvert › Bridge on the north end to leave Coasters Island (Navy). Coast flooding east and north. Access issue. › Bridge to Harbor Island	Tornadoes Earthquakes	The Van Zandt approach to the Pell Bridge is in the City Capital Improvement Plan. All bridges except for Memorial Blvd. are in the State Transportation Improvement Program (STIP). The U.S. Navy is looking at bridge vulnerability as part of a Military Installation Resiliency Review (MIRR) grant.	
Wastewater	Sewer collection system (Water Pollution Control Division and Newport Water Services LLC) › Wastewater Treatment Facility (WWTF): 250 JT Connell Highway › Wellington Avenue Combined Sewer Overflow Facility and Pumping Station: 50 Wellington Avenue › Washington Street Combined Sewer Overflow Facility (storage and treatment): 25 Washington Street › Sewer Pumping Station: 4-1/2 Alpond Drive › Sewer Pumping Station: Beach – 170 Memorial Boulevard › Sewer Pumping Station: Bliss Mine Road – 86 Ellery Road › Sewer Pumping Station: 224-1/2 Carroll Avenue	**Hazards:** High Winds/Microburst Hurricanes/Nor'easters Flooding Winter Storms Lightning Tornadoes Earthquakes Drought Heat Waves Dam Failure	The wastewater treatment facility and 2 Combined Sewer Overflow (CSO) sites are equipped with backup generators. Large pump stations have generators while others have hookups. Raised controls at: Wastewater treatment facility, Washington, Wellington, Long Warf Pump Stations (in construction).	7. Disconnect stormwater connections to the existing CSO system. Construct bioretention areas at Bellevue Avenue and Coggeshall Avenue. 8. Evaluate flooding frequency and magnitude near the Wastewater Treatment Facility (WWTF) outfall at Coddington Point in coordination with Naval Station Newport and relevant agencies. a. Review available stormwater and tide data. b. Map recurrent flood events and assess infrastructure vulnerability. c. Use results to inform local resilience planning and

At Risk	Location	Hazard/Problem	Ongoing Actions	Mitigation Actions
	› Sewer Pumping Station: 32 Codington Wharf › Sewer Pumping Station: 7 Dyre Street › Sewer Pumping Station: Goat Island › Sewer Pumping Station: 17 Hazard Road › Sewer Pumping Station: 25 Lees Wharf › Sewer Pumping Station: 100 Long Wharf › Sewer Pumping Station: 214 Maple Avenue › Sewer Pumping Station: 12 Murray Place › Sewer Pumping Station: 50 Ruggles Avenue › Sewer Pumping Station: Ranger Road		Resiliency was considered for all utility projects. Wastewater pump stations, along with stormwater and sewer collection systems, are currently under evaluation. Approximately 30 miles of pipeline remain to be inspected via CCTV	emergency preparedness for city-owned systems.
Water Supply Systems	› Station 1 Water Treatment Plant: 100 Bliss Mine Road › Lawton Valley Water Treatment Plant and water storage tanks: 2154 West Main Road, Portsmouth The City of Newport owns and operates the regional water system that serves Portsmouth, Middletown, and Newport, with reservoir sources located on the mainland.	**Hazards:** High Winds/Microbursts Hurricanes/Nor'easters Flooding Winter Storms Lightning Tornadoes Earthquakes Drought Heat Waves Dam Failure	Both water treatment plants have full generator power. Water Treatment Station 1 improvements considered sea level rise.	None at this time.
Services/Utilities	Electrical grid (RI Energy) Natural gas supply (RI Energy)	**Hazards:** High Winds/Microbursts Hurricanes/Nor'easters Flooding Winter Storms Lightning Tornadoes Earthquakes Drought	National Grid improved the electric grid at JT Connell Highway and the rest of Aquidneck Island. National Grid assessed the long-term resilience of the natural gas supply.	None at this time.

At Risk	Location	Hazard/Problem	Ongoing Actions	Mitigation Actions
		Heat Waves Dam Failure	National Grid is replacing low-pressure gas lines. National Grid has a temporary tank farm on Whapping Rd. in Portsmouth with a Focus on Aquidneck Island and gas supply resilience at the end of the pipe. Utilities are consulted on development projects located within 200 feet of a reservoir. There is an ongoing study of the effects of climate change on southern reservoirs. The city is looking to move from Liquefied Natural Gas to full electrification. The Health Equity Zone (HEZ) did a report on disadvantaged communities.	
Communication Facilities	› Cell tower on Old Fort Rd at the Fire Station › Internal communication tower is located at the Police Station on Broadway; additional towers are at the Fire Department site on West Marlborough and at Fire Station 5 on Touro Street.	**Hazards:** High Winds/Microburst Lightning	A new dispatch was constructed at Fire Station 5. The Police Department is making upgrades as	None at this time.

At Risk	Location	Hazard/Problem	Ongoing Actions	Mitigation Actions
	› Cell towers at Reservoir. Rd in Middletown and Lawton Valley in Portsmouth. › Equipment in churches, etc. › 800 MHz tower is in Middletown. › Hospital communication equipment.		needed. Grants were submitted for funding support. A bond was approved to acquire land for the development of a new Public Safety Complex.	
Dams	Easton Pond South (Dam #585) - high hazard	**Hazards:** Hurricanes/Nor'easters Flooding Winter Storms Tornadoes Earthquakes	A resiliency study was conducted at South Easton Pond Dam. A FEMA BRIC grant was submitted to better identify improvements from the study. It will then move to design and construction.	9. Design and implement resilience measures based on the findings from the second phase of the Easton Pond Dam Study. a. Raise the earthen embankments of South Easton Pond. b. Raise the earthen embankment separating North Easton Pond from South Easton Pond. c. Install two gates to prevent saltwater intrusion.
Marinas/Docks	Various	**Hazards:** Storm Surge Hurricanes/Nor'easters	Implement a Harbor Management Plan (October 2024).	None at this time.
Critical Municipal Hazard Response Facilities	› City Hall: 43 Broadway › Fire Station 1: 21 West Marlborough Street at America's Cup Avenue (within a flood zone). › Fire Station 2: 100 Old Fort Road › Fire Station 5: Touro Street at Mary Street › Police Station (EOC): 120 Broadway › Newport Hospital: 11 Friendship Street › Newport Animal Hospital: 541 Thames Street › JT Connell (evacuation route)	**Hazards:** High Winds Hurricanes/Nor'easters Flooding Winter Storms Lightning Tornadoes Earthquakes	Acquired a bond for funding a new Public Safety Complex in November 2024. A study was conducted to get support for a grant application for a generator,	None at this time.

At Risk	Location	Hazard/Problem	Ongoing Actions	Mitigation Actions
	› Sheffield School (Innovate Newport) – a potential EOC location. Emergency Shelters › Rogers High School, 15 Wickham Road, Newport › Pell School: 35 Dexter Street, Newport; capacity: 419 people (area of refuge, not Red Cross approved). › Florence Gray Center: 1 York Street, Newport; capacity: 345 persons › Gaudet Middle School: Tuner Rd. (Preferred Regional Shelter).		addressing gaps in available data.	
Populations	987 residential structures in the flood hazard area. Other housing complexes that may have vulnerable populations: › Heatherwood Nursing and Subacute Center, 398 Bellevue Avenue › St. Claire Home, 309 Spring Street › Village House Nursing and Rehabilitation Center, 70 Harrison Avenue › Scattered Elderly Housing Project: Edgar Court, Earl Avenue, Pond Avenue, Chapel Street (low-rise), and Coddington Street › Donovan Manor, Chapel Street › Mumford Manor, Farewell Street › John Clarke School Senior Apartments, Mary Street › Paramount Theatre Apartments, Broadway › Ahepa 245 I and II Senior Housing, Girard Avenue › Henderson Elderly Home › Old YMCA housing- 50 Washington Sq. › Seamen's Church Institute › Harbor House – Washington St.	**Hazards:** Hurricanes/Nor'easters Flooding Winter Storms Lightning Tornadoes Earthquakes Drought Heat Waves	Promote Special Needs Registry. Fire Department checks nursing home resiliency during annual site visits. Efforts are underway to finalize a Memorandum of Understanding (MOU) with Fisher Transportation Company to provide transportation support in advance of emergency events. Ongoing flood education efforts as part of Community Rating System (CRS) requirements.	10. Improved public education. a. Education on storm drain road flooding – wait it out. b. Better guidance on a 72-hour shelter-in-place. c. Effects of buildout on sea level rise and stormwater connections. d. Tactical urban education (educational signage or other installations). e. Climate change adaptation. 11. Create resiliency guidelines or ordinances for development, incorporating green infrastructure, stormwater infrastructure, protecting environmental assets, and promoting low impact development.

At Risk	Location	Hazard/Problem	Ongoing Actions	Mitigation Actions
	› Nina Lynette Home for independent seniors Residents in the North End, in particular, face multipole burdens including poor water quality, low income, and elevated rates of asthma.		Open Heating and Cooling Centers as needed. Collaborating with the Rhode Island Department of Environmental Management (RIDEM) on developing an Urban Tree Canopy Plan and map.	
Businesses	260 commercial/industrial structures in the flood hazard zone. Tourism-related sector Defense industry Wharf businesses and marinas Businesses at Easton's Beach	**Hazards:** High Winds/Microburst Hurricanes/Nor'easters Flooding Winter Storms Lightning Tornadoes Earthquakes	Small Business Resilience Project. University of Rhode Island (URI) students analyzed potential threats to JT Connell businesses along Elizabeth Brook that are vulnerable to flooding. A MIRR report simulated storm events and response actions. Rhode Island Commerce and Statewide Planning Ready, Set, Rhody, award to provide targeted infrastructure	12. Develop municipal guidelines for post-disaster redevelopment of waterfront properties that integrate hazard mitigation, equitable recovery, and long-term resilience, informed by best practices, local code review, and coordination with property owners and regional planning agencies.

At Risk	Location	Hazard/Problem	Ongoing Actions	Mitigation Actions
			vulnerability assessments, including information for the city on specific "hot spots" and ways to increase resilience for those areas.	
Schools	› Pell School: 35 Dexter Street › Thompson Middle School: 55 Broadway › Rogers High School: 15 Wickham Road › Newport Area Career and Technical Center: 16 Wickham Road › Aquidneck Island Adult Learning Center: 435 Broadway › Naval War College › Met School › Community College of Rhode Island – Newport County Campus › St. Michael's Country Day School › Salve Regina University › Various Private Schools	**Hazards:** High Winds/Microburst Hurricanes/Nor'easters Flooding Winter Storms Lightning Tornadoes Earthquakes	Rogers High School has been deconstructed and is currently undergoing reconstruction. An $8 million addition was completed at the Pell School Improved distance learning capabilities. New buildings will be more resilient to storms/high winds and will also consider energy efficiency.	None at this time.
Recreation Facilities	› Cliff Walk › Beaches › Major Parks	**Hazards:** Hurricanes/Nor'easters Flooding Winter Storms Lightning Extreme Heat	The Cliff Walk continues to have improvements made. Seawall repairs are underway throughout the city. Easton Beach – looking at structural	None at this time.

At Risk	Location	Hazard/Problem	Ongoing Actions	Mitigation Actions
			issues to create resiliency. The carousel and snack bar at First Beach has been removed.	
Natural Resources	Freshwater wetlands Saltwater resources Newport Harbor Forested areas Beaches	**Hazards:** High Winds/Microburst Hurricanes/Nor'easters Flooding Winter Storms Lightning Tornadoes Earthquakes Drought Heat Waves	Implementation of a robust tree planting program. Tree maintenance by the City of Newport and RI Energy. The annual Save the Bay dune restoration event. Dune restoration activities at the Inlet at Hazard Road. Lily and Almy Ponds are subject to Total Maximum Daily Loads (TMDLs) for nutrient loading. Efforts are underway to identify contributing outfalls in the surrounding residential areas. Proposed solutions include tree filters and other best management practices (BMPs),	None at this time.

At Risk	Location	Hazard/Problem	Ongoing Actions	Mitigation Actions
			supported by a DEM grant. Reducing beach closures by improving water quality. A UV system treats runoff from moat. Continue to support our partners in habitat restoration. › Newport Tree Program › Aquidneck Land Trust	
Historic/Cultural Resources	In the floodplain › Weatherly (yacht), 49 America's Cup Boulevard, (8/28/12) › Castle Hill Lighthouse, Castle Hill, off Ocean Avenue, at the west end of Newport Neck (3/30/88) › Fort Adams State Park/Fort Adams, Harris Avenue-Fort Adams (7/28/70) › Newport Harbor Lighthouse, Goat Island (Newport Harbor) (3/30/88) › Ida Lewis Rock Lighthouse, Lime Rock (in Newport Harbor off Wellington Avenue) (2/25/88) › Seamen's Church Institute, Market Square (8/4/83) › Rose Island Lighthouse, Rose Island (4/10/87) › The Brick Market Historical Society, 127 Thames Street (10/15/66) NHL 1960 › Perry Mill, 337 Thames Street (1/13/72)	**Hazards:** High Winds/Microburst Hurricanes/Nor'easters Flooding Winter Storms Lightning Tornadoes Earthquakes	Rhode Island Coastline Coastal Storm Risk Management (CSRM) Feasibility Study (USACE) is underway. Guidelines on Flood Adaptation for Rehabilitating Historic Buildings: re-released in 2021. Elevate historic structures as part of streetscape and historic preservation efforts, with elevations ranging from no change to	None at this time.

At Risk	Location	Hazard/Problem	Ongoing Actions	Mitigation Actions
	› Francis Malbone House, 392 Thames Street (4/28/75) › Coronet (yacht), 449 Thames Street (6/3/04) › Newport Steam Factory (Electric Works), 449 Thames Street (1/20/72) › Hunter House, 54 Washington Street (11/24/68) NHL		full Base Flood Elevation (BFE) compliance. The local historic district has guidelines for elevating structures. City of Newport | City Seeks to Elevate History Against Climate Change. A State Historic Preservation Officer (SHPO) is to maintain the facade of Old Navy Hospital.	

Mission Statement

The City of Newport is building a disaster resistant community and achieving sustainable development through the commitment of state and local government and its policymakers to mitigate hazard impacts before disaster strikes. By doing so, local leaders aim to preserve and enhance quality of life, property, and resources.

Mitigation Goals

To effectuate the mission statement, the City of Newport establishes the following hazard mitigation goals, toward which all action must reach:

1. Protect public health, safety and welfare; minimize social dislocation and distress due to impacts from natural hazards.
2. Prioritize underserved and disadvantaged communities, especially those in high-risk areas.
3. Reduce property damages caused by natural hazards.
4. Reduce economic loss and minimize disruption to local business due to natural hazards.
5. Implement actions which protect Newport's cultural, historic, and natural environments.
6. Protect the ongoing operations of critical facilities and infrastructure during and after a storm or event.
7. Expedite post-disaster mitigation efforts during the recovery phase.
8. Promote non-structural flood and coastal erosion measures, such as planting vegetation, preserving natural buffers, or restoring dunes and wetlands, to reduce the risk of damage to the surrounding properties and environmental habitats without solely relying on hard infrastructure like seawalls or ripraps.

Status of Prior Actions

Action	Status	Notes
Evaluate timing and routes for evacuation from Coasters Island, base of operations for U.S. Navy Newport Training Station and Naval War College.	Completed	Improved pre-disaster planning.
Implement solutions to natural gas resiliency on Aquidneck Island.	Ongoing	No longer considered a mitigation action; therefore, not included in the plan. Newport is still implementing solutions.
New generator for the EOC. a. Perform a study on building needs. b. Purchase and install a generator at Innovate Newport/Emergency Operations Center (EOC).	No Longer Active	No longer necessary as the City is building a new Public Safety Complex.
Evaluate reconstruction/relocation options for the Easton's Beach Carousel/snack bar facilities to improve resiliency from coastal storms and high tides.	Ongoing	No longer considered a mitigation action; therefore, not included in the plan. This action is still in process and under development by Newport.
Continue to support our partners in habitat restoration. - Newport Tree Program - Aquidneck Island Land Trust - Save the Bay - Clean Ocean Access	Ongoing	Aquidneck Island Land Trust is now listed as one of the primary stakeholders responsible for helping to implement the HMP with municipalities.
Engage in a community discussion after the U.S. Army Corps of Engineers (USACE) Rhode Island Coastline Coastal Storm Risk Management (CSRM) Feasibility Study is complete.	Complete	

Mitigation Actions

The members of the Regional Hazard Mitigation Committee (RHMC) from Newport decided to propose actions that addressed certain vulnerabilities that were identified earlier in the planning process. See **Chapter 4**.

Please note that Newport adopted their previous mitigation plan in 2022; many of those actions were carried over into this 2025 plan.

The worksheets below summarize each specific problem and proposed solution, outline the primary tasks, identify an appropriate lead agency, and suggest potential funding sources.

After all the Newport action details were completed, the representatives from Newport were given an anonymous survey to rank the priority of each action in the city. Each action was rated a high, medium, or low priority for the city. This helps to prioritize needs when funding becomes available or budgeted. In the case where the survey results showed a tie, the higher priority was assigned. When an equal number of respondents prioritized an action as low and high, the medium priority was assigned. All rankings were reviewed by the Newport representatives during the draft plan review stage.

Actions that received a high priority ranking would provide more benefits than low priority items. Understanding that priorities can and will change, it was helpful to document what is important at that moment in time. Having this discussion as a group helped the Newport group consider maximum benefits to the entire region, not just individual municipal departments or residents.

The Newport group was encouraged to propose a range of mitigation actions regardless of project costs. If costs have already been set aside for a particular mitigation action, the Newport group prioritized that action to ensure that it was completed, and funds were spent in a timely manner.

Funding and staff time will be the determining factors on when various actions are completed. The Newport group understands that implementation of many of these proposed actions requires the securing of external funding.

These actions include wants to prevent or reduce the consequences of disaster (mitigation), planning and education (preparedness), improved response in the immediate aftermath of an event (response), and improved restoration efforts (recovery). Those which are true mitigation actions are noted as such.

Certain planning elements must be completed before additional mitigation actions can be implemented. The Middletown group has identified a range of actions, including several planning activities; however, a mitigation action has been proposed for each vulnerable area where applicable.

Priority Level

- **High:** Reduces the greatest risks, is important to accomplish first, funding has already been secured.
- **Medium:** May require other actions to be completed first, funding may need to be identified.
- **Low:** Less of an impact on safety and property.

Time Frame (from date of plan adoption)

- **Short Term:** less than 2 years
- Medium Term: 2-3 years
- **Long Term:** 3-5 years

Mitigation Actions

The following section identifies specific vulnerabilities and outlines 21 mitigation actions to address each vulnerability category.

VULNERABILITY: Flood Prone Streets or Infrastructure

MITIGATION ACTION:	ACTION PRIORITY
1. **Create A Stormwater Management Overlay District.**	☐ High ☒ Medium ☐ Low
	Action Status
	2022

Rationale

People are upgrading dwelling sizes, increasing stormwater generation. There are few options to improve stormwater capacity. The issue is compounded with climate change. Creating the overlay district has the added benefit of a public education component.

Benefits

Minimize hazards and safeguard structures and land uses from damage resulting from development on unsuitable or hazardous land.

Protect public infrastructure, natural resources, and water quality from the impacts of improper land use or development on environmentally sensitive or physically constrained sites.

Preserve and enhance environmentally significant land features and natural resources that are vital to the community's ecological health and character.

Hazard Addressed

Flooding

Mitigation Type	Supporting Plans/Efforts	Alignment With Plan Goals	
☐ Prevention	☒ Local Hazard Mitigation Plans	☐ 1	☒ 5
☐ Property Protection	☐ CRB Workshop Summary of Findings	☐ 2	☐ 6
☐ Emergency Services	☐ Local Capital Improvement Plans	☐ 3	☐ 7
☒ Local Plans and Regulations	☐ Local Comprehensive Plans	☐ 4	☒ 8
☐ Structure and Infrastructure	☐ Military Installation Resilience Review		
☐ Natural Systems Protection			
☐ Education and Awareness			

Obstacles

Deciding if this would be citywide or a true overlay for targeted areas.

Lead/Champion	Support
Department of Utilities	Department of Planning

Potential Funding Sources	Estimated Cost	Timeline
Southeast New England Program (SNEP) Grant	☒ less than $10,000 ☐ $10,000 to $100,000 ☐ Over $100,000	☒ Short Term (less than 2 years) ☐ Medium Term (2-3 years) ☐ Long Term (3-5 years)

Other Notes

Currently being discussed.

VULNERABILITY: Flood Prone Streets or Infrastructure

MITIGATION ACTION:	ACTION PRIORITY
2. **Create a High-Water Table Limitations Overlay district.**	☐ High ☒ Medium ☐ Low
	Action Status
	2022

Rationale

The water table fluctuates seasonally. When new development occurs in areas with a high-water table, automatic sump pumps often discharge into the street, causing not only a flooding problem but an icing problem in the winter. This discharge also causes wetland migration.

Benefits

Create an enforcement mechanism to address problem properties for public safety.

Hazard Addressed

Flooding

Mitigation Type	Supporting Plans/Efforts	Alignment With Plan Goals	
☐ Prevention	☒ Local Hazard Mitigation Plans	☐ 1	☒ 5
☐ Property Protection	☐ CRB Workshop Summary of Findings	☐ 2	☐ 6
☐ Emergency Services	☐ Local Capital Improvement Plans	☐ 3	☐ 7
☒ Local Plans and Regulations	☐ Local Comprehensive Plans	☐ 4	☒ 8
☐ Structure and Infrastructure	☐ Military Installation Resilience Review		
☐ Natural Systems Protection			
☐ Education and Awareness			

Obstacles

Seasonal problem. Requiring property owners to create drywells.

Lead/Champion	Support
Department of Utilities	Department of Planning

Potential Funding Sources	Estimated Cost	Timeline
City General Funds	☒ less than $10,000 ☐ $10,000 to $100,000 ☐ Over $100,000	☐ Short Term (less than 2 years) ☒ Medium Term (2-3 years) ☐ Long Term (3-5 years)

Other Notes

See Narragansett Municipal Code: Appendix A, Section 4.5

"District defined. This [high water table limitations overlay] district is composed of areas in which the water table is within three feet below the surface of the ground for significant periods of the year, creating moderate to severe limitations for subsurface development. In high water table limitations overlay district "A," the water table is generally within 18 inches of the surface of the ground. Areas included in district "A" are designated on the environmental inventory soils maps with the following symbols: Aa, Co, Mk, Re, Rc, Rf, Sb, Se, Sf, Wa, Ma, Me, Mc. In high water table limitations overlay district "B," the water table is generally between 18 inches and three feet below the surface of the ground. Areas included in district "B" are designated on the environmental inventory soils maps with the following symbols: Bc, Nt, PmA, PmB, PnB, RaA, RaB, RbB, StB, WbB, WhA, WhB, WoB, StB, Ss, Tb."

VULNERABILITY: Flood Prone Streets or Infrastructure

MITIGATION ACTION:	ACTION PRIORITY
3. Improve flooding conditions along Elizabeth Brook through a daylighting project to uncover and restore culverted stream segments. . **a. Complete feasibility and hydrologic assessments, coordinate with property owners and identify priority segments.**	☒ High ☐ Medium ☐ Low **Action Status** 2022

Rationale

Low-lying areas along Elizabeth Brook in the North End neighborhood are prone to flooding due to the surcharge of existing utility outfalls along the coastline as well as limited overland flooding during high tide storm events. Sea level rise will further threaten the North End neighborhood where Elizabeth Brook flows into Narragansett Bay.

Benefits

Protect public infrastructure and private homes from flooding. The streambed can serve as both a stormwater mitigation and public amenity with the addition of walking paths and open space.

Hazard Addressed

Flooding

Mitigation Type	Supporting Plans/Efforts	Alignment With Plan Goals	
☐ Prevention	☒ Local Hazard Mitigation Plans	☒ 1	☒ 5
☐ Property Protection	☐ CRB Workshop Summary of Findings	☒ 2	☐ 6
☐ Emergency Services	☐ Local Capital Improvement Plans	☒ 3	☐ 7
☐ Local Plans and Regulations	☐ Local Comprehensive Plans	☒ 4	☐ 8
☐ Structure and Infrastructure	☐ Military Installation Resilience Review		
☒ Natural Systems Protection			
☐ Education and Awareness			

Obstacles

Funding.

Lead/Champion	Support
Department of Utilities	Department of Planning and Economic Development

Potential Funding Sources	Estimated Cost	Timeline
Private developer as part of a land development project. FEMA BRIC grant funding	☐ less than $10,000 ☐ $10,000 to $100,000 ☒ Over $100,000	☐ Short Term (less than 2 years) ☐ Medium Term (2-3 years) ☒ Long Term (3-5 years)

Other Notes

Part of a larger stormwater management program with RIDOT"s conveyance system. Working w Jacobs Engineering.

See the North End Urban Plan https://www.cityofnewport.com/CityOfNewport/media/City-Hall/Boards-Commissions/Boards/Planning%20Board/2021-05-12-Newport-NEUP-compressed.pdf

VULNERABILITY: Flood Prone Streets or Infrastructure

MITIGATION ACTION:	ACTION PRIORITY
3. **Improve flooding conditions along Elizabeth Brook through a daylighting project to uncover and restore culverted stream segments.** b. **Create deep stormwater storage green areas along the brook.**	☒ High ☐ Medium ☐ Low **Action Status** 2022

Rationale

Low-lying areas along Elizabeth Brook in the North End neighborhood, are prone to flooding due to surcharge of existing utility outfalls along the coastline as well as limited overland flooding during high tide storm events. Sea level rise will further threaten the North End neighborhood where Elizabeth Brook flows into Narragansett Bay.

Benefits

Protect public infrastructure and private homes from flooding. The streambed can serve as both a stormwater mitigation and public amenity with the addition of walking paths and open space.

Hazard Addressed

Flooding

Mitigation Type	Supporting Plans/Efforts	Alignment With Plan Goals	
☐ Prevention	☒ Local Hazard Mitigation Plans	☒ 1	☒ 5
☐ Property Protection	☐ CRB Workshop Summary of Findings	☒ 2	☐ 6
☐ Emergency Services	☐ Local Capital Improvement Plans	☒ 3	☐ 7
☐ Local Plans and Regulations	☐ Local Comprehensive Plans	☒ 4	☐ 8
☐ Structure and Infrastructure	☐ Military Installation Resilience Review		
☒ Natural Systems Protection			
☐ Education and Awareness			

Obstacles

Funding.

Lead/Champion	Support
Department of Utilities	Department of Planning and Economic Development

Potential Funding Sources	Estimated Cost	Timeline
Private developer as part of a land development project. FEMA BRIC grant funding	☐ less than $10,000 ☒ $10,000 to $100,000 ☐ Over $100,000	☐ Short Term (less than 2 years) ☐ Medium Term (2-3 years) ☒ Long Term (3-5 years)

Other Notes

Part of a larger stormwater management program.

See the North End Urban Plan https://www.cityofnewport.com/CityOfNewport/media/City-Hall/Boards-Commissions/Boards/Planning%20Board/2021-05-12-Newport-NEUP-compressed.pdf

VULNERABILITY: Flood Prone Streets or Infrastructure

MITIGATION ACTION:	ACTION PRIORITY
3. **Improve flooding conditions along Elizabeth Brook through a daylighting project to uncover and restore culverted stream segments.** c. **Coordinate with RIDOT to address chronic flooding where Elizabeth Brook flows into Coasters Harbor, with local roles in documenting impacts, sharing storm data, and pursuing opportunities for additional mitigation measures such as flood gates.**	☐ High ☐ Medium ☒ Low **Action Status** 2022

Rationale

Low-lying areas along Elizabeth Brook in the North End neighborhood, are prone to flooding due to surcharge of existing utility outfalls along the coastline as well as limited overland flooding during high tide storm events. Sea level rise will further threaten the North End neighborhood where Elizabeth Brook flows into Narragansett Bay.

Benefits

Protect public infrastructure and private homes from flooding as well as the restored wetlands. The streambed can serve as both a stormwater mitigation and public amenity with the addition of walking paths and open space.

Hazard Addressed

Flooding

Mitigation Type	Supporting Plans/Efforts	Alignment With Plan Goals	
☐ Prevention	☒ Local Hazard Mitigation Plans	☒ 1	☒ 5
☐ Property Protection	☐ CRB Workshop Summary of Findings	☒ 2	☐ 6
☐ Emergency Services	☐ Local Capital Improvement Plans	☒ 3	☐ 7
☐ Local Plans and Regulations	☐ Local Comprehensive Plans	☒ 4	☐ 8
☐ Structure and Infrastructure	☐ Military Installation Resilience Review		
☒ Natural Systems Protection			
☐ Education and Awareness			

Obstacles

Funding. Coordinating with the Navy.

Lead/Champion	Support
Public Services and Utilities	Department of Planning and Economic Development, Navy

Potential Funding Sources	Estimated Cost	Timeline
Federal funding via the U.S. Navy American Rescue Plan Act (ARPA) Infrastructure funding	☐ less than $10,000 ☐ $10,000 to $100,000 ☒ Over $100,000	☐ Short Term (less than 2 years) ☐ Medium Term (2-3 years) ☒ Long Term (3-5 years)

Other Notes

Part of a larger RIDOT stormwater management program. Daylighting and bottleneck issues need to be resolved by RIDOT before the evaluation for storm surge gates can occur.

See the North End Urban Plan https://www.cityofnewport.com/CityOfNewport/media/City-Hall/Boards-Commissions/Boards/Planning%20Board/2021-05-12-Newport-NEUP-compressed.pdf

See 2023 article https://www.newportthisweek.com/articles/newport-considering-65m-stormwater-mitigation-project/

VULNERABILITY: Flood Prone Streets or Infrastructure

MITIGATION ACTION:	ACTION PRIORITY
4. Improve stormwater education. a. Continue Adopt-a-Catch Basin initiative which encourages residents to help keep the city's storm drains and catch basins clear of leaves.	☐ High ☒ Medium ☐ Low **Action Status** 2022

Rationale

Clogged catch basins can result in minor street flooding, creating a nuisance for motorists, pedestrians, and businesses. Oftentimes, it doesn't take much more than a thin layer of leaves to block these critical drainage elements.

Benefits

Reduced flooding. Fewer beach closures.

Hazard Addressed

Flooding

Mitigation Type	Supporting Plans/Efforts	Alignment With Plan Goals	
☒ Prevention	☒ Local Hazard Mitigation Plans	☐ 1	☐ 5
☐ Property Protection	☐ CRB Workshop Summary of Findings	☐ 2	☒ 6
☐ Emergency Services	☐ Local Capital Improvement Plans	☒ 3	☐ 7
☐ Local Plans and Regulations	☐ Local Comprehensive Plans	☐ 4	☐ 8
☐ Structure and Infrastructure	☐ Military Installation Resilience Review		
☐ Natural Systems Protection			
☒ Education and Awareness			

Obstacles

Other priorities for the city. As of date, there has been very little buy-in.

Lead/Champion	Support
Department of Utilities	Newport Communications Department

Potential Funding Sources	Estimated Cost	Timeline
City General Funds	☒ less than $10,000 ☐ $10,000 to $100,000 ☐ Over $100,000	☒ Short Term (less than 2 years) ☐ Medium Term (2-3 years) ☐ Long Term (3-5 years)

Other Notes

Catch basin adoption: https://www.newportri.com/news/20191107/as-leaves-cover-streets-newport-catch-basins-go-up-for-adoption

VULNERABILITY: Flood Prone Streets or Infrastructure

MITIGATION ACTION:	ACTION PRIORITY
4. Improve stormwater education. **b. Continue public education on how tide gates and tides interact during a storm. Teach adaptation, let the waters recede.**	☒ High ☐ Medium ☐ Low
	Action Status
	2022

Rationale

The city has invested in new tide gates to reduce flooding. The tide gates permit water flow in only one direction, so tide water will be prevented from flowing back into the stormwater system.

Benefits

Having a better understanding of the infrastructure intent and capabilities can reduce the number of citizen complaints.

Hazard Addressed

Flooding

Mitigation Type	Supporting Plans/Efforts	Alignment With Plan Goals	
☐ Prevention	☒ Local Hazard Mitigation Plans	☐ 1	☐ 5
☐ Property Protection	☐ CRB Workshop Summary of Findings	☐ 2	☒ 6
☐ Emergency Services	☐ Local Capital Improvement Plans	☒ 3	☐ 7
☐ Local Plans and Regulations	☐ Local Comprehensive Plans	☐ 4	☐ 8
☐ Structure and Infrastructure	☐ Military Installation Resilience Review		
☐ Natural Systems Protection			
☒ Education and Awareness			

Obstacles

Lead/Champion	Support
Department of Utilities	Newport Communications Department

Potential Funding Sources	Estimated Cost	Timeline
City General Funds Rhode Island Department of Environmental Management (RIDEM) green economy bond	☒ less than $10,000 ☐ $10,000 to $100,000 ☐ Over $100,000	☒ Short Term (less than 2 years) ☐ Medium Term (2-3 years) ☐ Long Term (3-5 years)

Other Notes

Catch basin adoption: https://www.newportri.com/news/20191107/as-leaves-cover-streets-newport-catch-basins-go-up-for-adoption

VULNERABILITY: Flood Prone Streets or Infrastructure

MITIGATION ACTION:	ACTION PRIORITY
4. **Improve stormwater education.** c. **Educate residents and builders on the effects of buildout, sea level rise, and stormwater connections. Promote adaptation to rising sea levels.**	☒ High ☐ Medium ☐ Low **Action Status** 2022

Rationale

The City's stormwater system cannot and will never fully be capable of diverting all the rainwater, especially as tides rise.

Benefits

Smarter building practices that consider reclaimed water, or water retention infrastructure.

Hazard Addressed

Flooding, sea level rise.

Mitigation Type	Supporting Plans/Efforts	Alignment With Plan Goals	
☒ Prevention	☒ Local Hazard Mitigation Plans	☒ 1	☐ 5
☐ Property Protection	☐ CRB Workshop Summary of Findings	☐ 2	☐ 6
☐ Emergency Services	☐ Local Capital Improvement Plans	☐ 3	☐ 7
☐ Local Plans and Regulations	☐ Local Comprehensive Plans	☒ 4	☐ 8
☐ Structure and Infrastructure	☐ Military Installation Resilience Review		
☐ Natural Systems Protection			
☒ Education and Awareness			

Obstacles

Lead/Champion	Support
Department of Planning and Economic Development	Department of Utilities, Communication Department, Building Department, University of Rhode Island (URI) Coastal Resource Center.

Potential Funding Sources	Estimated Cost	Timeline
City General Funds	☐ less than $10,000 ☒ $10,000 to $100,000 ☐ Over $100,000	☒ Short Term (less than 2 years) ☐ Medium Term (2-3 years) ☐ Long Term (3-5 years)

Other Notes

As of October 2024, the city is working on creating a pilot project to teach stormwater education.

VULNERABILITY: Flood Prone Streets or Infrastructure

MITIGATION ACTION:	ACTION PRIORITY
4. **Improve stormwater education.** d. **Educate residents on the damaging effects of phosphorus loading.**	☒ High ☐ Medium ☐ Low
	Action Status
	2022

Rationale

Freshwater lakes and ponds have experienced algal blooms as a result of historic and ongoing phosphorus loading. In addition to being unsightly, algae blooms create high biochemical oxygen demand (BOD) as the algae decomposes and uses up available oxygen supplies. This low oxygen environment threatens the survival of fish and other aquatic organisms.

There is local data to prove that nutrient loading is coming from neighboring lawns.

Benefits

Healthier ecosystems.

Improved water quality.

Hazard Addressed

Flooding

Mitigation Type	Supporting Plans/Efforts	Alignment With Plan Goals	
☒ Prevention	☒ Local Hazard Mitigation Plans	☐ 1	☒ 5
☐ Property Protection	☐ CRB Workshop Summary of Findings	☐ 2	☐ 6
☐ Emergency Services	☐ Local Capital Improvement Plans	☐ 3	☐ 7
☐ Local Plans and Regulations	☐ Local Comprehensive Plans	☐ 4	☐ 8
☐ Structure and Infrastructure	☐ Military Installation Resilience Review		
☒ Natural Systems Protection			
☒ Education and Awareness			

Obstacles

Language barriers, competing priorities.

Lead/Champion	Support
Department of Planning and Economic Development	Department of Utilities, Communication Department, Building Department, University of Rhode Island (URI) Coastal Resource Center.

Potential Funding Sources	Estimated Cost	Timeline
City General Funds	☐ less than $10,000	☒ Short Term (less than 2 years)
	☐ $10,000 to $100,000	☐ Medium Term (2-3 years)
	☒ Over $100,000	☐ Long Term (3-5 years)

Other Notes

This is also a Natural Resource Mitigation Action.

VULNERABILITY: Flood Prone Streets or Infrastructure

MITIGATION ACTION:	ACTION PRIORITY
5. **Require the use of the CRMC coastal hazards analysis worksheet for all development and redevelopment.**	☐ High ☒ Medium ☐ Low
	Action Status
	2022

Rationale

The State requires eligible applicants to go through the exercise of evaluating the risk of climate change on the project. The City of Newport would like to require development applicants to of potential coastal hazards such as sea level rise, storm surge and associated flooding and shoreline erosion.

Benefits

New development or redevelopment designed to be more resilient to future flooding impacts through smarter, adaptive construction practices.

Hazard Addressed

Flooding, sea level rise.

Mitigation Type	Supporting Plans/Efforts	Alignment With Plan Goals	
☒ Prevention	☒ Local Hazard Mitigation Plans	☒ 1	☐ 5
☐ Property Protection	☐ CRB Workshop Summary of Findings	☐ 2	☐ 6
☐ Emergency Services	☐ Local Capital Improvement Plans	☒ 3	☐ 7
☐ Local Plans and Regulations	☐ Local Comprehensive Plans	☒ 4	☒ 8
☐ Structure and Infrastructure	☐ Military Installation Resilience Review		
☒ Natural Systems Protection			
☒ Education and Awareness			

Obstacles

Resistance to change in workflow

Lead/Champion	Support
Department of Planning and Economic Development	Building Department, University of Rhode Island (URI) Coastal Resource Center.

Potential Funding Sources	Estimated Cost	Timeline
City General Funds	☐ less than $10,000 ☒ $10,000 to $100,000 ☐ Over $100,000	☐ Short Term (less than 2 years) ☒ Medium Term (2-3 years) ☐ Long Term (3-5 years)

Other Notes

See http://www.crmc.ri.gov/coastalhazardapp.html

VULNERABILITY: Flood Prone Streets or Infrastructure

MITIGATION ACTION:	ACTION PRIORITY
6. Improve resilience of seawalls and associated structures at: Storer Park and Causeway Seawall, Long Wharf Seawall, Battery Park, Washington St., Van Zandt Pier, Elm St. Pier, Ocean Avenue.	☒ High ☐ Medium ☐ Low
	Action Status
	New

Rationale

The seawalls in the coastal city of Newport protect the waterfront business district. Not only do the structures age over time but increased storm activity and sea levels promote destructive erosion. Repairing the seawalls, making them more resilient to storm surge better protects the business community and economic driver for the city.

Benefits

Infrastructure resilience. Better protection of the downtown area from destructive wave action.

Hazard Addressed

Flooding, sea level rise, hurricanes, Nor'easters

Mitigation Type	Supporting Plans/Efforts	Alignment With Plan Goals	
☐ Prevention	☐ Local Hazard Mitigation Plans	☒ 1	☐ 5
☒ Property Protection	☐ CRB Workshop Summary of Findings	☐ 2	☒ 6
☐ Emergency Services	☒ Local Capital Improvement Plans	☐ 3	☐ 7
☐ Local Plans and Regulations	☐ Local Comprehensive Plans	☒ 4	☐ 8
☒ Structure and Infrastructure	☐ Military Installation Resilience Review		
☐ Natural Systems Protection			
☐ Education and Awareness			

Obstacles

Lead/Champion	Support	
Department of Public Services	Newport Harbormaster	
Potential Funding Sources	**Estimated Cost**	**Timeline**
City funds, bond issue	☐ less than $10,000 ☒ $10,000 to $100,000 ☐ Over $100,000	☐ Short Term (less than 2 years) ☒ Medium Term (2-3 years) ☐ Long Term (3-5 years)

Other Notes

Capital Improvement funding has been committed as a match to repair or replace seawalls, making them more resilient. Current efforts include installing riprap which dissipates wave energy.

- 2020: Storer Park/Goat Island seawall re-built.
- 2024: King Park seawall repairs. $2.3 million grant from Infrastructure Bank.

VULNERABILITY: Wastewater

MITIGATION ACTION:	ACTION PRIORITY
7. **Disconnect stormwater connections to the existing combined sewer-stormwater overflow (CSO) system. Construct bioretention areas at Bellevue Avenue and Coggeshall Avenue.**	☐ High ☒ Medium ☐ Low
	Action Status
	New

Rationale

After heavy rainstorms, runoff from roads is directed into the water treatment system. The City of Newport maintains over 90 miles of sanitary sewer pipes, many of which have been in service for more than a century. Prior to the 1970s, much of the system was constructed as a combined sewer network, collecting both sanitary sewage and stormwater. During rain events, the added volume can exceed system capacity, leading to the discharge of untreated water. Since the 1970s, the City has implemented several projects to separate stormwater from the sanitary sewer system in order to reduce the frequency and severity of combined sewer overflow (CSO) events.

Benefits

Improved water quality. Reduced volume entering the CSO eases the strain of the system.

Hazard Addressed

Flooding

Mitigation Type	Supporting Plans/Efforts	Alignment With Plan Goals	
☐ Prevention	☐ Local Hazard Mitigation Plans	☐ 1	☐ 5
☐ Property Protection	☐ CRB Workshop Summary of Findings	☐ 2	☐ 6
☐ Emergency Services	☒ Local Capital Improvement Plans	☐ 3	☐ 7
☐ Local Plans and Regulations	☐ Local Comprehensive Plans	☐ 4	☐ 8
☒ Structure and Infrastructure	☐ Military Installation Resilience Review		
☒ Natural Systems Protection			
☐ Education and Awareness			

Obstacles

Lead/Champion	Support	
Department of Utilities		
Potential Funding Sources	**Estimated Cost**	**Timeline**
RIDEM Narragansett Bay and Water Restoration Fund (BYRF) grant. RISE Grant	☐ less than $10,000 ☐ $10,000 to $100,000 ☒ Over $100,000	☒ Short Term (less than 2 years) ☐ Medium Term (2-3 years) ☐ Long Term (3-5 years)

Other Notes

Designs are 90 percent done. In partnership with Spouting Rock Beach Association which owns the area.

VULNERABILITY: Wastewater

MITIGATION ACTION:	ACTION PRIORITY
8. **Evaluate flooding frequency and magnitude near the wastewater treatment facility outfall at Coddington Point in coordination with the Naval Station Newport and relevant agencies.** a. **Review available stormwater and tide data.** b. **Map recurrent flood events and assess infrastructure vulnerability.** c. **Use results to inform local resilience planning and emergency preparedness for city-owned systems.**	☒ High ☐ Medium ☐ Low **Action Status** 2022

Rationale

The roadways on Navy-owned property used to access the outfall may be compromised due to flooding. Stress from development in the North End has exacerbated the flooding issue.

Benefits

Reduced flooding.

Hazard Addressed

Flooding

Mitigation Type	Supporting Plans/Efforts	Alignment With Plan Goals	
☐ Prevention	☒ Local Hazard Mitigation Plans	☐ 1	☐ 5
☐ Property Protection	☐ CRB Workshop Summary of Findings	☐ 2	☒ 6
☐ Emergency Services	☐ Local Capital Improvement Plans	☐ 3	☐ 7
☐ Local Plans and Regulations	☐ Local Comprehensive Plans	☐ 4	☐ 8
☒ Structure and Infrastructure	☐ Military Installation Resilience Review		
☐ Natural Systems Protection			
☐ Education and Awareness			

Obstacles

Lead/Champion	Support
Department of Planning	Naval Station Newport

Potential Funding Sources	Estimated Cost	Timeline
Military Installation Resiliency Review (MIRR) grant	☐ less than $10,000 ☐ $10,000 to $100,000 ☒ Over $100,000	☐ Short Term (less than 2 years) ☐ Medium Term (2-3 years) ☒ Long Term (3-5 years)

Other Notes

This area was evaluated in the Military Installation Resilience Review (MIRR), which focused on future probabilistic scenarios. It is also included in a broader grant initiative and forms part of the City's Transportation Master Plan. One potential improvement under consideration is the installation of a tide gate.

VULNERABILITY: Dams

MITIGATION ACTION:	ACTION PRIORITY

9. Design and construction resiliency actions as per results of the second round of the Easton Pond Dam Study. **a. Raise earthen embankments of South Easton Pond.** **b. Raise the earthen embankment separating North Easton Pond from South Easton Pond.** **c. Install two gates to prevent saltwater intrusion.**	☒ High ☐ Medium ☐ Low **Action Status** 2022

Rationale

The aging dam and moat infrastructure has deteriorated over the past 70 years, which is now resulting in soil loss and threatening the future structural stability of the dam.

The runoff from these neighborhoods as well as activities in and around the dam and moat system generate significant bacteria loadings that lead to beach closures at Easton Beach.

Benefits

Enhances resiliency by protecting the drinking water supply from saltwater intrusion and overtopping, while ensuring a consistent embankment height.

Hazard Addressed

Flooding, hurricanes, Nor'easters, sea level rise, dam failure

Mitigation Type	Supporting Plans/Efforts	Alignment With Plan Goals	
☐ Prevention	☒ Local Hazard Mitigation Plans	☒ 1	☐ 5
☒ Property Protection	☐ CRB Workshop Summary of Findings	☐ 2	☒ 6
☐ Emergency Services	☐ Local Capital Improvement Plans	☐ 3	☐ 7
☐ Local Plans and Regulations	☐ Local Comprehensive Plans	☒ 4	☐ 8
☒ Structure and Infrastructure	☐ Military Installation Resilience Review		
☐ Natural Systems Protection			
☐ Education and Awareness			

Obstacles

Funding

Lead/Champion	Support
Department of Utilities	

Potential Funding Sources	Estimated Cost	Timeline
FEMA grant to advance two design alternatives.	☐ less than $10,000 ☐ $10,000 to $100,000 ☒ Over $100,000	☒ Short Term (less than 2 years) ☐ Medium Term (2-3 years) ☐ Long Term (3-5 years)

Other Notes

The city will submit a FEMA grant application later in 2024 to do some of the recommended actions.

Earthen embankments armored with articulated concrete blocks. 100-foot gate at South Pond Primary Spillway will prevent saltwater intrusion and increase storage capacity of South Easton Pond.

Second gate (tidal/flap) will be installed across the discharge channel near the NW corner of South Eason Pond. This will prevent saltwater from backing up the discharge channel and intruding into Noth Easton Pond.

VULNERABILITY: Populations

MITIGATION ACTION:	ACTION PRIORITY
10. Improved public education. **a. Education on storm drain road flooding, wait it out.** **b. Better guidance on 72-hour shelter-in-place.** **c. Effects of buildout on sea level rise and stormwater connections. (same as action 4c)** **d. Tactical urban education (educational signage or other installations)** **e. Climate change adaptation**	☒ High ☐ Medium ☐ Low **Action Status** 2022

Rationale

Education can encourage changes in behavior and help people make informed decisions.

Benefits

Fewer drivers getting stranded in floodwaters, more informed building decisions, reducing damages from rising sea levels.

Influence behavior change.

Hazard Addressed

Hurricanes, Nor'easters, flooding, severe winter weather, high winds, drought, extreme temperatures, sea level rise, brushfire, dam failure, tornadoes, earthquakes

Mitigation Type	Supporting Plans/Efforts	Alignment With Plan Goals	
☐ Prevention	☒ Local Hazard Mitigation Plans	☐ 1	☒ 5
☐ Property Protection	☐ CRB Workshop Summary of Findings	☐ 2	☒ 6
☐ Emergency Services	☐ Local Capital Improvement Plans	☒ 3	☐ 7
☐ Local Plans and Regulations	☐ Local Comprehensive Plans	☐ 4	☒ 8
☐ Structure and Infrastructure	☐ Military Installation Resilience Review		
☐ Natural Systems Protection			
☒ Education and Awareness			

Obstacles

Funding

Lead/Champion	Support
Department of Planning	Department of Utilities, Communication Department, Building Department, University of Rhode Island (URI) Coastal Resource Center. Resiliency and Sustainability Director

Potential Funding Sources	Estimated Cost	Timeline
City General Funds	☐ less than $10,000 ☒ $10,000 to $100,000 ☐ Over $100,000	☒ Short Term (less than 2 years) ☐ Medium Term (2-3 years) ☐ Long Term (3-5 years)

Other Notes

Level of storm surge, flooding as shown on stop signs, buildings, etc.

VULNERABILITY: Populations

MITIGATION ACTION:	ACTION PRIORITY
11. **Create resiliency guidelines or ordinances for development, incorporating green infrastructure, stormwater infrastructure, protecting environmental assets, and promoting low impact development.**	☐ High ☒ Medium ☐ Low
	Action Status
	New

Rationale

The city wants to ensure that projects are in line with climate change projections and municipal goals. The working waterfront area, which is the main commercial area in Newport, may benefit from elevation guidelines.

Benefits

Planning consistency, future resiliency.

Hazard Addressed

Hurricanes, Nor'easters, flooding, severe winter weather, high winds, drought, extreme temperatures, sea level rise, brushfire, dam failure.

Mitigation Type	Supporting Plans/Efforts	Alignment With Plan Goals	
☐ Prevention	☐ Local Hazard Mitigation Plans	☐ 1	☒ 5
☐ Property Protection	☒ CRB Workshop Summary of Findings	☐ 2	☒ 6
☐ Emergency Services	☐ Local Capital Improvement Plans	☐ 3	☐ 7
☒ Local Plans and Regulations	☐ Local Comprehensive Plans	☒ 4	☒ 8
☐ Structure and Infrastructure	☐ Military Installation Resilience Review		
☐ Natural Systems Protection			
☐ Education and Awareness			

Obstacles

Lead/Champion	Support
Department of Planning and Economic Development	City Council, Town Manager, City Solicitor

Potential Funding Sources	Estimated Cost	Timeline
Planning Department funds	☒ less than $10,000 ☐ $10,000 to $100,000 ☐ Over $100,000	☐ Short Term (less than 2 years) ☒ Medium Term (2-3 years) ☐ Long Term (3-5 years)

Other Notes

See Appendix H of the Aquidneck Island Regional Hazard Mitigation Plan.

VULNERABILITY: Businesses

MITIGATION ACTION:	ACTION PRIORITY
12. **Develop municipal guidelines for post-disaster redevelopment of waterfront properties that integrate hazard mitigation, equitable recovery, and long-term resilience, informed by best practices, local code review, and coordination with property owners and regional planning agencies.**	☐ High ☒ Medium ☐ Low
	Action Status
	2022

Rationale

Facilitate pre-disaster planning in a way that guides long-term recovery efforts (five years or more) following a disaster. Rebuilding damaged structures or infrastructure in the same location and/or in the same way may leave the community at risk from similar disaster losses in the future.

Benefits

Swifter return of community stability.

Hazard Addressed

Hurricanes, Nor'easter, flooding, sea level rise

Mitigation Type	Supporting Plans/Efforts	Alignment With Plan Goals	
☐ Prevention	☒ Local Hazard Mitigation Plans	☐ 1	☐ 5
☐ Property Protection	☐ CRB Workshop Summary of Findings	☐ 2	☐ 6
☐ Emergency Services	☐ Local Capital Improvement Plans	☐ 3	☒ 7
☒ Local Plans and Regulations	☐ Local Comprehensive Plans	☒ 4	☐ 8
☐ Structure and Infrastructure	☐ Military Installation Resilience Review		
☐ Natural Systems Protection			
☐ Education and Awareness			

Obstacles

Lead/Champion	Support	
Department of Planning and Economic Development	Building Department	
Potential Funding Sources	**Estimated Cost**	**Timeline**
Capital Improvement Program As part of a larger grant opportunity	☐ less than $10,000 ☒ $10,000 to $100,000 ☐ Over $100,000	☒ Short Term (less than 2 years) ☐ Medium Term (2-3 years) ☐ Long Term (3-5 years)

Other Notes

May be a longer-term project.

See: https://www.fema.gov/sites/default/files/2020-07/post-disaster-redevelopment-planning.pdf

Appendix G: Prudence Island Community Wildlife Protection Plan (CWPP)

2024 Prudence Island CWPP Addendum

Wildfire Hazard Mitigation

A Community Wildfire Protection Plan (CWPP) is a comprehensive strategy developed through the collaboration of residents and various governmental agencies at local, state, and federal levels. These plans are specifically designed to address the unique needs of the community, emphasizing key aspects such as wildfire response, hazard mitigation, and overall preparedness, with a particular focus on the wildland-urban interface (WUI). The WUI represents the vulnerable zone where developed areas intersect with wildfire-prone landscapes, posing significant risks to life, property, and the environment. Fire departments prioritize mitigating these threats, as the WUI is often where fires can inflict severe damage, including loss of life, presenting one of the most daunting challenges for firefighters.

The threat of devastating wildfires has escalated over the years driven by climate change, increased fuel load due to significant tree mortality with minimal mitigation, invasive species, and expanded development in the WUI. In the Northeast, wildfires are most prevalent during the spring and fall when trees are bare, allowing sunlight and wind to dry the forest floor. The combination of persistent drought, low humidity, and accumulated debris creates a highly flammable environment, leading to more frequent and intense brush fires. Since late October 2024, New England has issued almost daily red flag warnings, signaling dangerous fire weather conditions characterized by heat, dryness, and wind. Human carelessness remains the primary cause of these fires.

As wildfires increase in frequency, size, and severity, their impact on lives, property, and the environment becomes more pronounced. To mitigate these effects, it is essential to engage in a collaborative planning process. Community Wildfire Protection Plans offer a structured framework that empowers communities to effectively address and minimize wildfire risks.

Risk management experts often use historical data to identify worst-case scenarios to project future risks. They reference the most severe events as benchmarks for potential future crises. What this does not fully take into account are the factors that significantly increase the risk of wildfire in the WUI. The failure to confront risk leaves us vulnerable. The worst that can happen may be far worse than anything we can imagine.

The Prudence Island Community Wildfire Protection Plan (CWPP) was completed in April of 2018 and to date, it is the only CWPP that has been completed in the State of Rhode Island. Over the past 6 years progress has been made on several recommendations made in the plan. In addition, some of the underlying assumptions and conditions have changed. While a full update or rewrite of the CWPP would be both time-consuming and require funding, this document will outline progress made, changes that have occurred, particularly in Local Preparedness, and the resulting reprioritization of the Recommendation Matrix. Of particular note is work done by the Prudence Island Volunteer Fire Department (PIVFD) to revise the water supply strategy for many parts of the island that are within 250 feet of accessible shoreline.

According to the 2020 census data, Prudence Island comprises 456 housing units and has a permanent population of 231 residents, 56% of whom are aged 65 and older. The island is a seasonal community, experiencing a significant influx of visitors during the summer months, which raises the population to an estimated 2,000 to 3,000 individuals.

Progress Made on 2018 Management Recommendations

A group of representatives from key stakeholders in the CWPP meet quarterly to track progress against the recommendations made in the 2018 plan. Included in this regular meeting are representatives from PIVFD, RI Department of Environmental Management Division of Forest Environment (RI-DEM-DFE), Narragansett Bay National Estuarine Research Reserve (NBNERR), Prudence Conservancy, Prudence Island Planning Commission (PIPC). Notable progress has been made. Process improvements identified through these efforts have been established as part of regular operational procedures for the various agencies.

PIVFD has added focused training on wildfire mitigation. A number of Prudence Island firefighters have completed National Wildfire Coordinating Group (NWCG.GOV) training. PIVFD firefighters have also worked with RI-DEM-DFE firefighters on multiple prescribed burns on the island. All of these training opportunities have been worked into standard operating procedures for the PIVFD.

Progress has also been made on community education through the National Fire Protection Association (NFPA) Firewise USA program. These efforts have included a Firewise Day in May of 2024 and the distribution of Firewise USA materials and public events on the island. Several islanders were trained by foresters from RI-DEM-DFE on how to assist homeowners in performing wildfire risk assessment using the Firewise Homeowner Assessment Tool.

RI-DEM-DFE, in collaboration with NBNERR and PIVFD, has successfully conducted two prescribed burns on NBNERR's South Reserve property. To enhance their firefighting capabilities, NBNERR has also acquired a 125-gallon portable skid pump equipped with wildland firefighting tools. These prescribed burns have been pivotal in developing standardized procedures, paving the way for a consistent prescribed burn program. Looking ahead, more burns are scheduled for spring 2025.

In 2024, RI Energy implemented a major vegetation clearance project beneath and around electric lines, resulting in a noticeable decrease in wind-related power outages. Additionally, NBNERR has initiated a consistent fuel reduction program, especially in areas adjacent to private properties. As we look toward 2025, NBNERR is partnering with the USFS to bring Job Corps crews to the island, focusing on improving forest management and minimizing fuel loads.

As detailed below, PIVFD has worked to improve its inventory of firefighting apparatus on the island. PIVFD has made significant efforts to address water supply issues. Since the CWPP was finalized in 2018 a cistern was installed in the Warnerville neighborhood. The department has procured a TurboDraft Fire Eductor which provides a portable tool to use water from the bay. These changes are seen in an updated PIVFD strategy for wildfire protection as detailed below.

Change in PIVFD Equipment Inventory

The equipment used by the PIVFD has changed dramatically since 2018. The organization's two Type 1 engines have both been replaced with newer, upgraded fire apparatus. The department still has three tankers of over 1,000 gallons each. However, Tanker 3 which was a 6x6 off-road capable fire apparatus was replaced with a 1,000 gallon type 1 engine, thus eliminating an off-road capable tanker. Additionally, the portable pump truck, which was used to pump salt water or to draft from cisterns was taken out of service without a replacement. The two Type 6 wildland fire engines have both been taken out of service. The department currently has two 4x4 pickup trucks, one of which holds a 125-gallon portable skid pump with wildland firefighting equipment. Lastly, the PIVFD has recently acquired a Polaris UTV with an EMS skid.

Engine 82   2024 Pierce   600-gallon capacity

Engine 83   1993 Emergency One   500-gallon capacity

Tanker 1   1975 Ford/Farrar   4,000-gallon capacity

Tanker 2   1985 GMC Brigadier   2,500-gallon capacity

Tanker 3   1991 Emergency One   1,000-gallon capacity

Brush 1   2004 Ford F250 4x4   (not pictured) 125-gallon capacity skid pump

Utility 1   2004 Ford F250 4x4

2024 Polaris Ranger with EMS skid

Update to Prudence Island Water Supply Strategy

Since the publication of this report in April 2018 there has been a fundamental change in how the Prudence Island Volunteer Fire Department supplies water for firefighting operations. Traditional drafting methods from static water sources are limited to about 30 feet of distance from the pump to the water source. This was a significant factor in the need to strategically place cisterns on the island. However, the department now carries a Turbo Draft Fire Eductor on Engine 83, which is the designated water supply fire apparatus.

The Turbo Draft allows a piece of fire apparatus to gain access to a static water source up to 250 feet away from the pump. With this piece of equipment, the fire department can now access multiple areas of coastline and pump salt water from Narragansett Bay. Additionally, the Turbo Draft can be placed into operation quicker than a traditional drafting operation and can generate fire flows of over 670 gallons per minute. The Turbo Draft can supply water directly to fire attack apparatus via supply hose or can refill tankers at any number of convenient access points across the island, thus reducing travel distance and time for a refilling operation and the need for multiple cisterns scattered across the island.

2024 Prioritized Management Recommendations

Current equipment needs upgrading in order to maintain and improve firefighting capabilities on the island:

- Brush 1 and Utility 1 are both 20 years old respectively, and need replacement.
- The areas that require water shuttling are generally difficult to access. Tankers 1, 2, and 3 do not have off-road capabilities and can only be used in areas with paved roads. A wildland capable tanker is needed to augment wildfire firefighting capabilities. The new tanker should be off-road capable with a capacity of 1,000 gallons or greater.
- It is recommended that one side-by-side off-road utility vehicle (UTV) be purchased and outfitted with slip-on pump systems. UTVs serve as Type 7 wildland fire engines that can attack wildland fires in more remote areas than larger engines. The maneuverability allows for patrol of fire breaks, and for direct attack along trails and other areas inaccessible to other engines. The large number of trails on the island potentially could provide access to a UTV engine, allowing for initial attack in areas previously inaccessible by engine. A UTV engine can deliver significantly more capability than firefighters with backpack pumps. UTVs can serve other functions in the fire department, assisting in search and rescue or other operations needing access to the forests.

- A second Turbo Draft added to Engine 83 would allow for fire flows of over 1000 gallons per minute.
- There are several areas on the island that are currently inaccessible to the Turbo Draft but could be made accessible with minor effort. For example, the neighborhood known as Bristol Colony on the eastern end of Broadway, Steven's Landing, and areas along Bay Avenue, on the western side, should be made more accessible to allow the Turbo Draft to be placed into operation.
- Establish Plan for Wildfire Evacuations – Evacuations from wildfires in the WUI are substantially different in comparison to organized evacuations before a hurricane. Wildfire evacuations tend to come with very short notice, limited information and unpredictable wildfire behavior weather pattern movement, resulting in rapidly changing and dangerous situations. The reality for many WUI communities is that residents may not have time or existing road infrastructure to evacuate safely from an area threatened by wildfire. There is a need for first responders to engage residents in pre-evacuation planning and coordination, including an upgrade to community warning systems. A whole community approach that involves everyone, including underserved populations and residents with disabilities, must be incorporated in this process. (https://www.usfa.fema.gov/downloads/pdf/publications/wui-issues-resolutions-report.pdf)
- Perform a comprehensive update to the Prudence Island CWPP.

Respectfully submitted by the Prudence Island CWPP Workgroup:
Chief Louis Lepere - Prudence Island Volunteer Fire Department
Pat MacMeekin - Wildland Fire Supervisor, RIDEM Division of Forest Environment
Allan Waterman - Senior Fire Control Officer, RIDEM Division of Ag & Forestry
Jon Mitchell - Stewardship Coordinator, Narragansett Bay National Estuarine Research Reserve
John Spadaro - Chairperson, Prudence Island Planning Commission
Robin Weber - Wildland Firefighter, Business Owner
Linda O'Brien - Prudence Island Preparedness Group, Wildland Firefighter/EMT
Raymond Jenness, Chairperson, Prudence Conservancy

Prudence Island

COMMUNITY WILDFIRE PROTECTION PLAN

This plan is designed to provide Prudence Island land managers and residents with information on wildfire mitigation and to aid in prioritizing areas for management across numerous property ownerships. The plan identifies wildland fire hazard areas on the island, assesses current wildland fire suppression capabilities, and summarizes methods for educating the public on how to reduce the threat of wildland fire to structures. In addition, the PI CWPP provides guidance for the build-out of wildfire suppression capacity and creates additional prospects for soliciting funding support. This plan was developed by a guidance committee comprised of representatives from the RIDEM Division of Forest Environment, Narragansett Bay National Estuarine Research Reserve, and the Prudence Island Volunteer Fire Department in collaboration with Northeast Forest and Fire Management LLC.

MAJOR TOPICS ADDRESSED BY THE PI CWPP

- History, current land use and wildfire problems
- Fuel types and potential fire behavior
- Zone descriptions
- Preparedness assessment
- Management recommendations
- **Firewise®** guidance for homeowners

What is a Community Wildfire Protection Plan?

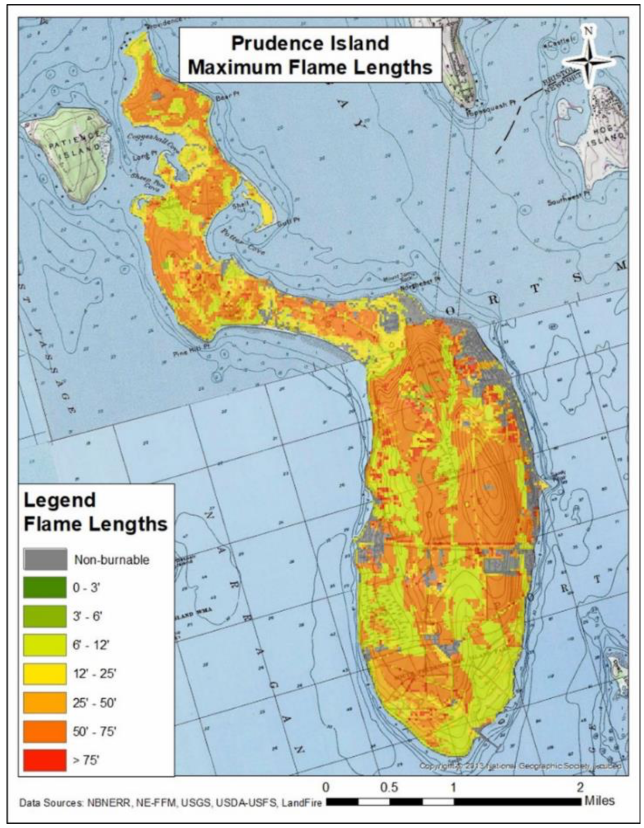
The Community Wildfire Protection Plan (CWPP) is a strategic plan that identifies specific wildland fire risks facing communities and neighborhoods and provides prioritized mitigation recommendations that are designed to reduce those risks. CWPPs may address issues such as wildfire response, hazard mitigation, community preparedness, or structure protection – or all of the above.

USFS Healthy Forests Restoration Act 2003

Photo Credit: Michael Stultz, RI DEM

IDENTIFIED WILDLAND FIRE CONCERNS

- The island has the potential for extreme fire behavior
- Remoteness creates lag time and logistical complications for mutual aid response
- The PIVFD has outdated equipment and insufficient capabilities for dealing with a large fire
- Current water supply requires shuttling for most of the island



SUMMARY OF RECOMMENDATIONS

Implement Wildfire Focused Trainings

- Host drills and simulations with mutual aid partners
- Pursue specialized trainings for wildland firefighting, water shuttling, and water conservation
- PIVFD and mutual aid partner participation in prescribed burns

Modernize Firefighting Apparatus

- Replace outdated equipment with modern, off-road capable apparatus
- Construct a new substation to house equipment in a temperature controlled environment

Improve Water Supply in order to Decrease Refill Times and Increase Water Availability

- Construct new cisterns in identified locations
- Replace cistern at PIVFD station

Develop Fire Department Policies and Procedures Specific to Wildland Fire

- Develop wildfire SOPs and communication plan
- Conduct hazard assessment for wildfire suppression

Decrease Fire Danger to Community through Fuel and Hazard Mitigation

- Improve and maintain existing fire breaks
- Implement fuel treatments in area of high fire danger risk
- Implement prescribed fire to reduce fuel loads

*The **Firewise USA®** program provides a collaborative framework for neighbors to reduce wildfire risks at the local level. The national recognition program's annual criteria is designed to empower and engage residents living in wildfire prone areas with a plan and actions that can increase their home's chances of surviving a wildfire, while also making it safer for firefighters.*

NFPA.org

Reduce Structural Ignitibility through Firewise®

- Implement parcel-based assessments for all properties on the island
- Conduct public outreach on Firewise® mitigation measures
- Develop a process to allow property owners to implement Firewise® recommendations on forested lands within the home ignition zone

Photo Credit: Mike Armington, PIVFD

The PI CWPP is available for download at: http://nbnerr.org/

Funding for this project was provided in part through the RIDEM Division of Forest Environment Forest Fire Program, in cooperation with the USDA Forest Service, Northeastern Area.

Prepared by Northeast Forest & Fire Management, LLC
www.ne-ffm.com

PRUDENCE ISLAND

COMMUNITY WILDFIRE PROTECTION PLAN

Narragansett Bay Research Reserve,
Rhode Island Division of Forest Environment,
Rhode Island Department of Environmental Management &
Prudence Island Volunteer Fire Department

April 2018
PRUDENCE ISLAND COMMUNITY WILDFIRE PROTECTON PLAN

Guidance Committee

Olney Knight
Rhode Island DEM
Division of Forest Environment
Forest Fire Program Coordinator

Robin Weber
Narragansett Bay NERR
Stewardship Coordinator

Kevin Blount
Prudence Island Fire Department
Officer

Prepared By

Alex Entrup, Senior Specialist
and
Joel R. Carlson, Principal Consultant

Northeast Forest and Fire Management LLC

Funding for this project was provided in part through the Rhode Island Division of Forest Environment Forest Fire Program, Department of Environmental Management, in cooperation with the USDA Forest Service, Northeastern Area.

Table of Contents

INTRODUCTION/EXECUTIVE SUMMARY

This plan is designed to provide Prudence Island managers and residents with information on wildfire mitigation and to aid in prioritizing areas for management across numerous property ownerships. The plan identifies wildland fire hazard areas on the island, assesses current wildland fire suppression capabilities, and summarizes methods for educating the public on how to reduce the threat of wildland fire to structures. In addition, this plan meets the federal criteria for Community Wildfire Protection Plans (CWPP) as outlined in the 2003 Healthy Forest and Recreation Act. The three criteria are as follows:

- The plan should be a product of collaboration between state, local, and federal agencies.
- The plan must identify and prioritize areas for hazardous fuel reduction treatments in addition to recommending methods of treatments that will protect at-risk communities and essential infrastructure.
- The plan must recommend measures that homeowners and communities can take to reduce structural ignitability.

COMMUNITY BACKGROUND

Prudence Island is located in the geographic center of Narragansett Bay. The island is approximately 3,565 acres (1443 hectares). According to the 2000 census, there are 88 year-round residents on the island. Prudence Island is part of the town of Portsmouth in Newport County, Rhode Island.

Approximately 8% of the land area of Prudence Island is developed, with 85% of the island protected from development. Conservation properties are either owned in fee by a land conservation agency or have development rights restricted through conservation easements. Much of the island is nature reserve administered through the Narragansett Bay National Estuarine Research Reserve (NBNERR), which was established to preserve, protect and restore coastal and estuarine ecosystems of Narragansett Bay through long-term research, education and training. NBNERR currently focuses efforts on terrestrial and submerged land on Prudence, Patience, Hope and Dyer islands.

Historically, the island was seasonally occupied by the ancestors of Narragansett and Wampanoag people. The Narragansett people named the island “Chibahwese” meaning “place of separation of the passage”. The name Prudence Island was adopted by Roger Williams following his acquisition. The island was jointly purchased by Roger Williams and Gov. Winthrop from the Narragansetts in 1637. All natives were forcibly removed from the island in 1676 following King Philip’s War (Arnold 1859). The island was settled by English immigrants in the mid- 17th century, and by the mid-18th century. There were nearly 30 small farms on the island. The island was used primarily for farming until the late 19th century. By the 1930s there were only 3 working farms. Currently, there are about 475 homes on the island, with a strong seasonal shift in occupancy that is highest during the summer months.

Structures on Prudence Island are built primarily near the shoreline. The settled areas are concentrated on the eastern shore, with the exception of the Prudence Park community and a few other smaller neighborhoods located on the western shore of the island. Many structures are built in the Wildland Urban Interface (WUI). The National Wildfire Coordinating Group (NWCG) defines the WUI as “the line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuel.”

The 2001 Federal Register divides the WUI into three categories:

Category 1 – Interface Community:
The interface community exists where structures directly abut wildland fuels. There is a clear line of demarcation between structures and wildland fuels and wildland fuels do not generally continue into the developed area.

Category 2 – Intermix Community:
The intermix community exists where structures are scattered throughout a wildland area. There is no clear line of demarcation; wildland fuels are continuous outside of and within the developed area.

Category 3 – Occluded Community:
The occluded community generally exists in a situation, often within a city, where structures abut an island of wildland fuels (e.g., park or open space). There is a clear line of demarcation between structures and wildland fuels (USDA and USDI 2001).

Most of Prudence Island is a blend of Interface and Intermix Community types. Structures are generally clustered with a clear line between the developed and wildland areas. Between structures, however, there are often patches of wildland fuels such as tall grass or vine and shrub dominated areas. The best examples of Interface Community are Prudence Park and Warnerville, in which wildland fuels end where the manicured lawns of the neighborhood begin. The best examples of Intermix Community are the houses along Bay Avenue north of Prudence Park and along Pleasant Ave where houses are surrounded by forested and shrub dominated fuels. Examples of Occluded Community on the island could include structures near the lighthouse on the eastern shore where small patches of wildland fuel occur within the developed neighborhoods.

Development in the WUI can increase wildfire risk to structures. Fires that ignite in wildlands, such as the middle portion of the island, can burn into areas with structures, putting them at risk for ignition. High flame lengths and long-distance spotting could cause airborne firebrands to fall on and near structures. Fires started along the coastline could burn quickly through coastal grass and shrubland, spreading into residential areas. Also possible on Prudence Island is a structural fire spreading to wildland fuels which then carries the fire to other structures. Strategies to reduce fire hazard in WUI areas are found later in the plan.

WILDFIRE PROBLEM STATEMENT

The 3,565-acre island is mix of forests, shrublands, and open fields. The largest portion of the island (~75%) is forested with oak (*Quercus alba* and *Q. velutina*) and red maple (*Acer rubrum*). In the oak-maple forests, the understory is generally dominated by greenbrier (*Smilax* spp.) and other vines. Pitch pine forests are present on the island and could support high fire behavior, but the pitch pine areas are generally isolated from populated areas. Shrub fuels are abundant in the southwestern corner of the island and in the northern area. Both coastal shrublands and upland shrublands have a heavy greenbrier component with coastal areas containing primarily sumacs (*Rhus* spp.), bayberry (*Morella pensylvanica*) and stunted trees. Upland shrublands contain ericaceous shrubs and hardwood saplings with a heavy greenbrier component.

Under moderate weather conditions, fire behavior would be expected to be low in some areas and moderate to high in others. Under dry and windy conditions, however, the high resin content of greenbrier could escalate fire behavior, creating fire activity that would be difficult to contain. The limited capabilities for wildland fire suppression combined with the delayed response times for mutual aid, increase the wildland fire risk. The greatest wildland fire risk on the island would occur if an ignited structure were to ignite wildland fuels and ignite neighboring structures.

Changes to the forest composition and structure may be leading to increased fire potential on Prudence Island. Numerous years of drought combined with gypsy moth outbreaks has led to widespread oak mortality in the forested areas. The standing dead and downed woody debris increase fuel loading and could lead to more intense fire behavior and excessive smoke production. The large amount of coarse woody debris on the ground may create problems for fire suppression. Engines cannot drive over downed trees, and hose may be damaged if dragged through burned areas with still smoldering heavy fuels. The vegetative response to the increase in light availability in the understory could lead to expanded growth of waxy shrubs and vines causing an increase in potential fire behavior.

LAND USE HISTORY

Prudence Island has a long history of human use. Prior to European contact (c. 1640), the island was seasonally inhabited by the ancestors of the Narragansett and Wampanoag people. The island was mostly forested and subject to frequent disturbance by both natural and human causes (Foster and Motzkin, 2003). Hurricanes and other storms have periodically caused major blowdowns and forest disturbances. American Indians are believed to have frequently utilized fire to remove understory vegetation, creating what was described in early accounts as an open and park-like appearance (Adams, 1883 [Morton, 1632]). During European settlement, the forests were cleared for agriculture. Following the period of farm abandonment throughout the late 1800s and early 1900s, forest succession began, eventually developing into the forests found today.

Steamboat service to Prudence Island began in 1875 and a later ferry service began in 1904, facilitating the transition of the island to a summer cottage destination. Fishing and tourism formed the foundation of the economy on Prudence Island for most of the early 20th century. In 1942, 65 acres in the southeastern portion of the island was established as an ammunition storage site for the U.S. Navy. The facility was intermittently in use until being turned over to the state of Rhode Island in 1980. Conservation efforts have preserved or protected much of Prudence Island, with approximately 85 percent of the island under protected status.

WEATHER

Climate on Prudence island is considered humid subtropical type (Kottek 2006). As is the case for the state of Rhode Island, Prudence Island lies within the “prevailing westerlies”, with the majority of winds blowing in an easterly direction. The frequent passing of low air masses brings frequent weather changes to the area. Generally, weather alternates roughly twice a week between fair and cloudy or stormy weather. There are often much longer periods between weather cycles, with no regular pattern existing (RIDEM). Oceanic influences affect weather in Prudence Island. During summer and early fall, hurricanes and tropical storms bring heavy winds and rains; similarly, in the winter, nor’easters bring severe weather which may cause blowdowns and flooding. When combined with high tides, some roadways on the island can be impassible. The following table (Table 1) is a summary of data collected at Quonset State Airport, in North Kingstown, RI, the nearest weather station with a long-term weather data set.

Table 1. Monthly weather data 1945-2017 KOQU (Quonset State Airport, North Kingstown, RI)

Month	Avg. High (°)	Avg. Low (°)	Avg. Mean Temp (°)	Avg. PM Relative Humidity (%)	Avg. Total Precipitation (in)	Avg. Wind Speeds (mph)
January	37	20	29	58	3.90	13
February	39	22	30	56	3.60	13
March	46	29	38	54	4.20	14
April	58	39	48	51	4.10	13
May	68	48	58	55	3.70	10
June	77	57	67	58	2.90	9
July	82	63	73	58	3.20	10
August	80	62	71	60	4.00	9
September	73	54	64	60	3.50	10
October	63	43	54	58	3.60	10
November	52	35	44	60	4.50	11
December	41	25	33	60	4.30	13

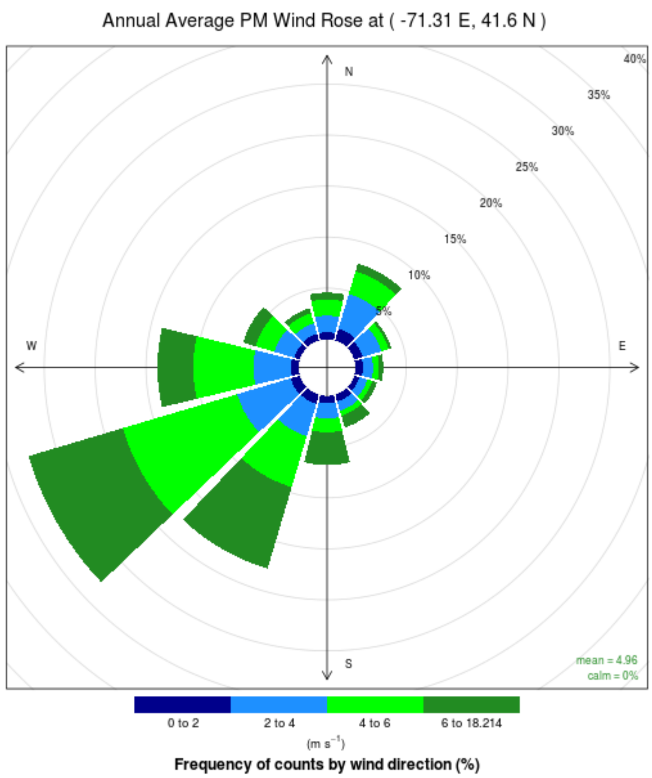
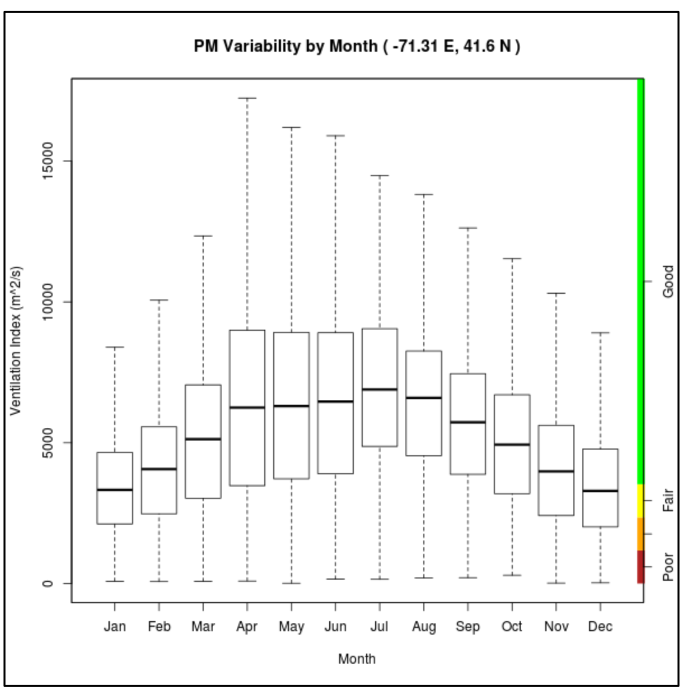


Figure 1: Wind rose of average afternoon wind speed and direction for Prudence Island (VCIS accessed 2018)



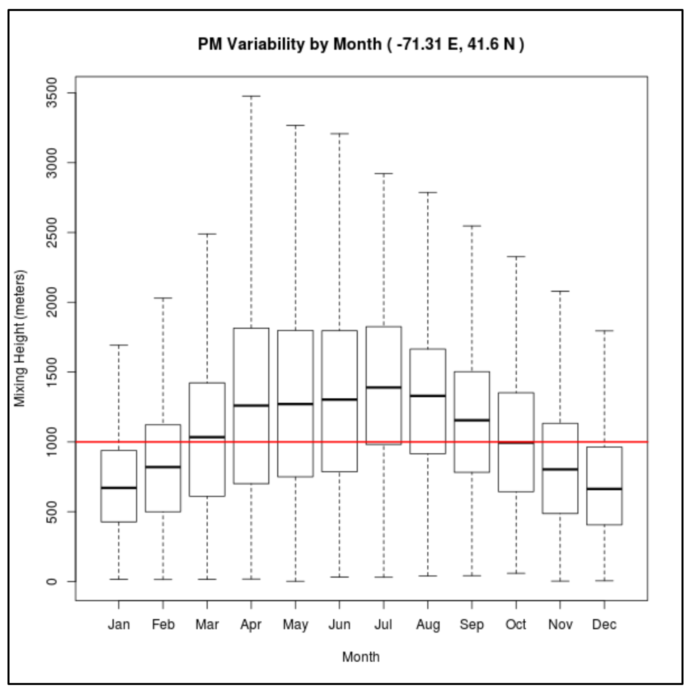


Figure 2 & 3: Afternoon ventilation rate and mixing height for Prudence Island (VCIS accessed 2018)

FUEL TYPES AND FIRE BEHAVIOR

FUEL TYPES

Prudence Island is primarily a forested landscape, but also contains a wide variety of vegetative communities. The vegetation was mapped by NBNERR based on 1997 aerial imagery and is portrayed in the following map (Figure 4).

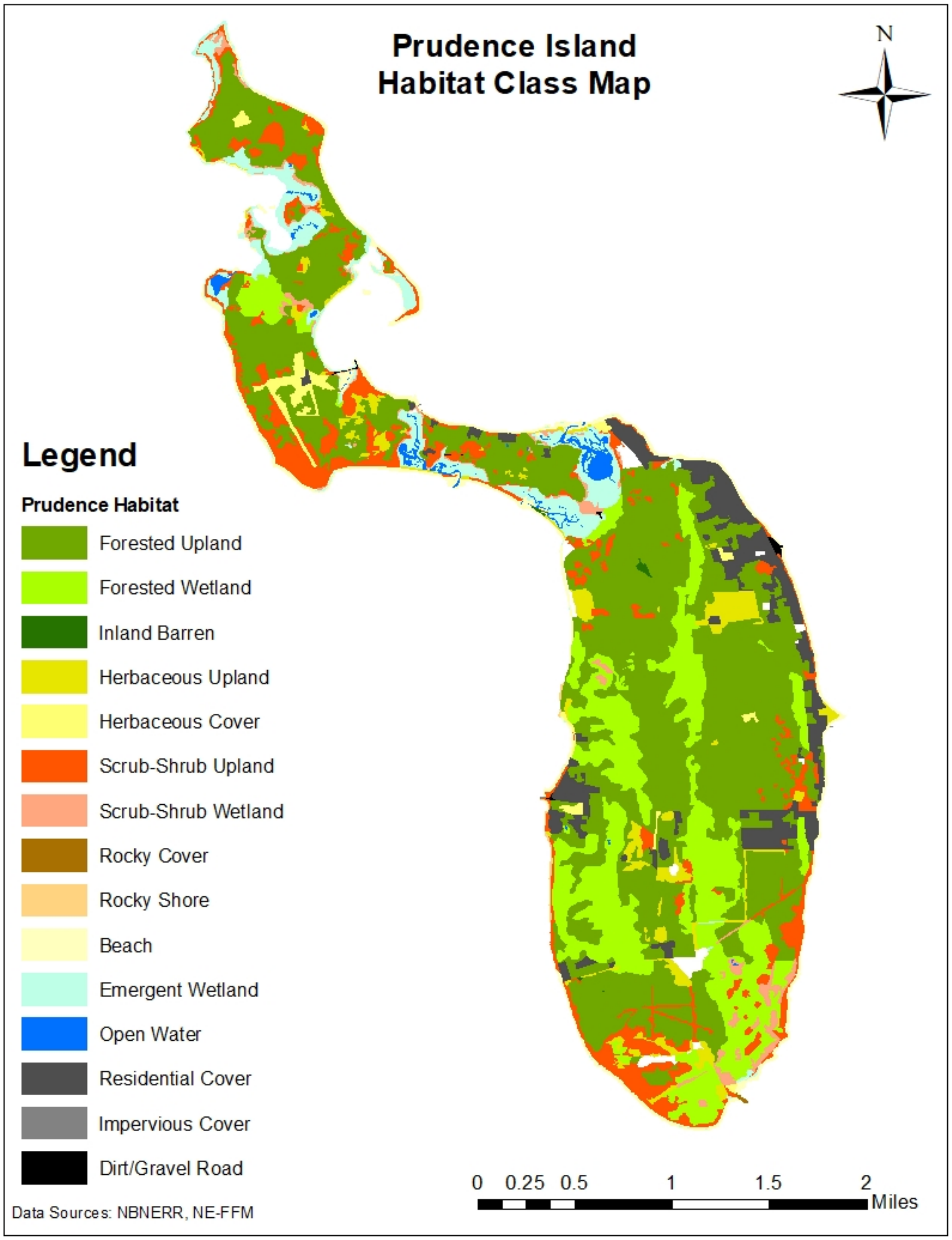


Figure 4: Vegetative Communities of Prudence Island

Deciduous forests dominate the island. Tree oaks and maples constitute the majority of the overstory. Uplands contain more oak, and wetlands more maple. The understory is, for the most part, dominated by greenbrier (*Smilax* spp.) and other vines. Pockets of pitch pine forest/woodland are scattered throughout the island. The largest areas of pitch pine forest are nearly 100% pitch pine overstory with little herbaceous or shrub layer to carry fire. Edges of the pitch pine forests can contain tightly spaced pitch pine saplings. Along the shorelines, grasses are a primary fuel, mixing with shrubs in many areas. In tidally influenced areas, vegetation is dominated by marsh grasses such as smooth cordgrass (*Spartina alterniflora*) and may be bounded in scattered areas by taller species such as common reed (*Phragmites australis*). Some culturally maintained grasslands, such as the Baker Farm and the North End Airstrip, as well as other managed grassland areas contain warm season grasses such as little bluestem (*Schizachyrium scoparium*) and switchgrass (*Panicum virgatum*) which could support fast moving fire. Many roadsides are maintained wide as fire breaks and contain switchgrass and other perennial bunch grasses. The former Navy property, now managed by NBNERR, in the south of the island, has been more intensively managed than most other portions of the island. Because of past land use, prescribed fire history, and mechanical treatments, it has a significant component of early successional forest.

The vegetation data were classified into fuel models using the Scott & Burgan's (2005) 40 wildland fuel models (Figure 5). The fuel models characterize the composition, structure and depth of the fuel bed, and are used in fire behavior prediction software to predict flame lengths, rates or spread, crown fire potential and other characteristics of wildland fire. Fuel models were chosen that most closely represent the current vegetation (Table 2). Shrub models were used in the forested areas because under high fire conditions, greenbrier and other vines are expected to the primary carrier of fire.

Table 2: Fuel Model by Vegetation Type

Fuel Model	Vegetation Type
NB1 – Non-burnable, urban developed	Developed
NB3 – Agriculture	Managed turf
NB9 – Bare Ground	Beach
NB8 – Open Water	Creeks, Ponds, Pools, etc.
GR3 – Low Load, Very Coarse, Humid Climate Grass (Dynamic)	Smooth cordgrass marsh, switchgrass grassland, mixed grassland, herbaceous old field
GR9 – Very High Load, Humid Climate Grass (Dynamic)	Common reed marsh, cattail marsh
GS3 – Moderate Load, Humid Climate Grass-Shrub (Dynamic)	Coastal dune grassland, coastal dune shrubland, Switchgrass grassland with shrubs
SH6 – Low Load, Humid Climate Shrub	Scrub-shrub upland/wetland, forested wetland
SH8 – High Load Humid Climate Shrub	Forested uplands
SH9 – Very High Load Humid Climate Shrub	Pitch pine saplings
TL5 – High Load Conifer Litter	Pitch pine forest/woodland

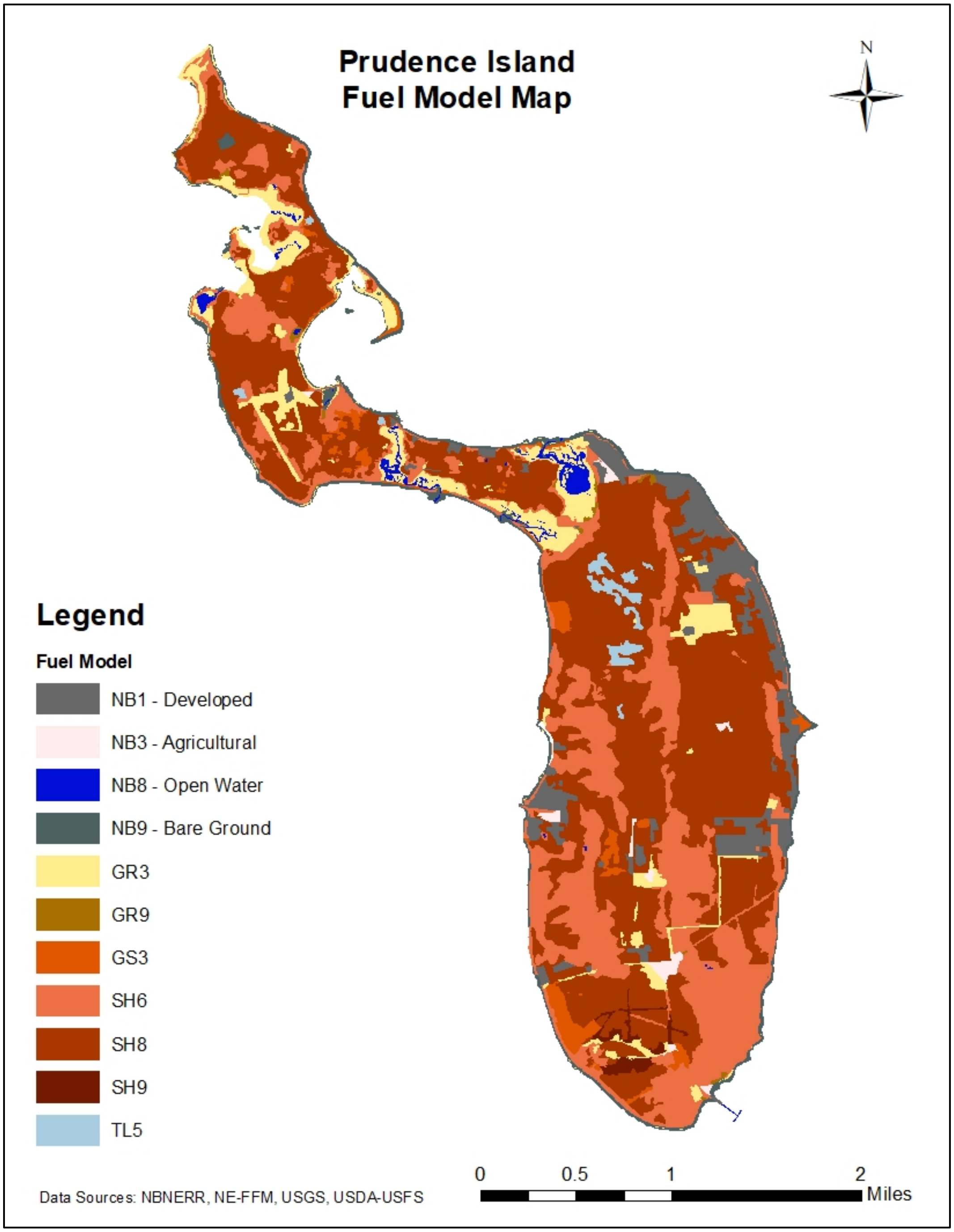


Figure 5: Fuel Model Map of Prudence Island

FIRE BEHAVIOR MODELING

Fire behavior was modeled to identify areas of potential for high wildfire risk. Areas of high fire risk may be prioritized for fuel treatments in order to reduce fire behavior near residences.

Vegetative and topographic characteristics including canopy cover, canopy bulk density, canopy height and canopy base height, elevation, aspect and slope were acquired from LANDFIRE, a federal online fire and resource management tool. LANDFIRE data were combined with the fuel model classifications and weather inputs using FlamMap, a fire modeling system, to estimate potential flame lengths, rates of spread and crown fire potential under worst-case conditions. Some outputs were edited to compensate for errors in the LANDFIRE data set.

The weather data used were based on conditions reported during the 1957 Plymouth wildfire, a mid-late spring fire, the time when most local wildland fires occur. The 1957 fire is one of the larger wildfires in southern New England having burned 15,000 acres in southeastern Massachusetts. Fuel moistures were modeled as higher for wetland forests to reflect increased moisture availability and shading.

Table 3: Fire behavior modeling design parameters

Design Variable	**Design Condition**	
20' wind speed:	25 mph	
Class	Uplands	Wetland Forests
1-hour fuel moisture:	5%	8%
10-hour fuel moisture:	8%	12%
100-hour fuel moisture:	12%	50%
Live herbaceous fuel moisture:	30%	300%
Live woody fuel moisture:	30%	300%
Foliar fuel moisture:	100%	100%

The maps displayed in figures 8, 9 ,10 show FlamMap outputs for maximum rates of spread, maximum flame lengths, and crown fire potential under the worst-case weather scenario. Rate of spread is the activity of a fire extending in horizontal dimensions. It is measured in chains per hour (1 chain = 66 feet). Flame length (Figure 6) is defined as the distance between the flame tip and the midpoint of flame depth at the base of the flame (generally the ground surface). Generally, the flame length limit for direct attack of a wildfire for hand crews is four feet. When flames are greater than four feet, engines are needed to attack with water. When flame lengths are beyond eight feet, engines are generally not effective and indirect attack is recommended.

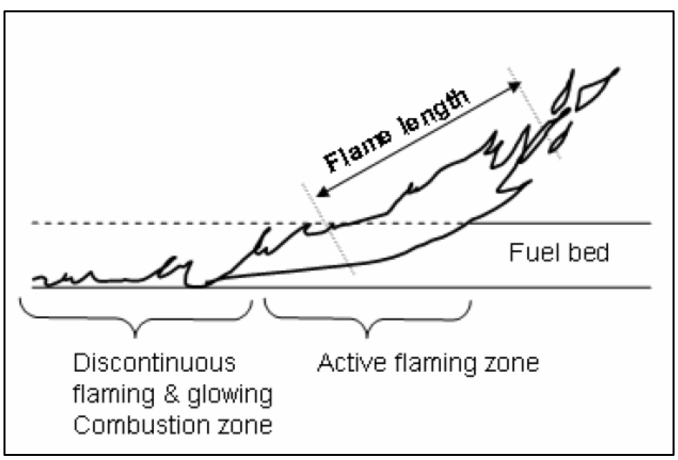


Figure 6: Flame length (from BehavePlus Fire Modeling System, Version 4.0: Variables).

Crown fire potential is classified into four categories: surface fire, passive or torching, active crown fire and independent crown fire (Figure 7). Surface fire does not spread into the crowns of the trees. Passive or torching climbs into single or small group of trees but does not carry through a canopy. Active crown fire moves through the tree tops at the same pace as fire moves through the understory. Independent crown fire burns through the canopy independent of ground fire. FlamMap is not capable of differentiating between active and independent crown fire potential.

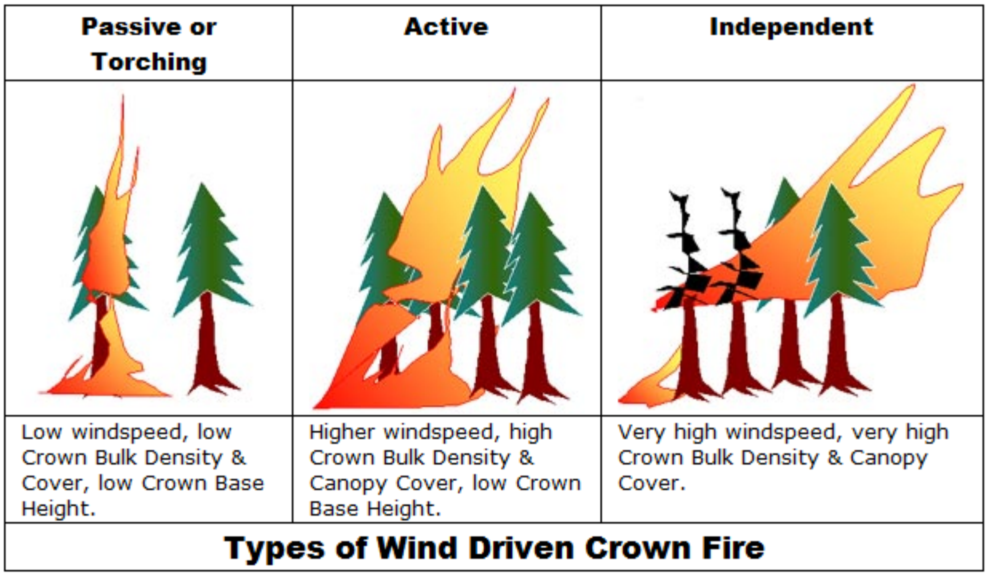


Figure 7: Three Types of Wind Driven Crown Fires (U.S. Forest Service 2011).

The outputs show that upland forests have the potential for relatively high rates of spread and flame lengths under severe fire conditions. Direct attack of fire in the upland forests may be unsafe and difficult because high flame lengths and tree torching. The vines and shrubs are so dense in areas that they would pose a risk of entrapment for firefighters attacking fire interior to the forest. Fire behavior would be dramatically reduced in the wetland forests because of increased fuel moistures. Attacking fire in the wetlands may be the best opportunity to suppress a large flaming front. High crown fire risk areas are generally somewhat distant from residences, however, under dry windy conditions embers from torching trees could easily travel the distance necessary to impact populated areas. Fuel treatments in upland areas near residential zones may decrease flame lengths, torching and rates of spread.

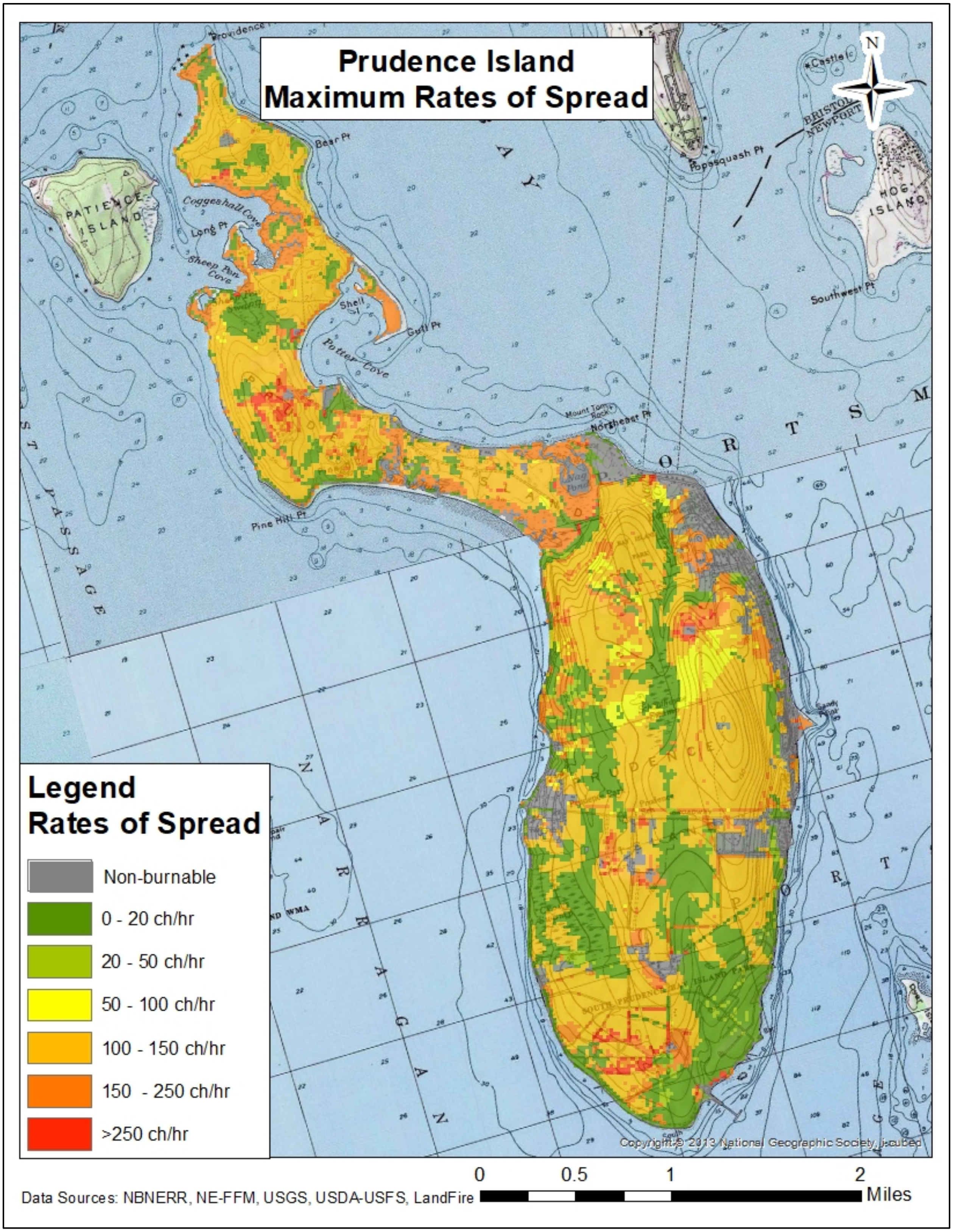


Figure 8: Rates of spread in chains (66 feet) per hour

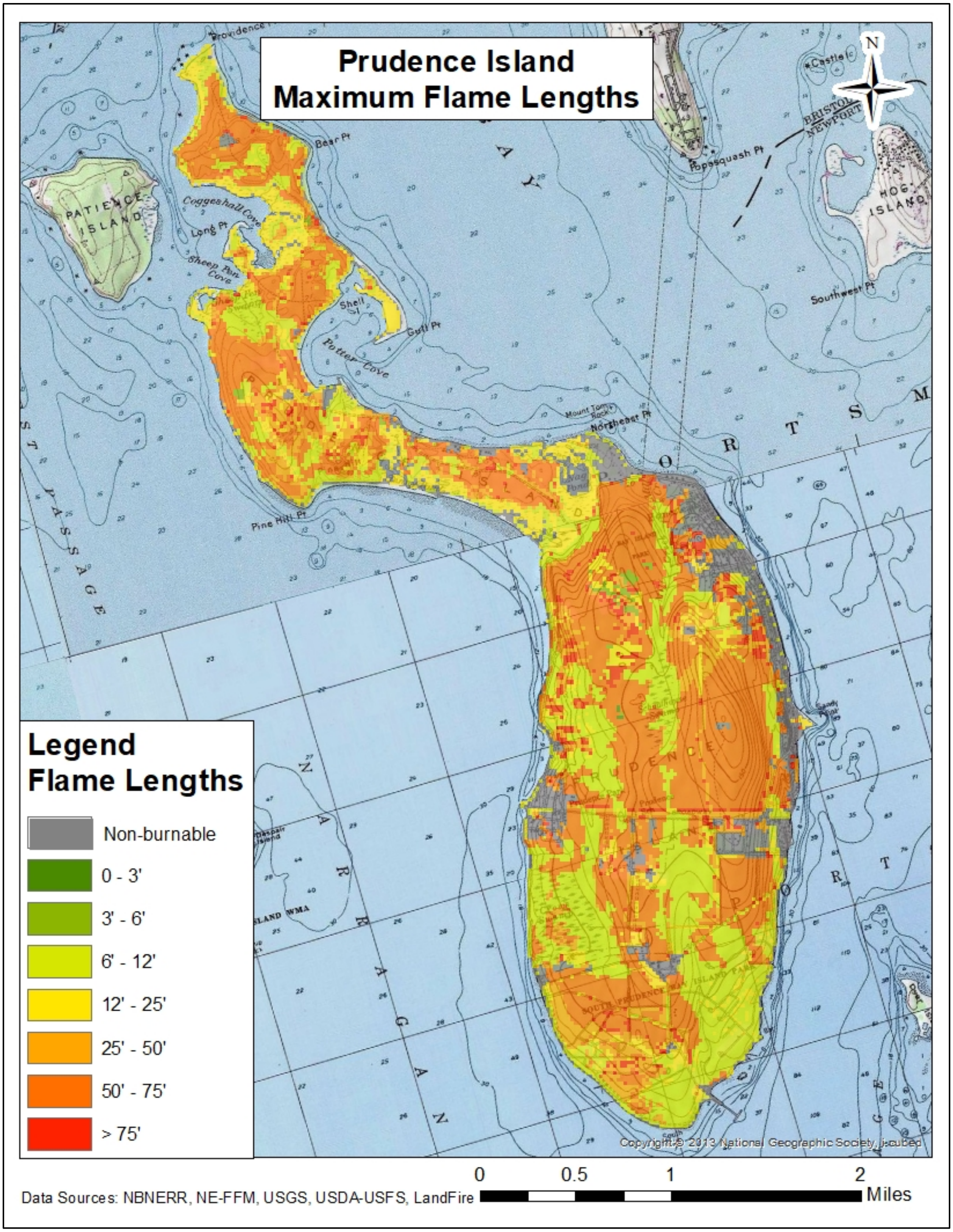


Figure 9: Maximum flame lengths in feet

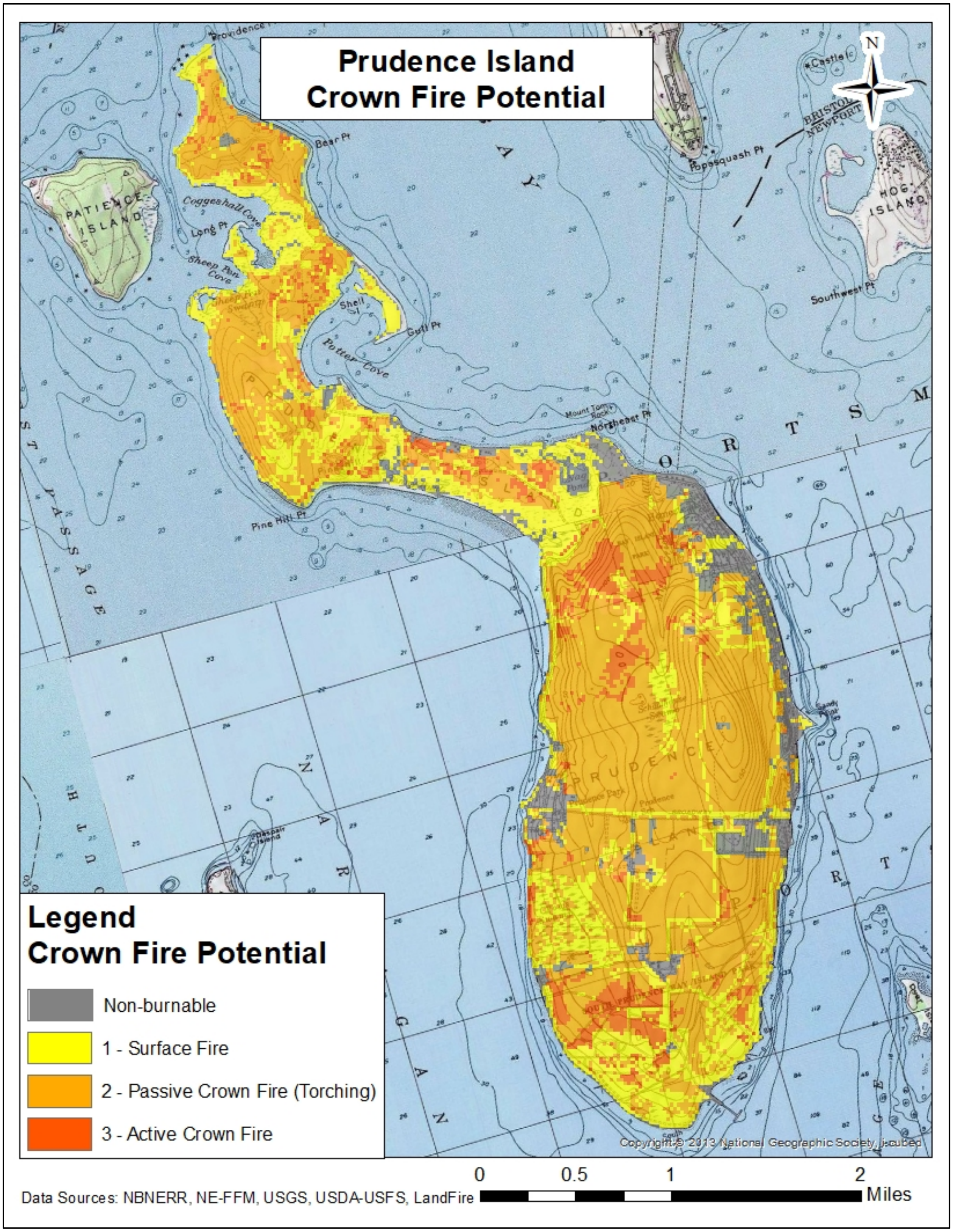


Figure 10: Crown fire potential by crown fire class

ANALYSIS

For planning purposes and to aid in further discussion of fuels, fire behavior, and specific treatments, Prudence Island has been divided into seven zones (Figure 11). Zones 2, 3 and 5 contain the majority of the WUI. Zones 1, 4, 6 and 7 are sparsely inhabited or uninhabited. Zone 1 (South End) is comprised of the former Navy property at the south end of the island. It contains the NBNERR headquarters and visitor center. Zone 2 (Prudence Park) contains the Prudence Park settlement and the majority of the structures on the western side of the island. It includes the residences along Mt. Pleasant Ave. and at Stevens Landing. Zone 3 (Eastern Shore) contains the largest number of structures. It includes Bristol Colony, Sandy Point and Homestead neighborhoods. Zone 4 (Central Forest) is made up primarily of the forested areas in the middle of the island. A few structures are located along Bay Ave. along the western shore. Zone 5 (Warnerville) is a small neighborhood north of Narragansett Ave. and west of Mill Creek. Zone 6 (The Neck) is located between Nag Pond and the northern gate on Neck Farm Rd. It contains residences along Neck Farm Rd., the North End Airstrip, Rossi Farm and a number of unoccupied buildings. Zone 7 (North End) is unoccupied shrublands and forests beyond the north gate.

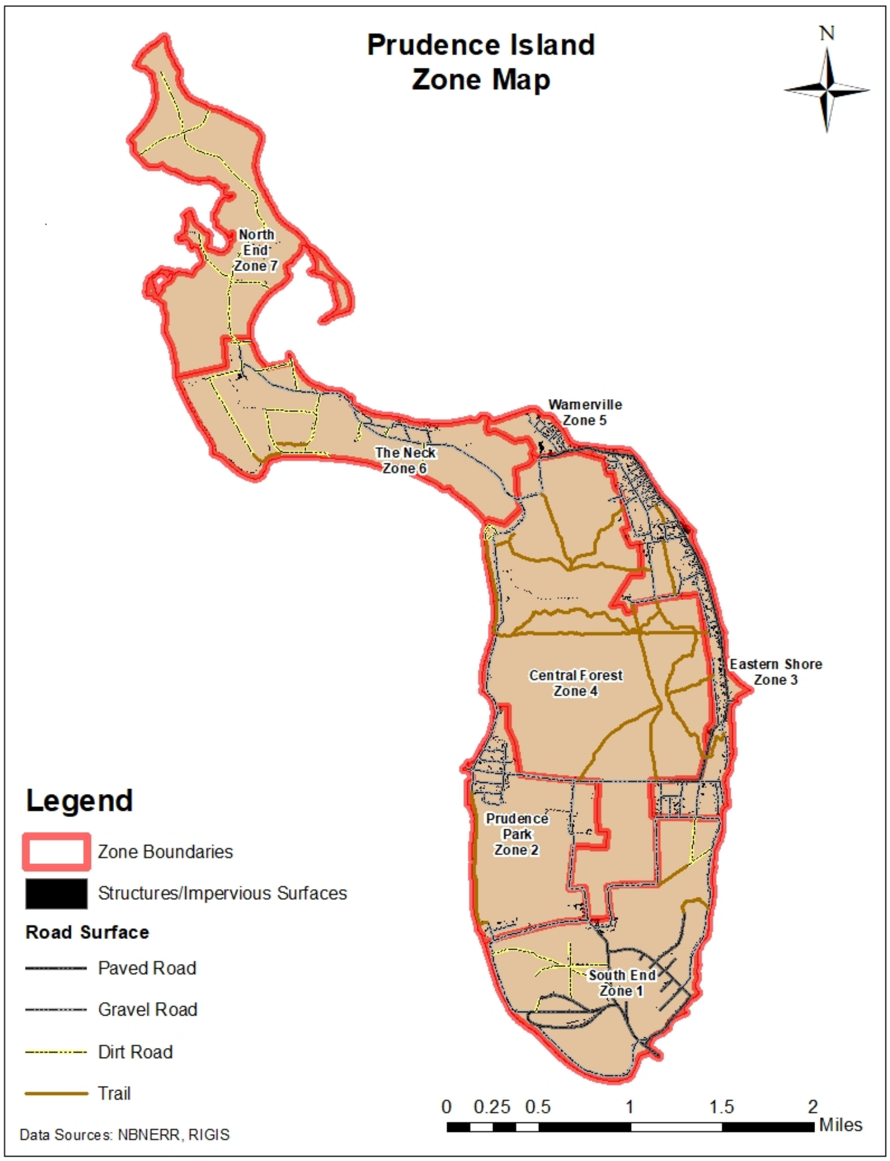


Figure 11: Prudence Island CWPP Zone Map

ZONE DESCRIPTIONS

Zone 1 – South End

Zone 1 is approximately 615 acres located in the southern end of the island. It contains the former U.S. Navy ammunition dump. The land was dramatically altered by construction and land use practices during the period of Naval use, and the traces of this past land use remains today. The property is now owned by the State of Rhode Island Department of Environmental Management and is managed by NBNERR. The zone contains a cluster of buildings that house the NBNERR headquarters and visitors center located in the northern-central portion of the zone near the intersection of Mt. Pleasant Ave., Albro Farm Rd, and South Reserve Dr.

The zone is crisscrossed with abandoned roads that now serve as trails and access to the preserved land. The trails and roads could be utilized by a brush fire engine. A number of abandoned ammunition storage bunkers are dotted across the zone. The southeast corner contains a wooden pier. Zone 1 currently contains no water supply, but a site near NBNERR offices has been proposed as a site for future cistern construction. The structures within the zone are within 10 minutes response time of the fire station. The nearest water source at this time is the cistern at the fire station. Refilling could take up to 45 minutes. Installation of a proposed cistern at the NBNERR offices would cut down refill time considerably.

Vegetation types within Zone 1 are highly varied. The western portion is primarily upland and the eastern portion is mostly wetland. Early successional habitat dominates the southwestern area. Later successional forests occupy most of the eastern wetlands. Closer to the northeast corner, upland forests abut the residences in the Bristol Colony neighborhood. Because of the diverse vegetation, Zone 1 contains numerous fuel models. The wetland forests and shrublands are modeled as SH6, low load humid climate shrub. The upland forests, containing a heavy greenbrier component, are modeled as SH8, high load humid climate shrub. Both shrub models support high flame lengths and high rates of spread. Juvenile pitch pine stands are modeled as SH9, very high load humid climate shrub which supports high rates of spread and very high flame lengths. Former larch plantations, now an open grass-shrub mix are GS3, moderate load humid climate grass-shrub. GS3 supports high rates of spread and moderate flame lengths. The grasslands near NBNERR offices, along roadsides and scattered throughout the zone are modeled as GR3, low load very coarse humid climate grass. GR3 supports high rates of spread and moderate flame lengths. A few patches of marsh grass containing Phragmites grow along the southeastern shore and are modeled as GR9, very high load humid climate grass. Flame lengths and rates of spread can be very high in Phragmites. The areas of highest potential fire behavior are in the interior of this preserved land, relatively far from residences. The areas of highest fire danger are in the northwest and northeast corners where upland forest with greenbrier understory abuts residential areas.

Vegetation within the zone is among the most heavily managed of the wildland areas. Mechanical treatments and prescribed fire have reduced crown fire potential and increased the prevalence of shrub and grass fuels. If management were to stop or be greatly diminished, reductions in fuel loading and potential fire behavior would likely be reversed. Pitch pine barrens would become densely packed pine forest with high crown fire potential. Shrublands and forests would undergo a transition to higher fuel loading with an increase in ladder fuels. If left untreated, the potential for crown fire would likely increase across the zone.

Zone 2 – Prudence Park

Zone 2 is 374 acres located in the western portion of the island. The zone contains an estimated 58 structures concentrated within three populated areas surrounded by large tracts of preserved lands. The largest number of residences is the Prudence Park settlement around the western end of Broadway. More structures are located along Mt. Pleasant Ave. in the middle of the island. A small neighborhood of eight structures is located on Stevens Landing Ln. and Chippoquasett Rd. near the western shore of the island. The zone contains a roughly 220-acre forested area. The majority of the forested area is wetland, known as Crow's Swamp. The zone currently does not have any water resources for firefighting. In the event of a fire in the area, water would be shuttled from the fire station.

Residences within the zone are accessible by engine. Broadway, Bay Ave., Mt. Pleasant Ave. and Albro Farm Rd. are all easily travelable by engine. Many side roads dead end at residences and are dirt or gravel. Bay Ave. south of Prudence Park is a dirt trail and would not readily allow vehicle passage with the exception of perhaps a brush engine or off-highway vehicle (OHV). Residences at the end of Broadway are generally within 10 minutes response from the fire station, and those by Stevens Landing Ln. and Albro Farm Rd. may be up to 15 minutes. Refill time in the zone is currently 35-45 minutes under optimal conditions because the nearest cistern is at the fire station. The area is not within the Prudence Island Water District, but the Prudence Park neighborhood is serviced by its own community well and distribution system. In other areas of this zone, water is available only through private wells. As a result, water to all areas of this zone would currently need to be shuttled. Proposed cistern installations at Prudence Park, the NBNERR offices and Broadway would allow for direct supply to engines fighting fire in Prudence Park and would cut refill time considerably for all other areas within the zone.

The zone contains a mix of upland and wetland soils. The largest tract of wetlands is primarily red maple swamp, which is modeled as SH6, low load humid climate shrub because of the prevalence of greenbrier and other vines in the midstory. Coastal shrublands, present along the coast, are modeled as SH6 as well. The uplands are mostly a mix of Oak-Maple Forest and Pine-Oak Forest, modeled as SH8, high load humid climate shrub. Both SH6 and SH8 can support high flame lengths and high rates of spread. Roughly ten acres of grassland are located west of Mt. Pleasant Ave. The grassland is primarily switchgrass with sapling pine, cedar and hardwoods intermixed. The grasslands are modeled as GS3, moderate load, humid climate grass-shrub. Spread in the grasslands can be high and flame lengths moderate.

Zone 3 – Eastern Shore

Zone 3 is 291 acres located in the eastern portion of the island. It is the most thickly settled of the zones. The zone contains roughly 330 structures. It includes Bristol Colony, Sandy Point and Homestead neighborhoods. The zone contains the site of the ferry dock, the fire station and all three of the cisterns currently operational on the island. The zone contains the Bacon Farm, an open grassland on the site formerly occupied by a vineyard.

Narragansett Ave. is the primary roadway in the zone. It is a two-lane paved road that provides access to all the neighborhoods along the eastern shore. Side roads are generally accessible by engine, although many roads dead-end at residences. Properties west of Homestead Ave. and Governor Paine Rd. are built in the WUI with maintained lawn and other vegetation as a break between the residences and wildland fuels. Because the fire station is located within the zone, response times are shortest, at 5-10 minutes, as long as roads are passable. Refill times are also relatively short because the zone contains all three currently operational cisterns. The addition of a proposed cistern on Broadway would increase capacity and shorten refill time for the southern section of Zone 3 as well as Zones 1 and 2.

The zone is primarily developed and within the WUI. The forested areas west of the zone are upland and wetland hardwood forest with thick greenbrier dominating the understory. Coastal shrublands line the eastern coast between the beach and Narragansett Ave. Fuels are modeled as SH6 in the wetlands and coastal shrublands, and SH8 is modeled in the uplands. Wooded areas are intermixed with the maintained yards in the residential areas, generally containing thick greenbrier as well. The open areas of the Bacon Farm are dominated by mixed perennial grasses and are modeled as GR3, low load, very coarse, humid climate grass.

Zone 4 – Central Forest

Zone 4 is the largest zone, at approximately 1,188 acres of primarily preserved lands. The central forest is generally unpopulated, with two residences along the western shore. Bay Ave. runs along the western coast, mostly between 50 and 250 feet from the shore. Broadway divides the island east and west. A 145-acre portion of the zone is south of Broadway. The rest of the zone is one large forested block. Numerous trails run through the zone. The two most prominent trails are the east-west Division Wall Trail and the north-south Heritage – Army Camp Trail. Currently, none of the trails are wide enough to be safely used by engines for suppression. The plan recommends widening the Heritage – Army Camp Trail in order to create a reliable fuel break and provide a north-south travel corridor under high water conditions in which Narragansett Ave. may be impassable. A widened trail, passable by a type 6 engine, would allow for direct or indirect attack in the forest interior. Other trails in the zone may be used as fire breaks if attacking with hand tools and bladder bags. Many of the trails are accessible by off-road utility vehicle (UTV). The fire department does not currently have a UTV engine, but the addition of a UTV fire engine would increase the capacity and range of wildland fire suppression on the island.

Linear wetlands occupy a swath of the middle and western portion of the zone. The largest wetland, known as Schoolhouse Swamp is located between the two ridges, draining north into Mill Creek. South of Broadway, the wetlands drain to the south through the former Navy property. A small 13-acre wetland sits west of the residences near Sandy Point. The large hill in the northwestern portion of the zone is dominated by pitch pine. The area was formerly cleared to bare ground and grew up in thick pitch pine. The resulting forest is dense canopy of adult pitch pine with little understory vegetation. Edges of the pitch pine forest are a mix of juvenile pitch pine, tree oak, small shrubs and greenbrier. The fuel model in the pitch pine forest is modeled as TL5, high load conifer litter. Spread rate and flame length in the conifer litter is low. Thick juvenile pitch pine stands, however, can support high flame lengths and rates of spread. The upland hardwood forests are modeled as SH8 and the wetland forests are modeled as SH6. Flame lengths and rates of spread and flame lengths in the hardwoods forests are high because of the heavy greenbrier component.

Forests have been heavily impacted by gypsy moth defoliation over the last number of years. An estimated 15-25% of oaks were killed by the combined stressors of defoliation and periods of moderate to severe drought. The long-term impacts of the overstory mortality is not yet understood. It is possible that it could lead to an increase in shrubs and waxy vines, thus increasing fire behavior, but it is also possible for red maple to fill in where oaks have died, limiting increases in potential fire behavior. The oak mortality has caused a dramatic increase in the amount of coarse woody material on the ground and standing dead throughout the forest. The increased fuel loads associated with deadfall will likely increase fire behavior and smoke production. Downed trees limit the ability of wildland fire engines from driving off-road and create difficulties for deploying hose. Standing dead trees, when ignited, produce embers that may travel long distances and present hazards for firefighters working under them. A number of mitigation measures are possible, including salvage harvest of dead trees, understory mowing and prescribed fire implementation.

Zone 5 – Warnerville

Zone 5 is the smallest zone at 54 acres. It is located between Narragansett Ave., Mill Creek, Nag Pond and Narragansett Bay. The zone contains roughly 35 structures. Narragansett Ave. separates Warnerville from Zone 3 to the south. Under extremely high tides and storm conditions, tidal and storm waters at Mill Creek and Nag Pond can rise over Narragansett Ave. blocking access from the south. Ongoing road improvements are being planned to prevent high water from blocking the roadway at Mill Creek, however under extreme conditions, access remains a concern. The zone is mostly residential, with a three-acre coastal shrubland between Nag Pond and the mowed areas west of Raphael Ave. The edges of Nag Pond are dominated by marsh grasses, with small areas of Phragmites. Between the houses vegetation is mostly mowed lawns, however some areas are wooded with a heavy greenbrier component.

Response time to Warnerville is roughly 15 minutes but could vary more or less depending on road and traffic conditions. A cistern is currently under construction at the Town Barn on Narragansett Ave. Once completed, it will allow for direct water supply to engines in Warnerville and will reduce refill times and increase capacity for firefighting in the Neck and beyond.

Fuels within the zone are mostly considered non-burnable. The coastal shrublands are modeled as SH6, the marshes are modeled as GR3, low load, very coarse, humid climate grass, except for Phragmites, which is modeled as GR9, very high load humid climate grass. Phragmites can support high flame lengths and rates of spread.

Zone 6 – The Neck

Zone 6 is located between the intersection of Bay Ave. and Narragansett Ave. to the northern extent of developed land near the North End Airstrip. The zone is approximately 498 acres. The majority of structures, roughly 17, are along the northern shore of the Neck. One residence is located near Jenny Pond, south of Neck Farm Rd. The North End Farm is located on the uplands north of Pine Hill Point in the western portion of the zone. The North End Farm area contains a number of structures, some in use and some abandoned. The North End Airstrip is west of the farm. The northern boundary of the zone is the north fire break, a mowed break which follows a stone wall dividing the uninhabited North End from the rest of the island. The non-residential areas of this zone, including the Rossi Farm, are generally comprised of preserved lands.

Neck Farm Rd. is the primary roadway in the zone and is travelable by engine. Beach Rd. and Harbor Rd., north of Neck Farm Rd., provide access to most of the residences in the Neck. Roads off of Neck Farm Rd. are mostly dirt or gravel, and while generally accessible by engine, could be muddy if ground conditions are wet. Response time to residences in the Neck could be up to 20 minutes or longer with poor road conditions. Once the cistern is completed at the town barn, refill time will be roughly 40-60 minutes. A cistern is proposed to be constructed at the intersection of Neck Farm Rd. and Beach Rd. It would allow for direct supply for most residences and would reduce refill time for areas beyond direct fill radius.

Soils in the zone are constituted of both till and outwash soils. The central and eastern portion of the Neck are low elevation and contain marshes and tidal streams. Vegetation in the marshes is primarily marsh grass, such as smooth cordgrass (*Spartina alterniflora*), modeled as GR3, low load, very coarse, humid climate grass. Patches of Phragmites are modeled as GR9, very high load humid climate grass, and would support higher fire behavior than other marsh grasses. Forests in the Neck have different composition than the central forest. The Neck forests contain a significant component of cherry and Eastern red cedar. Many lower elevation areas are dominated by coastal shrublands. Greenbrier is an important carrier of fire in most of the shrublands and forests. The western portion of the Neck, west of Jenny Pond, has a number of managed grasslands intermixed with shrublands and forests. The grasslands are modeled as GS3, moderate load, humid climate, grass-shrub. The airstrip roughly follows a small upland ridge. The farm fields and airstrip are modeled as GR3.

Zone 7 – The North End

Zone 7 is the northernmost zone. It is roughly 496 acres in size and is a mix of upland, wetland and tidally influenced areas. The North End contains no structures and few roads. The primary road is Providence Point Trail, which is a two-track dirt road north of the northern break. Two smaller east-west roads cut across the Neck providing access to Potter Cove, Long Point and the east and west shores near Providence Point. A small, mowed, 3-acre clearing is located in the northern portion of the zone around a historic site containing foundations of buildings. Roads within the zone could be travelled by a Type 6 engine, off-road tanker or OHV.

Vegetation in the North End is a mix of coastal shrubland, maple swamp, cherry-Eastern red cedar forest and marshland. Vines including oriental bittersweet (*Celestrus orbiculatus*), greenbrier and invasive plants such as multiflora rose (*Rosa multiflora*) are a significant component of the plant community. Fuels are modeled as SH6 in wetlands and shrubland. Upland forests are modeled as SH8. Marshes and salt meadows are modeled as GR3, with Phragmites marshes as GR9. Upland grasslands are modeled as GS3.

LOCAL PREPAREDNESS ASSESSMENT

One goal of the Prudence Island Community Wildfire Protection Plan is to assess current wildland fire suppression capacities and identify areas to increase effectiveness. The Prudence Island Volunteer Fire Department (PIVFD) has primary fire suppression responsibilities on the island. Fire protection is supported by Rhode Island Department of Environmental Management (RIDEM) Forest Fire Control and mutual aid with numerous nearby fire departments including Portsmouth, Bristol and Warwick. In the event of a major wildfire or multiple structural fires, Narragansett Bay Marine Task Force (fire boats) and support personnel would be called in through mutual aid. Once activated, fire boats can be on scene in 30-40 minutes providing salt water for suppression. Transportation of engines onto Prudence Island from the mainland or Aquidneck Island would require ferry utilization and would take considerable time. Any fire response requiring the activation of multiple mutual aid agreements would involve a high degree of complexity because of the remoteness, logistics and communication challenges involved.

TRAINING/PERSONEL

PIVFD currently has 25 NFPA Certified firefighters. Because only a portion of firefighters live year-round on the island, and many work off-island, firefighter availability can vary greatly by day, time and season. Generally, 2-6 firefighters are available at any given time. All firefighters have been through the firefighter training at the Rhode Island Fire Academy or other accredited institution. A small number of the firefighters have been trained in wildland firefighting through the National Wildfire Coordinating Group (NWCG) S-130/S-190 Introduction to Wildland Fire Behavior and Firefighter Training. Some members of the department have attended specialized trainings such as FEMA sponsored All-Hazards Training and water delivery trainings.

Training Recommendations

A large fire event on the island would require a high degree of coordination between numerous fire departments and agencies. A mutual aid joint training exercise is recommended in order to test plans under the most realistic possible conditions. Scenario-based or simulation training involving all mutual aid departments is recommended to prepare for a large event. Ideally hosted by RIDEM Forest Fire Control, a simulation of a large fire would allow for the testing of dispatch, response and communication plans. It would help identify potential problems and areas for improvement. Such a training may require professional facilitation. Funding may be pursued through a grant if available.

Future success in wildfire protection will depend on well-coordinated attack and well-trained firefighters. Wildland fire training and experience are recommended for PIVFD members. Participation in prescribed fires on the island is recommended in order to provide the opportunity to engage in live wildland fire activities. Prescribed fires provide the opportunity to practice use of wildland engines and utilize wildland fire suppression tactics, including the use of hand tools, bladder bags, drip torches etc. Prescribed fires also allow firefighters to familiarize themselves with fire behavior in the wildland setting, increasing situational awareness and safety when engaging a wildfire. Continuing to train firefighters in NWCG wildland fire classes is recommended to build knowledge and wildland firefighting skill sets. In some areas, indirect attack may be the best firefighting option. Any indirect attack would require that firefighters are experienced in wildland fire tactics.

Specialized trainings focused on tactics required on Prudence Island would improve effectiveness of PIVFD. Water conservation is of particular concern. A large fire or numerous structure fires could quickly tax the available water supply on the island. Refill times can be quite long and the efficient use of water may be a critical factor in ensuring success. Additionally, community well pump capacity and recharge rates will limit the rate at which cisterns refill following use. A large fire event could stress the water supply on the island as a whole. It is recommended that water use and water conservation trainings are conducted periodically in order to build and maintain skills. Water shuttling is a critical component of fighting fire on the island. A number of courses are available to train firefighters in water supply methods. Several members of PIVFD have attended “Got Big Water” training, a rural water supply operations seminar and live training event. Similar trainings are recommended to maintain skills and train new firefighters.

EQUIPMENT

PIVFD is a wholly volunteer fire department. The department has one fire station located at 0292 Narragansett Ave. The fire station houses all suppression apparatus on the island. The fire department has two Type 1 engines primarily for use on structure fires, three large tankers of 1,000 gallons or larger, one pump truck (capable of pumping salt water), and two Type 6 wildland fire engines (figures 12-19). All vehicles are beyond the expected replacement date. National standards, NFPA 1906: Standard for Wildland Fire Apparatus (2016), do not set a required replacement period but do recommend wildland firefighting apparatus over 20 years old be evaluated for replacement. NFPA 1912: Standard for Fire Apparatus Refurbishing (2016) states: “Because the changes, upgrades, and fine tuning to NFPA 1901 since 1991 have been truly significant, especially in the area of safety, fire departments should seriously consider the value (or risk) to firefighters by keeping fire apparatus more than 15 years old in first-line service." PIVFD apparatus range in age from 33 to 44 years old, placing them well beyond typical replacement age.

Current Equipment

Figure 12: Engine #82 1976 Maxim F   500-gallon capacity photo credit: John Galla firenews.org

Figure 13: Engine #83 1974 Maxim   500-gallon capacity photo credit: John Galla firenews.org

Figure 14: Tanker #1 1975 Fore/Farrar 4,000-gallon capacity photo credit: John Galla firenews.org

Figure 15: Tanker #2 1985 GMC Brigadier/Farrar 2,500-gallon capacity photo credit: John Galla firenews.org

Figure 16: Tanker #3 1975 AM General 6x6 (off-road capable) 1,000-gallon capacity photo credit: John Galla firenews.org

Figure 17: Brush #84 1995 Ford F-450 200-gallon capacity photo credit: firenews.org

Figure 18: Brush #85 1977 Dodge 4x4 (off-road capable) 250-gallon capacity photo credit: John Galla firenews.org

Figure 19: Pump #1 1985 Chevrolet 4x4 750 GPM Pump Truck photo credit: firenews.org

Current Firefighting Tactics
The current firefighting capabilities are highly dependent on distance from the nearest cistern. Direct pumping from a pumper engine to the tactical engine is the most efficient means. Typically, when engaging a fire, an engine will draw water from the nearest cistern and deploy supply hose to reach the tactical engine or to relay to a tanker. One pumper relaying to an engine can supply water up to 1,800 feet from the cistern. Once fire operations have begun, tankers will begin shuttling water from other cisterns to the cistern tapped for the operations to prevent the cistern from running dry.

As distance from a cistern increases, a second pumper must be put in series to allow for water to be pumped greater distance from the water source. If the fire is greater than 1,800 feet from a cistern, a tanker is put in relay to deliver water another 1,800 feet for a total of 3,600 feet distance from the cistern to the tactical engine. Beyond roughly 3,600 feet, direct or series pumping is no longer possible and water shuttling must be used to supply the tactical engine.

Shuttling is much less efficient than direct pumping and involves considerable time and coordination for supplying water. If firefighting operations are beyond 3,600 feet from a cistern, a large portable tank is set up near the fire and is filled from tankers. The three tankers fill at cisterns and dump water into the portable tank from which the water is pumped to the tactical engine(s). Hooking up, detaching, filling, and travelling to and from the scene all take considerable time.

Wildland fire is typically engaged using Brush #84 and Brush #85. The brush engines are usually refilled from Tanker #3, the only off-road capable tanker, at 100 gallons per minute. Tanker #3 holds 1,000 gallons of water. The wildland engines are generally not capable of driving through the woods, and must remain on roads, trails or in open areas. As a result, lengthy hose lays are needed to attack remote fires. Fires with low flame lengths may be attacked using hand tools, but under high fire danger conditions flame lengths will likely be too high to be engaged using hand tools alone.

Equipment Recommendations
The firefighting apparatus for Prudence Island should be suited to fire environment. Large portions of the island, including many residences, are accessible only by rough paved, gravel or dirt roads which are difficult to access with traditional structural fire engines. During winter months, roadways are impacted by snow and ice making travel more difficult. Periods of heavy precipitation regularly cause wash-outs, and when coupled with high tides, roads may become impassable. The island has the potential for a large wildland fire and current capabilities leave Brush #84 and Brush #85 as the only engines capable of responding to a typical wildland fire. Engine #83 is the primary structural firefighting engine but has a limited ability to navigate the island under difficult road conditions. The fleet of fire apparatus should be constructed with access and agility as priorities. A combination of wildland and WUI engines is better suited for responding under difficult conditions while still meeting the needs for traditional structural firefighting.

Current equipment needs upgrading in order to maintain and improve firefighting capabilities on the island. The brush engines #84 and #85 are 23 and 41 years old respectively, and need replacement. Pump #1 is mounted on a truck that is over 30 years old. The pump is still suitable for use, however, the truck on which it is mounted should be replaced. A replacement truck for Pumper #1 should be a heavy duty off-road capable truck.

It is recommended that Brush #85 is retired and is replaced by two new wildland/WUI fire engines. The new engines should have capability for off-road wildland suppression and structure protection. Figure 20 shows a Nantucket engine designed for WUI fire suppression. A similar configuration is recommended for Prudence Island. It has 1,000-gallon capacity. It may be best to acquire two 1,000-gallon capable WUI engines similar to the engine shown in Figure 20. Alternatively, the replacement for Brush #85 could be one WUI engine and one Type 6 engine. With lower height and smaller turning radius, a Type 6 may have greater access to remote areas, however, it has less water capacity and less pumping capability (Figure 21, example Type 6 engine).

The areas that require water shuttling are generally difficult to access. Tankers #1 and #2 do not have off-road capabilities and can only be used in areas with paved roads. A wildland capable tanker is needed to augment wildfire firefighting capabilities. The new tanker should be off-road capable with a capacity of 1,000 gallons or greater. The tanker should be built on a Mercedes Unimog or similar truck body that provides adequate clearance and off-road accessibility.

It is recommended that one or two side-by-side off-road utility vehicles (UTVs) be purchased and outfitted with slip-on pump systems. UTVs serve as Type 7 wildland fire engines that can attack wildland fires in more remote areas than larger engines. The maneuverability allows for patrol of fire breaks, and for direct attack along trails and other areas inaccessible to other engines. The large number of trails on the island potentially could provide access to a UTV engine, allowing for initial attack in areas previously inaccessible by engine. A UTV engine can deliver significantly more capability than firefighters with backpack pumps. UTVs can serve other functions in the fire department, assisting in search and rescue or other operations needing access to the forests. Some UTVs, such as Bobcat's Toolcat, can utilize a number of attachments including mowers, buckets, graders and others that may be utilized in fire line prep and fuel reduction projects.

Figure 20: Nantucket WUI engine photo credit: Josh Nigro firenews.org

Figure 21: Type 6 engine Dartmouth Fire Department Photo credit: MEB firenews.org

WATER SUPPLY
Prudence Island has no standing fire hydrants for use in firefighting. The island relies on a system of cisterns to hold water to be accessed by the fire department. The Prudence Island Water District was established in 2004 to provide clean water to the residents of Prudence Island. The district serves the eastern portion of the island, including all Zone 3, the eastern shore, and Zone 5, Warnerville. The Neck and western portions of the island are not on district water supply and rely instead on wells. The water district relies on ground water which is pumped into large tanks and cisterns for fire suppression. Locations of water supply points and proposed additions are displayed in Figure 22.

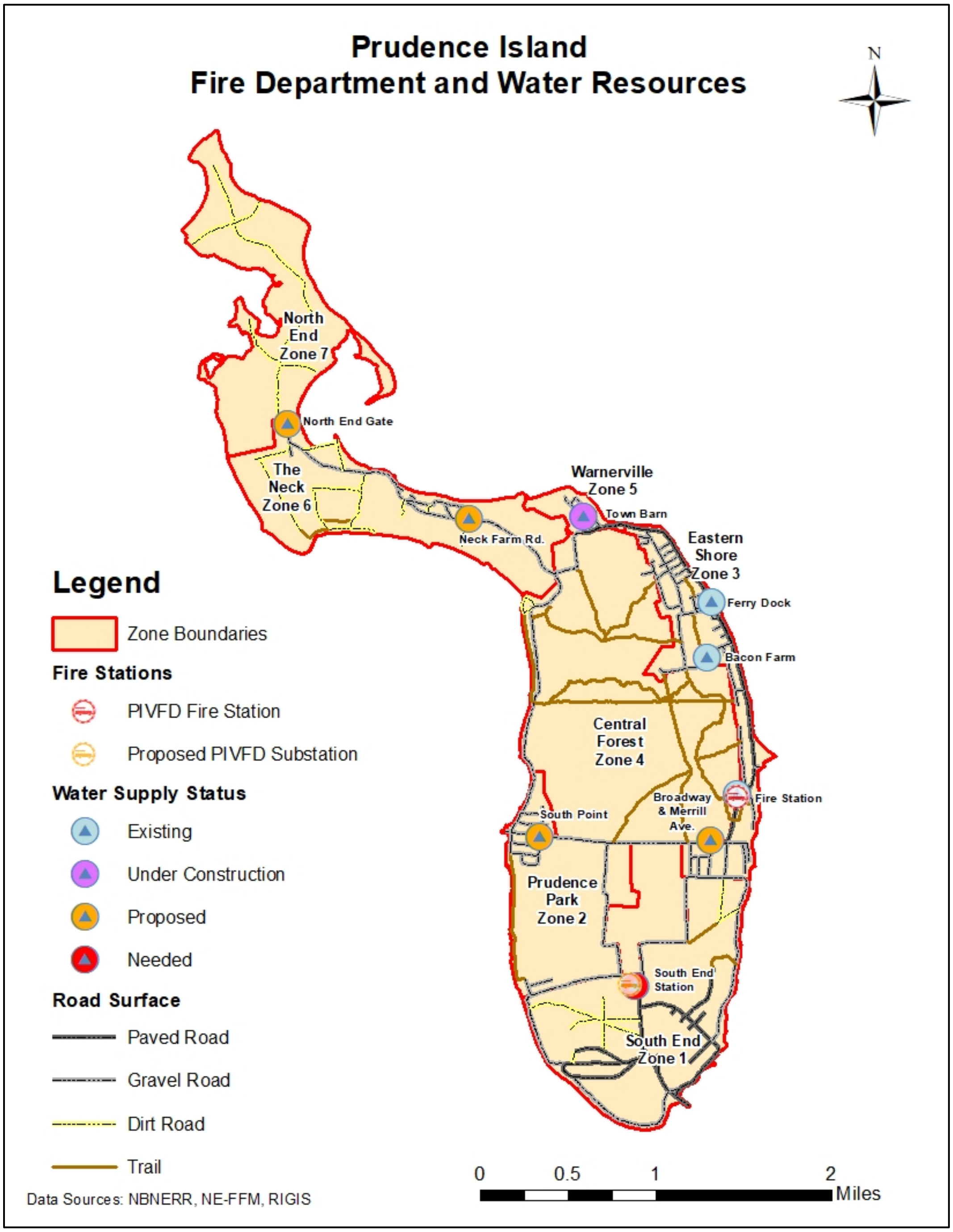


Figure 22: Map of current and proposed fire stations and water supply

Water Supply Goals

- Water supply located within one pumper direct supply distance (~1,500 feet) of 75% of residences
- Water supply located within two pumper direct supply distance (~3,000 feet) of 85% of residences
- Tanker refill time under 15 minutes (using 3 tankers) for all residences outside of direct supply area (requires 45-minute turn-around time per tanker)

  Note: 1,500 and 3,000 feet instead of 1,800 and 3,600 feet from water supply were used to account for curves in hose deployment

Current Water Supply

Fire Station: The fire station has a 10,000-gallon steel cistern used to for refilling during fire operations. The cistern was installed during the 1980s. It is the primary refilling option for fire suppression. The cistern is nearing replacement age. Steel cisterns are typically warrantied for 30 years, so a replacement cistern will be needed in the near future.

Ferry Dock: A 15,000-gallon buried reinforced concrete cistern is located at the ferry dock. It is accessed by the fire department through a stand pipe. The cistern was installed in 2015.

Greer Tank: The fire department has a 12,000-gallon cistern located adjacent to the water district storage cistern, known as “big blue”. The water district cistern is accessed by a dry hydrant and is the third filling option.

Under-Construction Water Supply

Warnerville Town Barn: A 15,000-gallon cistern is planned (anticipated 2018-2019 completion date) to be located behind the town barn in Warnerville. The cistern will provide the primary refill location for fires in Warnerville and the Neck. It should allow for direct pumping throughout Warnerville.

Proposed Water Supply

PIVFD has proposed the addition of four cisterns. The new cisterns will provide increased water supply capacity in the most densely populated areas and decreased refill time in other distant areas. The additional water supply would allow for faster refilling of cisterns being used during active fire suppression and would reduce the danger of running out of water during a large fire.

Broadway & Merrill Ave.: Town land located on the northwest corner of Broadway and Merrill Ave. has been identified as priority location for additional water supply. The addition of a cistern at the site would increase water supply availability, particularly in the more densely populated areas south of the fire station. The cistern would be capable of direct supply to engines fighting fire in the neighborhoods south of Broadway between Alden Ave. and Beach St. The cistern reduces the distance to refill for fires along the western shore by more than 2,000 feet.

Prudence Park: The Prudence Park neighborhood, located along the western shore, currently has no water supply for fighting fire in the developed area. The proposed cistern on Broadway is roughly one mile from the neighborhoods between Atlantic Ave. and Bay Ave. It is recommended that a site be identified for the construction of an additional cistern somewhere central in the neighborhood. Currently, the only way to resupply water to Prudence Park is by shuttling water with tankers from the fire station. A cistern located within the neighborhood would allow for a direct supply line during firefighting operations, limiting or eliminating the need for extensive water shuttling operations. The proposed new cistern in Prudence Park would also decrease the shuttle distance for residences on the west shore and would increase the amount of water available for firefighting.

Neck Farm Rd.: The northeast intersection of Neck Farm Rd. and Bay Rd. has been identified as the preferred location for a cistern supplying the residences in the Neck. Most structures in the Neck are within 1,500 feet of the proposed location. The cistern would allow for increased protection of structures within the Neck and would dramatically decrease refill time for any fires in the Neck or areas to the north.

North End Gate: A 15,000-gallon cistern is proposed to be installed at the entrance gate to the North End. The cistern would provide a water source to stop a wildland fire approaching from the north and would provide a large water source for the structures north of the entrance to Potters Cove. It would be the only water source north of Jenny's Creek.

Other Needed Water Supply:
NBNERR HQ: Former Navy land, now occupied by NBNERR offices, has been identified as a potential location for cistern installation. Sturdy, concrete foundations, remaining from removed Navy buildings, are already in place. The location has also been identified as the preferred site for a fire department substation. The addition of a cistern at the site would decrease the distance required for refill from Stevens Landing Ln. by over 1.5 miles.   The cistern would be between 2,500 and 3,500 feet from the Stevens Landing residences, allowing for two-pumper direct supply to most residences in the neighborhood.

Water Supply Improvements:
Cisterns which are not located in proximity to available water district distribution line connections, need to be filled by shuttling water. The addition of rain collection would reduce the need for refilling by shuttling water. The town barn roof could be used for rain collection and directed to the new cistern. A cistern constructed at the NBNERR offices may be able to use rainwater collection to assist in refilling after use. If possible, a cistern at NBNERR should be elevated to allow for top-filling of engines. Elevated tanks are of particular use in fighting wildland fire because wildland engines can be quickly top-filled and then return to the fire. Any elevated tank would need to be heated in order to prevent freezing. Other tanks should be heated as needed to prevent freezing during cold weather.

FIRE STATION(S)
Current Fire Station:
The Prudence Island Volunteer Fire Department Station is located at 0292 Narragansett Ave., roughly 1,300 feet north of the intersection of Narragansett Ave. and Broadway. The station is ~4,000 square feet, with three equipment bays occupying ~2,500 square feet and ~1,500 square feet of equipment storage and meeting space. Currently, Engine #81, Tanker #1 and Tanker #2 are stored in the bays and Brush #85, Tanker #3, and Brush #84 are stored outdoors in the open or under an open-sided metal shed. The station is centrally located to respond to fires on either shore.

The needs of the fire department have far surpassed what the current station provides. Six vehicles are currently stored in three bays. The two brush engines and one tanker are not protected from the elements, and during colder months must be winterized. All equipment should be stored in a temperature-controlled environment. The station does not have the space to accommodate the current equipment, let alone the recommended equipment additions and replacements.

Fire Station Needs:
Additional storage for apparatus is recommended. Ideally, a substation housing some of the equipment would be constructed somewhere on the island. The NBNERR headquarters, located on former Navy land, is the preferred location for a new wildland fire substation. Foundations, left over from demolished Navy buildings, are already in place, and would likely be suitable for a new substation. The proposed substation should provide temperature-controlled storage for equipment, space for personnel, and a heated water supply.

STANDARD OPERATING PROCEDURES (SOPs) FOR WILDFIRE

SOPs for wildfire response should be developed in order to improve preparedness and effectiveness in the event of a large wildfire. A communication plans should be in place, allowing for a dedicated wildfire tactical channel separate from other first responders. A risk assessment should be conducted to evaluate the feasibility of suppressing fire at designated fire breaks rather than attacking fire interior to the forests. The risk assessment should also consider the use of indirect attack, using backfire and burn out techniques to reduce risk to firefighters and equipment while providing for public safety.

RESPONSE SUMMARY

Current and under construction cisterns will provide one pumper or two pumper relay to most of the residential areas in Warnerville and along the Eastern Shore (see Figure 23). All other residential areas on the island rely on water shuttling for fire suppression. Response times and shuttling times are highly variable and dependent on weather, personnel and equipment. The dynamic operating conditions can result in bottlenecks and delays in consistently delivering sufficient water for high demand firefighting operations, such as multiple structure fires or a WUI fire involving wildland and structure fires. In the event of an extreme emergency, water may be drafted from the bay. Utilizing salt water has numerous logistical and environmental problems, and can damage firefighting equipment.

The addition of recommended cisterns would allow for relay pumping at nearly all residences on the island. Water shuttling areas would be limited to a few residences on the Western Shore and a number of uninhabited areas (see Figure 24). The maps (Figures 23, 24) display areas within a 1,500-foot buffer of cisterns and within 500 feet of a road to represent areas that could be supplied from one pumper at the cistern. The 3,000-foot buffer represents areas that would need two pumpers in relay to supply water. Distances of 1,500 and 3,000 feet are used instead of the 1,800 and 3,600-feet maximum capability to account for curves and slopes in the hose deployments. Distances of 300 feet and 500 feet from roads are displayed to show which areas are easiest and most difficult to access. The maps show access with the proposed improvements to the Army – Heritage Trail.

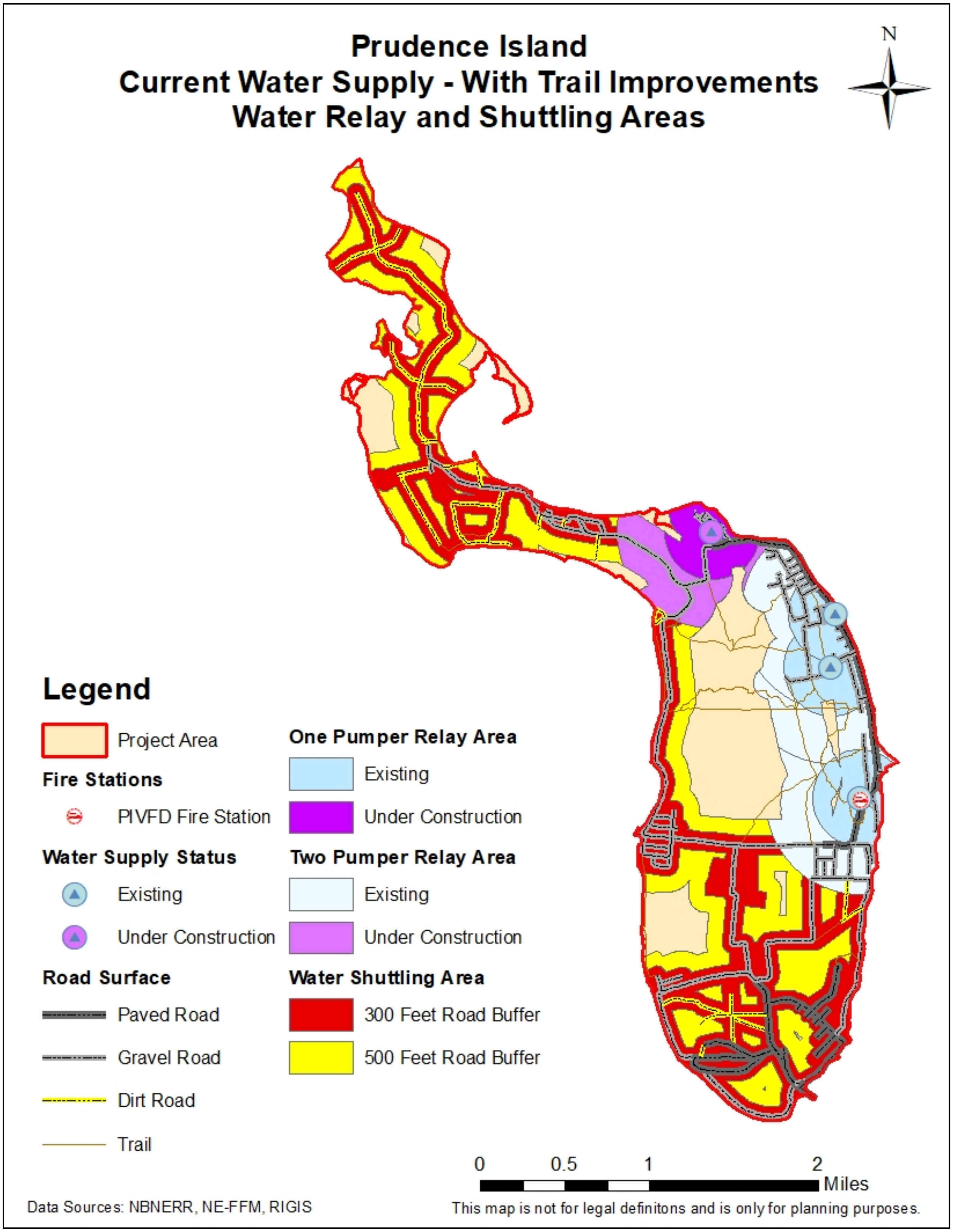


Figure 23: Map of estimated current and under construction water access type
Note: 1,500 and 3,000 feet distance were used to account for curves in hose deployment

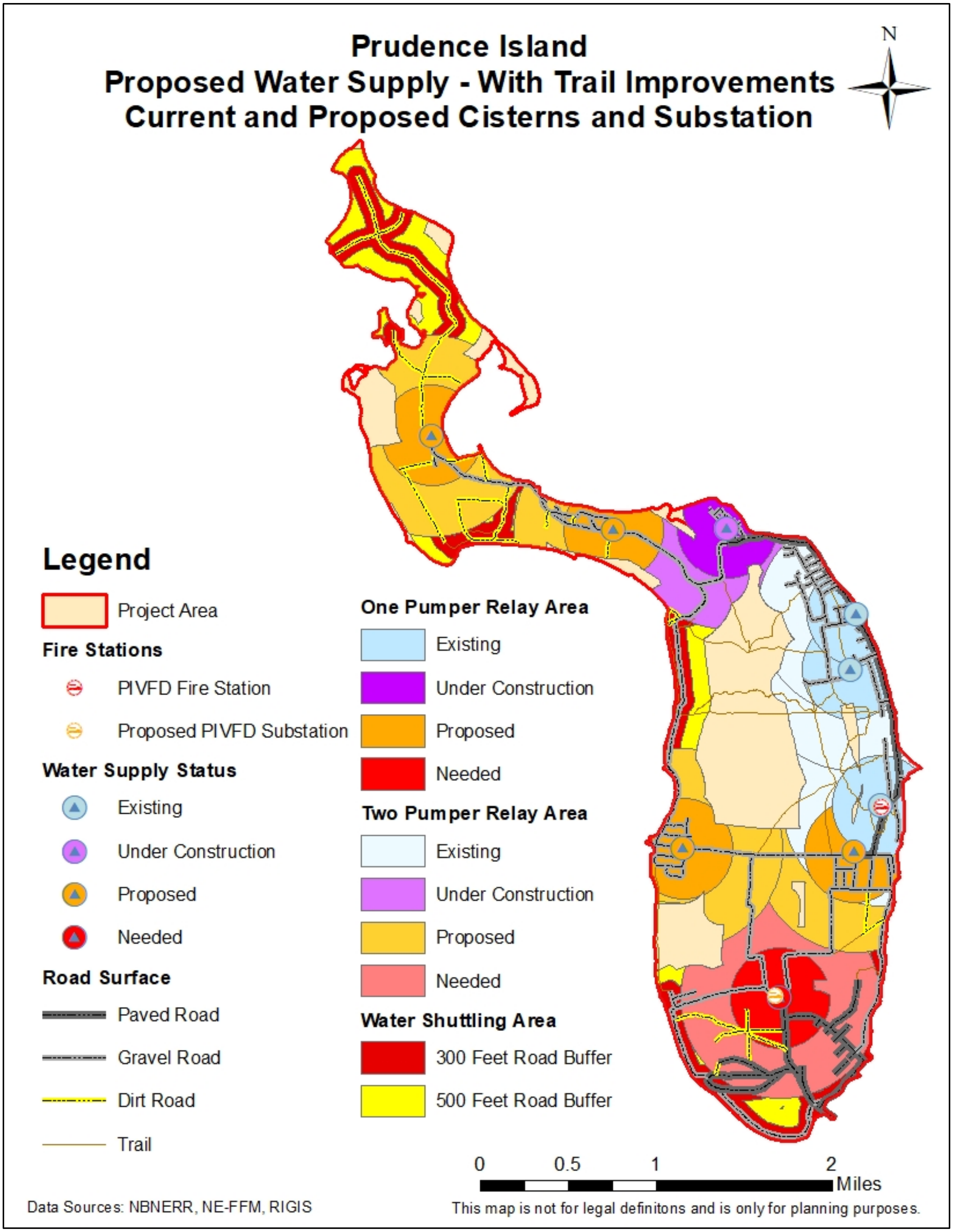


Figure 24: Map of estimated water access type with recommended improvements
Note: 1,500 and 3,000 feet distance were used to account for curves in hose deployment

Wildland Response

Most of Prudence Island is covered in hardwood forest. Suppression using hose lays is the preferred method of attack in the hardwood forest type. Interior areas of the forest may require long hose lays in order to reach a remote fire. Currently none of the trails in the interior of the forest are accessible by engine. The CWPP recommends opening up the Heritage – Army Camp Trail to be travellable by wildland fire engine. The map shown in Figure 25 shows all areas within 300 feet and 500 feet of a road or trail travellable by a Type 3 or Type 6 wildland fire engine. The map includes the Heritage – Army Camp Trail. The buffer of 300 feet was chosen as a distance easily reachable with a short hose lay, and 500 feet as a more complex hose lay. Areas farther from roads are accessible, but would require longer hose lays. Under some conditions indirect attack may be preferred. The map shows roadways from which burnouts or backfire could be lit. If the department acquires UTV engine(s), smaller trails may be utilized for suppression or indirect attack.

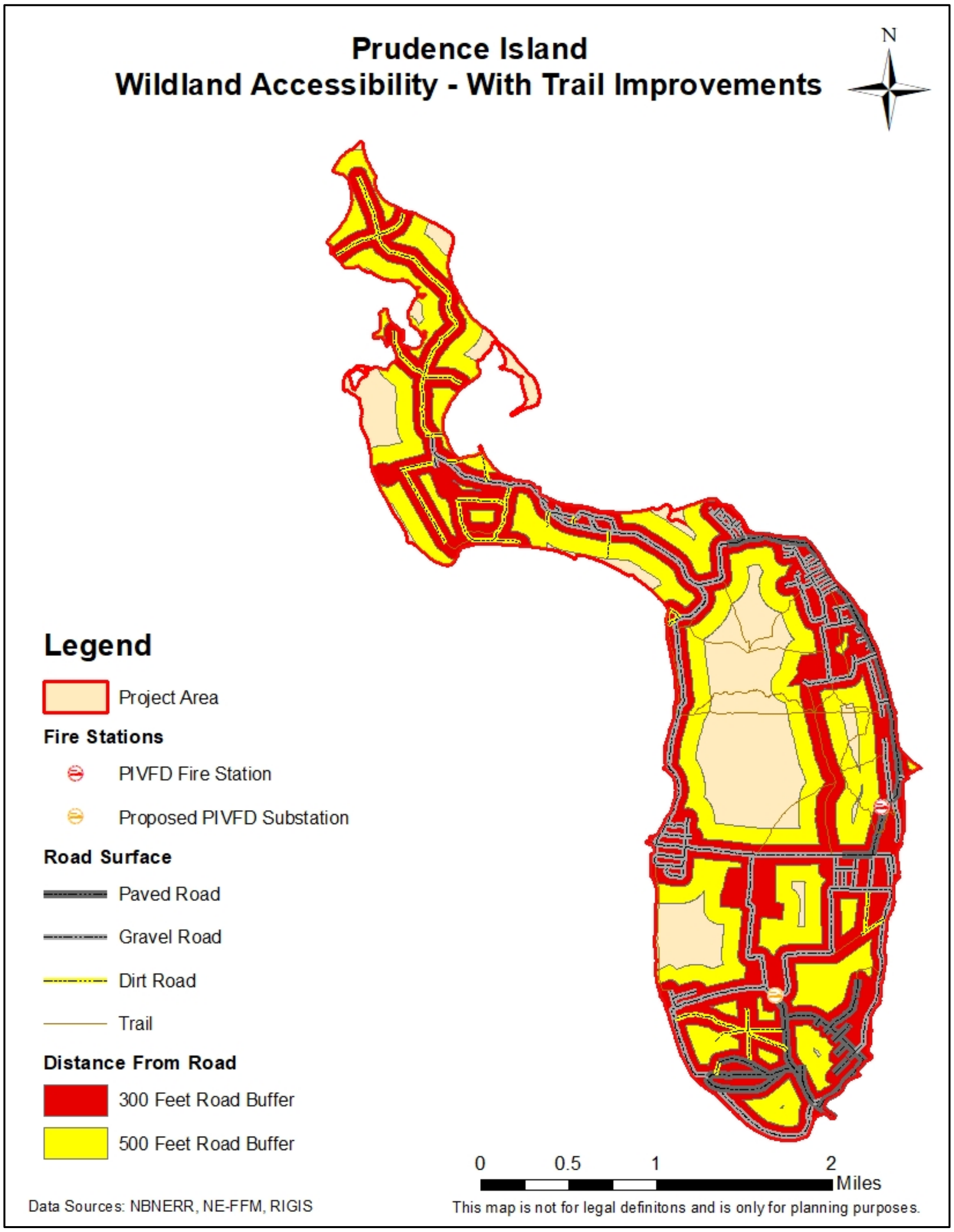


Figure 25: Map of all wildland accessible roads buffered 300 feet and 500 feet; map includes proposed improvement to Heritage – Army Trail

MANAGEMENT RECOMMENDATIONS

The Prudence Island Community Wildfire Protection Plan has identified four areas to increase wildland fire preparedness on the island. The four identified strategies are: incorporate Firewise practices, implement fuel treatments, install and maintain fuel breaks, and conduct prescribed burning designed to reduce wildland fire risk. See Figure 30 for map of fuel treatment areas.

The high proportion of protected land on the island may cause complications for the implementation of fuel treatments and Firewise recommendations. Many residences are located adjacent to or near conservation lands. Fuel mitigation activities on conservation lands may be limited by deed restrictions, conservation easements or ecological concerns. Efforts to manage fuels on protected land would require considerable coordination between residential property owners, conservation land owners, easement holders and town officials. Any fuel treatments would need to be done in a manner consistent with conservation objectives. Issues related to permissions, liability, responsibilities for treatments, funding, maintenance and documentation would all need to be addressed before any treatments could be planned on conservation land. It is recommended that a process be put in place to facilitate the treatment of high fire danger fuels on conservation lands within the WUI.

Zone 1 (South End):
Recommendations:

- Implement prescribed fire in NBNERR
- Maintain and improve firebreaks within the preserved land
- Clear flammable vegetation from under and around the powerline

Structures within Zone 1 are generally well protected. Ample defensible space surrounds the NBNERR offices. Some areas within Zone 1 are modeled to potentially carry crown fire and torching under high fire behavior conditions. Prescribed burns can reduce fuel loads, reduce ladder fuels and decrease the likelihood of extreme fire behavior. Continuing and expanding the prescribed fire program within the NBNERR South Reserve component is recommended.

The main power cable supplying electricity to the island comes ashore on the eastern shore of the island on the northern most point of the South End. This area is in constant need of brush cutting and maintenance. Most of the area is overgrown and, in the event of a fire, would sever power to the island for an extended period of time; resulting in limited access to the island's water supply and a short-term cessation of ferry service until repairs to the power supply could be implemented. Vegetation under and near the power line should be cleared and maintained as open to prevent a wildfire from compromising the island's power supply.

Zone 2 (Prudence Park):
Recommendations:

- Implement Firewise treatments on individual properties/structures
- Facilitate Firewise treatments on protected land within the "structural ignition zone"
- Implement fuel treatments between Broadway and residences near Stevens Landing Ln.
- Reduce midstory and ladder fuels in forested strip between houses and Broadway

Zone 2 contains numerous structures within the WUI. Most structure in the Prudence Park neighborhood, at the west end of Broadway have defensible space, however houses near the edges of the wooded areas should implement Firewise fuel treatments. Some areas between lots are covered in a mixture of greenbrier and grasses. Fire could move quickly through such fuels, allowing for fire to move between structures, or for falling embers to ignite structures that are isolated from the wooded edges. Mowing such patches or cutting them back from buildings would reduce the risk of structural ignition.

Zone 3 (Eastern Shore):
Recommendations:

- Implement Firewise treatments on individual properties/structures
    - Highest priority is structures west of Alden Ave., Governor Paine Rd., Narragansett Rd. (South of intersection with Gov. Paine Rd.) and Homestead Ave. because they directly interface the wildland areas
- Maintain and/or widen mowed shoulders along Broadway, South Reserve Dr., Narragansett Ave., and Governor Paine Rd. to serve as fuel breaks
- Mowing or other understory fuel treatments may be needed in the areas east and northeast of Baker Farm to mitigate modeled high flame lengths and rates of spread
- Isolated patches of grass and greenbrier may be mowed or burned to reduce the risk of fire burning to or between structures

Zone 3 contains the largest number of structures of any zone. The WUI is linear, running roughly parallel to the eastern shore with the structures concentrated along the coast with forest to the west. Most structures are east of a roadway, however, there are numerous structures that directly abut forested areas. Implementing Firewise practices is important for protecting structures in the zone, particularly those abutting the forest. Under high fire behavior conditions, shrubs and vines growing into the canopies of trees in the forest could ignite causing embers to fall in areas east of the roadways. Islands of fuels within in the zone may be mowed or burned to reduce the fire danger within settled portions of the zone.

Zone 4 (Central Forest):
Recommendations:

- Implement Firewise treatments on individual properties/structures
- The structures along the western shore should follow Firewise recommendations
- Widen trails to serve as fire breaks
- Heritage-Army Camp trail should be passable by a Type 6 engine.
    - A widened trail would serve as access and as an anchor point for attacking wildland fire
    - A widened trail would provide stability for safe passage of fire apparatus during high water or other emergencies. The trail would serve as an alternative north-south route connecting the fire station and south end to the neighborhoods around the ferry dock.
- Division Wall trail should be mowed or otherwise maintained to serve as a fuel break and access point for firefighters. If a UTV mounted engine is acquired, the break should be accessible by UTV
- Consider understory mowing as a fuel reduction technique or precursor to prescribed fire
- Consider prescribed fire as a means to reduce fuel loading and fire danger (current conditions make safe implementation difficult)
    - Remove ladder fuels through mowing or other treatment prior to implementing prescribed fire to reduce flame lengths and reduce mortality of overstory trees
    - Mowing with removal of ladder fuels alone would temporarily reduce the risk of high flame lengths and rates of spread and torching trees, if combined with prescribed fire the effect would be greater and longer lasting
- Potential target areas for prescribed fire:
    - The 200 acres between Baker Farm, Broadway, Heritage-Army Camp trail and Gov. Paine Rd.
    - Pitch pine woodlands in the northwest portion of the zone

Zone 4 is mostly forested. The fuels are dominated by thick greenbrier, with both green and dead canes forming a thick matrix of vines. The depth of the fuel bed typically ranges from two to four feet and climbs up trees into the canopy. Hardwood litter on the surface carries fire underneath the vines. Under extreme fire conditions, flames may carry up vines, into the tree tops. Fuel treatments should focus first on reducing ladder fuels by cutting and pulling vines from trees and second, reducing the fuel bed depth by mowing.

Zone 5 (Warnerville):
Recommendations:

- Implement Firewise treatments on individual properties/structures

Warnerville is separated from the large block of wildland fuels by Narragansett Ave. Fuel treatments around individual structures are the best treatment to prevent impacts from wildland fire. Fires within the zone would most likely originate from falling embers or from sources within the zone (e.g. pile burns, structure fires, etc.).

Zone 6 (The Neck):
Recommendations:

- Implement Firewise treatments on individual properties/structures
- Consider implementation of prescribed fire in uninhabited areas

Many residences and structures within the Neck abut wildland fuels. Clearing defensible space around structures is the highest priority fuel treatment in the zone. Prescribed fire would help reduce fuels and may have ecological benefits in the zone.

Zone 7 (The North End):
Recommendations:

- Improve and maintain the north fire break
- Implement prescribed fire

The North End is uninhabited. The north firebreak provides a defensible area in which to stop a fire approaching from the north. Prescribed fire could reduce fuel loads and provide ecological benefits. Mechanical treatments may be required to prepare for prescribed fire implementation.

Mechanical Fuel Treatment Guidelines
Mechanical fuel treatments in wildlands typically involve understory mowing and/or overstory thinning. Logging and/or mowing equipment is used to mow, chip, or remove vegetative materials. Fuel treatments may be implemented as a standalone project or as a precursor to prescribed fire. Fuel reduction treatments nearly always require regular follow-up maintenance to keep fuel loads low. Fuel treatments can often be done in a way that maintains or enhances wildlife habitat. Figures 26 and 27 show before and after photos from a fuel treatment project on Martha’s Vineyard.

Figures 26, 27: Before and after fuel treatment at M.F. Correllus State Forest. Credit: William Patterson III, funded by Joint Fire Science Exchange

A variety of equipment may be suitable to implement fuel reduction projects. In flat open areas, mowing may be done with a brush-cutter (a.k.a. “Bush Hog”) type tractor implement. In heavily forested areas, heavy equipment is usually required. The figures below show two equipment arrangements used for vegetation mastication. Figure 28 shows a tracked excavator with a forestry mulcher mastication head. Figure 29 shows a wheeled front end loader with a Fecon forestry mastication head. Either would be suitable for reducing ladder fuels and shrubs that may contribute to high fire behavior. On Prudence Island, an excavator based set up may be the best option because the reach of the arm would allow for cutting of vines, shrubs and low branches that allow fire to climb into the canopy. Any fuel reduction projects that are a precursor to prescribed fire should only be done in close consultation with a prescribed fire specialist because if done incorrectly, could make prescribed fire implementation difficult or impossible.

Figure 28: Excavator with mastication head
Credit: US Forest Service

Figure 29: Front end loader with Fecon mastication head
Credit: William Patterson III, funded by Joint Fire Science Exchange

Potential sites identified for fuel treatments on Prudence Island are generally located near residential areas. The treatment areas would be intended to provide defensible space for firefighters protecting structures, and a fuel arrangement unlikely to support crown fire. Figure 30 shows a number of areas that if treated, could reduce the risk of wildland fire impacting residential areas.

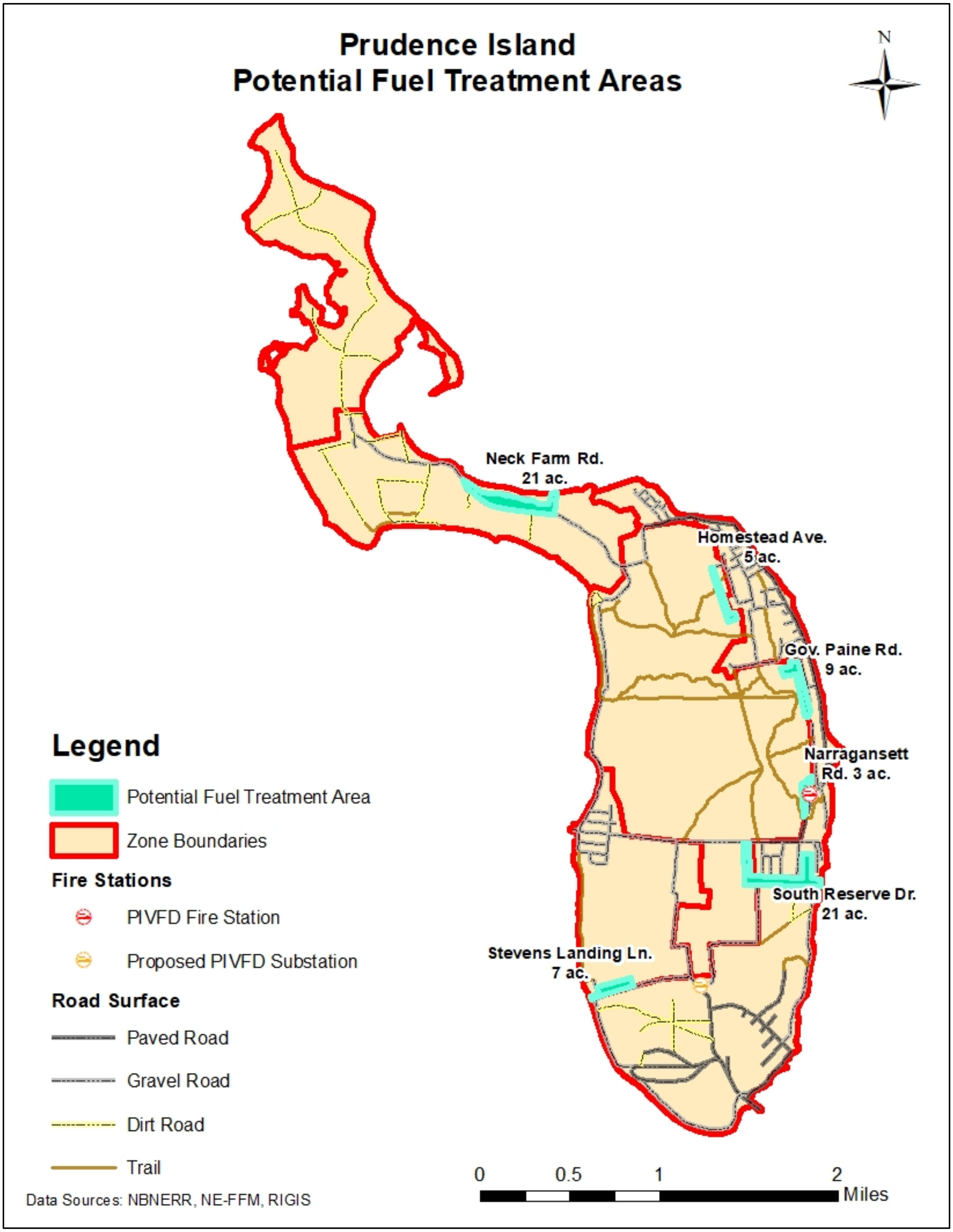


Figure 30: Map of potential fuel treatment areas and estimated acreage

MEASURES TO REDUCE STRUCTURAL IGNITABILITY – FIREWISE

Many structures on Prudence Island are vulnerable to wildfires because of the close proximity of wildland fuels and the increased time required for mutual aid response. However, homeowners can take simple actions to reduce the potential ignition of their homes. A home's exterior and yard characteristics can greatly influence its ignitability and chances for survival (Cohen 2000).

In addition to homeowner education, professional assessments would help identify vulnerabilities for individual properties. Structures should be evaluated on a parcel by parcel basis, in which the land owners would be given suggestions specific to their property. Such an effort could be part of a Firewise Community Program, discussed later in this section.

Forests and other protected wildlands are often in close proximity to structures. Clearing of brush, vines and other dangerous fuels may not be allowed by conservation land use restrictions. As a result, fuels may be located within the structural ignition zone, but homeowners lack the ability to manage the fuels. It is recommended that a process be put in place to allow property owners to implement Firewise practices on neighboring wildlands, in cooperation with the landowner, without negatively impacting conservation objectives.

For a home to ignite, all three sides of the fire triangle, heat, fuel and oxygen, must be present. In the WUI, which includes much of Prudence Island, a house may be the fuel. Flames from burning material like firewood piles, vegetation, and neighboring structures supply heat. Firebrands, or floating embers, can also supply heat when they collect on a house or nearby flammable materials like shrubs or firewood piles. Fires do not need to continuously burn through vegetation to ignite homes. Home ignitions depend on the characteristics of the home and its immediate surroundings, particularly the vegetation in the home ignition zone (Figure 31, 32).

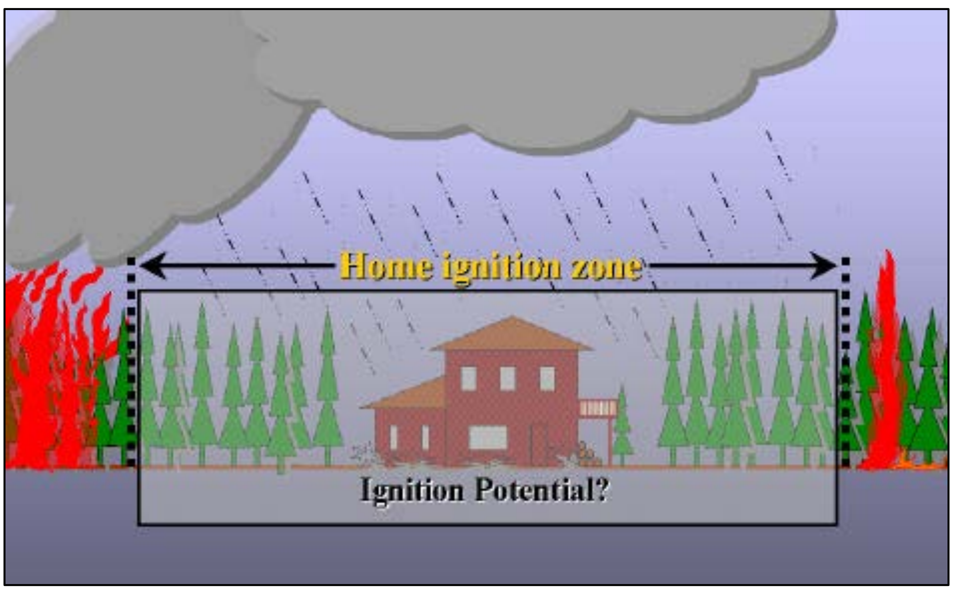


Figure 31: The home ignition zone (from Cohen 2000).

Most home ignitions in the WUI occur from lofted firebrands, measures to reduce home ignitability involve managing adjacent fuels and adjusting home design and building materials (Cohen 2000). Clearing the home ignition zone of vegetation or other flammable material and using non-flammable roofing material can greatly reduce the ignition of homes in the WUI. Howard et al. (1973) observed 95 percent survival for homes with non-flammable roofs and a vegetation clearance of 10 to 18 meters. Foote (1994) observed 86 percent survival for homes with non-flammable roofs and a clearance of 10 meters or more.

Homeowner initiatives to reduce the potential of home ignitions from wildland fire can be very successful. Many resources exist to aid homeowners in reducing structural ignitability from wildland fire. The National Fire Protection Association (NFPA) started the Firewise Communities initiative in 1997 to help communities adapt and live with wildfire while encouraging local solutions for wildfire safety and increased preparedness. The Firewise initiative has published many strategies to reduce the risk of structures burning in the WUI during a wildfire. Guides for landscaping and construction, as well as many other resources for homeowners, are available on the Firewise website, www.firewise.org.

Firewise has created guides and tools for homeowners, firefighters, and planners to aid in improving wildfire preparedness and reducing WUI fire hazards. For homeowners, they address strategies to reduce home ignition risk in two categories, landscaping and construction.

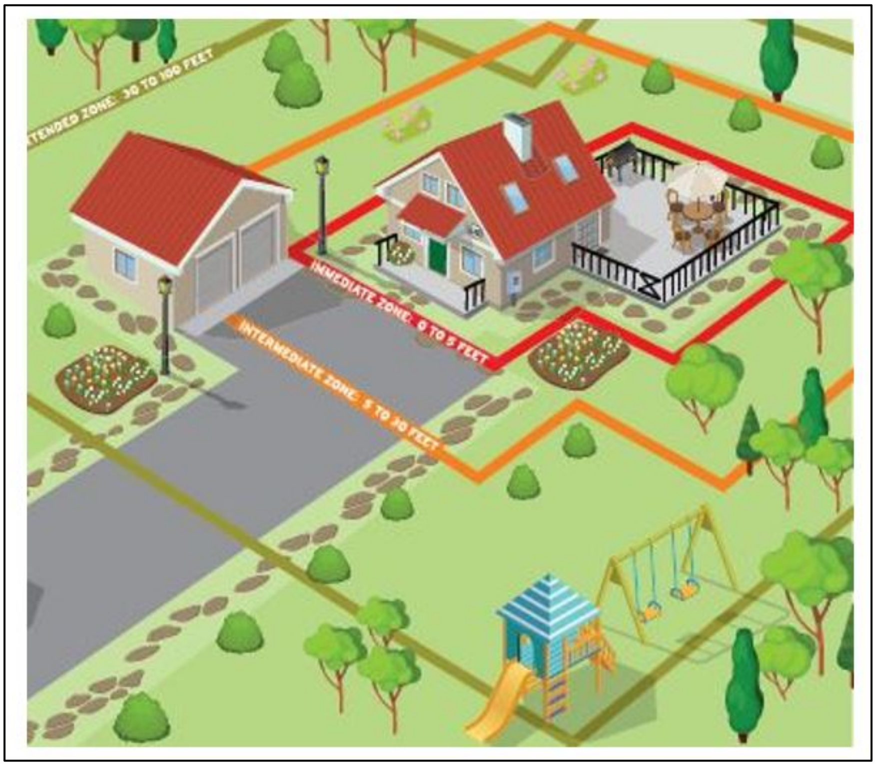


Figure 32: The Home Ignition Zone (FireWise accessed 2018)

LANDSCAPING
Firewise landscaping focuses on removing or limiting flammable vegetation in the home ignition zone. The home ignition zone can extend up to 200 feet surrounding the house in high hazard areas. A house surrounded by grass fuels has a home ignition zone of approximately 30 feet. In shrub fuels, the home ignition zone extends 50-100 feet around a structure (Figures 31,32). On Prudence Island, structural ignition from wildland fire would likely originate from falling embers resulting from burning shrubs and vines climbing into trees.

Maintaining a Firewise area in the 30 feet surrounding the home can reduce the risk of structural ignition from firebrands. This initial 30 feet should be a well-irrigated area free of dense vegetation. The Firewise Guide to Landscape and Construction makes the following recommendations for landscaping to reduce fire risk in this area:

- Space plants carefully, choose low-growing plants free of resins, oils, and waxes that burn easily.
- Keep grass short by mowing the lawn regularly.
- Prune trees up to 6-10 feet from the ground, trimming trees that overhang the house.
- Space conifer trees 30 feet between crowns.

- Within 5 feet of the home, create a 'fire-free' area using non-flammable landscaping material like pebbles and/or high-moisture content plants (Figure 33).
- Remove dead vegetation from under the deck and within 10 feet of the house.
- Store firewood away from the home.
- Water plants, trees, and mulch regularly.

Figure 33: Non-flammable materials near the home's foundation (from Firewise Guide).

If the home is in surrounded by dense shrub fuels, the next 30-100 feet should also be maintained to reduce fuel. Plants should also be low-growing, well-irrigated, and less flammable. The Firewise Guide suggests the following:

- Leave 30 feet between clusters of 2-3 trees, or 20 feet between individual trees.
- Encourage a mixture of deciduous and coniferous trees.
- Use driveways, gravel or rock walkways, and lawns to create fuel breaks (Figure 34).
- Prune trees up 6-10 feet from the ground.

Figure 34: Fuel breaks between vegetation and the house (from Firewise Guide).

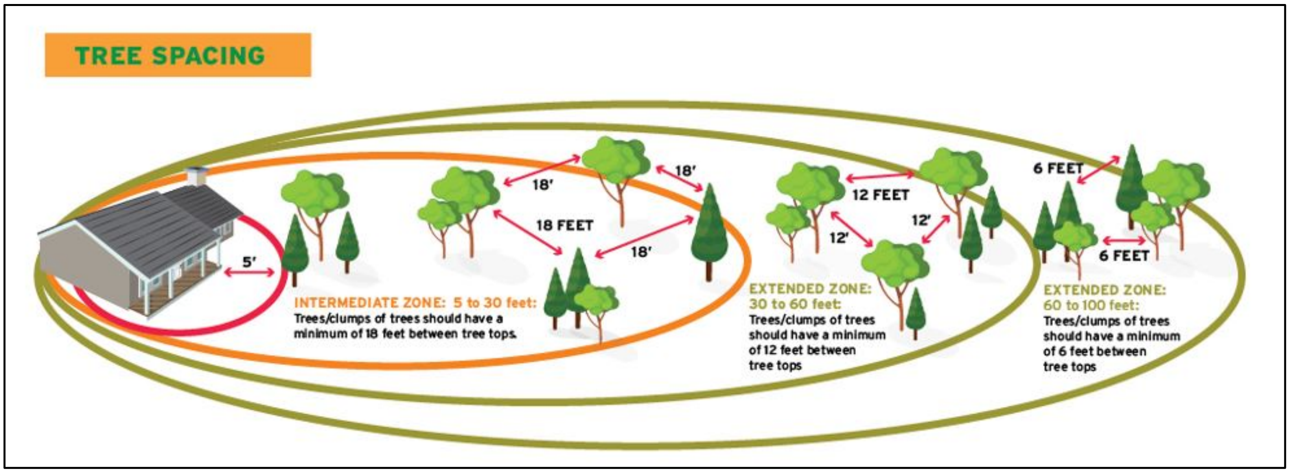


Figure 35: Intermediate and Extended Zones (FireWise accessed 2018)

CONSTRUCTION

Many homes on Prudence Island are historic and it may not be feasible to retro-fit Firewise designs. Thus, the primary focus of Firewise work on the island should be on creating defensible space around structures instead of addressing construction. New construction and home renovations, however, should incorporate the following simple recommendations in order to reduce the probability of structural ignition.

Fire resistant building materials and home design can reduce a home's ignition potential. Many lofted firebrands collect on roofs and are responsible for igniting structures (Cohen 2000). Roof ignitions commonly result in total home destruction. The Firewise Guide recommends using Class A, B, or C rated fire-resistant roofing material. Fire resistant building materials like cement, stucco, plaster, or masonry on exterior walls retard fire spread. The Firewise Guide also makes the following suggestions to building or retro-fitting a Firewise home:

- Use double-paned or tempered glass: This reduces the risk of fracture or collapse during an extreme wildfire. Glass skylights are a better choice than fiberglass or plastic, which could melt and allow embers to enter the home (Figure 36).
- Enclose eaves, fascias, soffits and vents: Enclosing eaves or vents with metal screens or boxing them in will prevent firebrands from collecting or entering the home through vents (Figure 37).
- Protect overhangs and other attachments: Remove vegetation from overhangs, room additions, bay windows, decks, or fences. Boxing in the undersides of decks or balconies with noncombustible or fire-resistant materials prevents firebrands from collecting underneath (Figure 38).
- Separate wooden fences from the house: Do not attach fences of flammable materials like wood directly to the house because they act as fuel bridges. Instead, separate the fence from the house with a masonry or metal barrier.

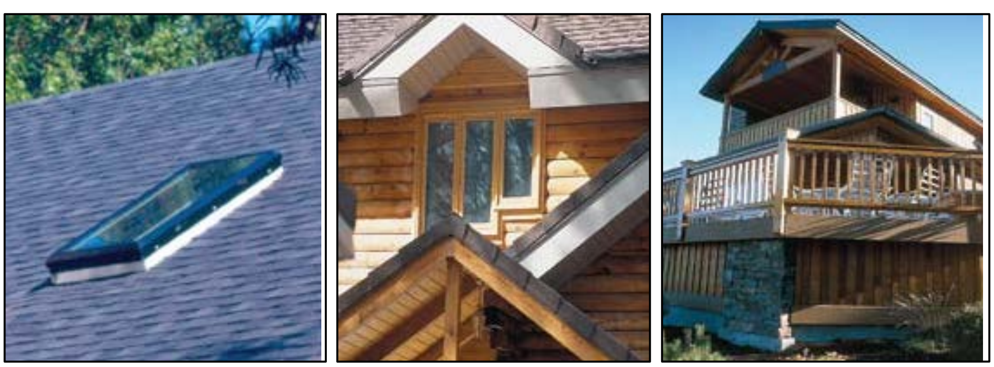


Figure 36, 37, 38: Home construction that reduces the ignition potential (from Firewise Guide).

FIREWISE COMMUNITIES
The Firewise program has a mechanism for certifying Firewise Communities. Communities, such as Prudence Island, can go through the process of becoming a certified Firewise Community. Benefits of the program include increased public knowledge and awareness about wildfire, a plan of action to reduce wildfire hazard, and greater access to grant funding for wildfire safety or fuel mitigation.

There are currently 13 Firewise Communities in New England; 9 in Maine, 3 in Massachusetts, and 1 in New Hampshire. There are currently no Firewise Communities in Rhode Island. Nationally, there are 1,486 participating communities across 41 states (Firewise 2018).

The five basic steps to becoming a nationally-recognized Firewise Community are as follows:

1. Obtain a wildfire risk assessment from the Rhode Island Department of Environmental Management (this plan may be able to be used as a surrogate risk assessment)
2. Create an action plan based on the assessment that includes 3 steps to improve wildfire preparedness (this plan satisfies the requirement as it outlines specific treatments)
3. Conduct a “Firewise Day” event to publicize the cause, educate residents, and do work such as clearing debris
4. Invest a minimum of $2 per capita in Firewise work each year, which could be through grants or volunteer hours (20 people volunteering 2.5 hours equates to nearly a $1,000 investment)
5. Submit an application to the state Firewise liaison

If Prudence Island residents follow the steps to become a Firewise Community, Firewise USA will present them with plaques and signs to display in the community. Becoming a Firewise Community can improve wildfire prevention education and increase wildfire preparedness. The certification also helps when applying for grants for fuel treatments. Individual parcel assessments may be included as part of Firewise Community planning.

SUMMARY OF RECOMMENDATIONS

RECOMMENDATION MATRIX	
Improve wildland suppression capabilities	
Implement wildland fire focused trainings	
Priority	Action Item
1	Host drills and simulations with mutual aid partners in order to increase cohesiveness and coordination for mutual aid responses
2	Pursue NWCG trainings and qualifications in order to increase firefighter knowledge and skills of wildland firefighting
3	Pursue specialized trainings for fire department in water delivery and water use conservation in order to increase effectiveness in fighting fire on the island
4	PIVFD and mutual aid partner participation in prescribed fires
Modernize firefighting apparatus to fit the needs of Prudence Island	
Priority	Action Item
1	Replace Brush #85 with two smaller, off-road capable brush engines
2	Construct a new substation to house equipment in a temperature-controlled environment
3	Acquire one off-road capable tanker of 1,000-gallon capacity or greater
4	Replace the truck on which Pumper #1 is mounted with a newer, off-road capable vehicle
5	Acquire two side-by-side off-road utility vehicles (UTV) engines to improve interior wildland fire fighting capabilities
Improve water supply in order to decrease refill times and increase the amount of water available for fire suppression	
Priority	Action Item
1	Complete construction of Warnerville cistern
2	Construct new cistern at Broadway & Merrill Ave.
3	Construct new cistern at Neck Farm Rd
4	Identify site and construct new cistern in the Prudence Park area.
5	Construct new cistern at NBNERR offices
6	Construct new cistern at North End State Park
7	Replace cistern at PIVFD station
Note	Preferred cistern characteristics: freeze-proof (heated where needed), rain-capturing capability where possible, raised off the ground for top-fill capability if constructed at proposed substation
Develop fire department policies and procedures specific to wildland fire	
Priority	Action Item
1	Develop wildfire SOPs and communication plan
2	Conduct hazard assessment for wildfire suppression – assessment should consider direct attack, indirect attack and the strategic use of fire breaks
Decrease fire danger to community through fuel and hazard mitigation	
Improve and maintain fire breaks	
Priority	Action Item
1	Maintain mowed roadsides to give firefighters defensible space to fight fire from roadsides
2	Maintain fire breaks in place at North End wall and within the south end
3	Improve the Heritage – Army Camp trail to serve as a fire break and remain accessible by Type 6 engine
4	Improve the Division Wall trail to be accessible by UTV fire engine

Implement fuel treatments in areas of high fire danger risk	
Priority	Action Item
1	Clear vegetation from under and around powerline
2	Evaluate the Albro Farm Rd. & Stevens Landing Ln. area for fuel reduction treatments
3	Evaluate South Reserve Dr. area for fuel reduction treatments
4	Evaluate Neck Farm Rd. area for fuel reduction treatments
5	Consider understory/ladder fuel treatments on forested areas near roadways west of Gov. Paine Rd. and Homestead Ave.
6	Evaluate Narragansett Rd. west of the fire station for fuel reduction treatments
Implement prescribed fire to reduce fuel loads	
Priority	Action Item
1	Expand prescribed fire program in the south end of the island
2	Consider implementing prescribed fire in the central forest, although ladder fuel treatments would likely be needed as a precursor to implementation
3	Consider prescribed fire operations in uninhabited areas of the Neck and North End, with fuel treatments likely necessary prior to implementation
Reduce structural ignitibility through Firewise measures	
Implement parcel-based assessments for all properties on the island, providing land-owners with site-specific recommendations	
Priority	Action Item
1	Cooperate with RI-DEM or other agency to evaluate individual properties
Conduct public outreach on Firewise mitigation measures	
Priority	Action Item
1	Host “Firewise Day”
2	Distribute printed materials
Develop a process to allow property owner to implement Firewise recommendations on forested lands within the home ignition zone	
Priority	Action Item
1	Work with public and private landowners to address liability, resource management and other concerns related to Firewise implementation

APPENDIX A: SOURCES OF FUNDING

Volunteer Fire Assistance – Rhode Island DEM Division of Forest Environment
Through the USDA Forest Service's Volunteer Fire Assistance program, the Division of Forest Environment is enabled to issue grants and materials to towns with populations less than 10,000. This program provides technical, financial and other assistance to fire departments for forest fire related purposes.
http://www.dem.ri.gov/programs/forestry/documents/vfagrant.pdf

Federal Excess Property Program – Rhode Island DEM Division of Forest Environment
Within Rhode Island, the Department of Administration oversees the USDA Forest Service's Excess Property Program. This program provides cities and towns with free firefighting materials. Any equipment acquired must be used for fire control purposes only.

State Agency for Surplus Property – Rhode Island State Agency Fire Marshal's Office
Federal surplus personal property donation programs enable certain nonfederal organizations to obtain property the federal government no longer needs.
https://www.gsa.gov/acquisition/government-property-for-sale-or-disposal/personal-property-for-reuse-sale/for-state-agencies-and-public-orgs/state-agencies-for-surplus-property-sasp-contacts#RhodeIsland

America the Beautiful Grant Program – Rhode Island DEM Division of Forest Environment
The purpose of the America the Beautiful Grant Program is to provide municipalities and non-governmental agencies to better plan and manage urban forest, and conduct public education and outreach.
http://www.dem.ri.gov/programs/forestry/

Forest Stewardship Program – Rhode Island DEM Division of Forest Environment
The FSP is implemented in cooperation with the USDA Forest Service, and supports private landowners' efforts to manage, enjoy and care for their land long-term. Enrollment in the plan provides tax incentives and requires a 10-year commitment from the landowner.
http://www.dem.ri.gov/programs/forestry/stewardship/index.php

Environmental Quality Incentives Program - Natural Resource Conservation Service
The Environmental Quality Incentives Program (EQIP) is a voluntary program that provides technical and financial assistance to agricultural producers and forest land owners who want to improve and protect the condition of soil, water, air, plants and animals.
https://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/ri/programs/financial/eqip/?cid=nrcs144p2_016499

Wildlife Habitat Incentive Program - Natural Resource Conservation Service
The Wildlife Habitat Incentive Program (WHIP) is a voluntary program that provides technical and financial assistance to private landowners who want to improve fish and wildlife habitat or restore natural ecosystems on their land.
https://www.nrcs.usda.gov/wps/portal/nrcs/detail/ri/programs/farmbill/rcpp/?cid=nrcs142p2_034734

Assistance to Firefighters Grant Program - FEMA and US Fire Administration Program
The Assistance to Firefighters Grant Program awards one-year grants directly to fire departments and non-affiliated emergency medical service organizations and State Fire Training Academies to enhance their fire and fire-related hazard response abilities. The funding is intended to supply critically needed resources to equip and train emergency personnel to recognized standards, enhance operations efficiencies, foster interoperability, and support community resilience.
https://www.fema.gov/assistance-firefighters-grant

Community Facilities Loans and Grants - Rural Housing Service, U. S. Dept. of Agriculture
Provides grants (and loans) to cities, counties, states and other public entities to improve community facilities for essential services to rural residents. Projects can include fire and rescue services; funds have been provided to purchase fire-fighting equipment for rural areas. No match is required.
https://www.rd.usda.gov/programs-services/community-facilities-direct-loan-grant-program

Fire Management Assistance Grant Program - Readiness, Response and Recovery Directorate, FEMA
Fire Management Assistance is available to States, local and tribal governments, for the mitigation, management, and control of fires on publicly or privately-owned forests or grasslands, which threaten such destruction as would constitute a major disaster.
https://www.fema.gov/grants

Hazard Mitigation Grant Program - Federal Insurance and Mitigation Administration, FEMA
The Hazard Mitigation Grant Program provides grants to States and local governments to implement long-term hazard mitigation measures after a major disaster declaration.
https://www.fema.gov/hazard-mitigation-assistance

Pre-Disaster Mitigation – FEMA
Grant proposals are submitted to FEMA through Rhode Island Emergency Management Agency with 75% of costs covered by Federal and 25% by local or state funds. Funding plans and projects reduces overall risks to people, property and infrastructure, while also reducing reliance on funding from actual disaster declarations. Ranking favors Firewise communities among many other factors.
https://www.fema.gov/pre-disaster-mitigation-grant-program
http://www.riema.ri.gov//grants/index.php

Wildfire Risk Reduction Program – Firewise USA, National Fire Protection Association (NFPA)
The Firewise USA program is co-sponsored by the USDA Forest Service, the U.S. Department of the Interior, and the National Association of State Foresters.

REFERENCES

Agee, James K.; Skinner, Carl N. 2005. Basic principles of forest fuel reduction treatments. Forest Ecology and Management, Vol. 211: 83-96.

Arnold, Samuel Greene. 1859. History of the State of Rhode Island and Providence Plantations. New York [etc.]: D. Appleton & co.

Cohen, J.D. 2000. Preventing disaster: home ignitibility in the wildland-urban interface. Journal of Forestry 98:15-21.

Finney, M.A., Brittain, S., Seli, R. C., McHugh, C.W., and Gangi, L. 2015. FlamMap:Fire Mapping and Analysis System (Version 5.0) [Software]. Available from http://www.firelab.org/document/flammap-software

Firewise. 2012. Firewise Communities. Retrieved March 27, 2018 from http://www.firewise.org

Firewise Communities. 2008. Firewise The Ember Threat and the Home Ignition Zone. Available: https://www.nfpa.org/Public-Education/By-topic/Wildfire/Firewise-USA/The-ember-threat-and-the-home-ignition-zone

Foster, David, Motzkin, Glenn. 2003. Interpreting and conserving the openland habitats of coastal New England: insights from landscape history. Forest Ecology and Management 185: 127-150.

International Associate of Fire Chiefs. 2017. A Fire Service Leader's Guide to Preparing a Community Wildfire Protection Plan

Kottek, M., J. Grieser, C. Beck, B. Rudolf, and F. Rubel, 2006: World Map of the Köppen-Geiger climate classification updated. Meteorol. Z., 15, 259-263. DOI: 10.1127/0941-2948/2006/0130.

Morton, Thomas, 1575-1646; John Adams Library (Boston Public Library) BRL; Adams, Charles Francis, 1835-1915

Narragansett Bay National Estuarine Research Reserve. 2009. An Ecological Profile of the Narragansett Bay National Estuarine Research Reserve. K.B. Raposa and M.L. Schwartz (eds.), Rhode Island Sea Grant, Narragansett, R.I.

Patterson III, William A., 2005 (Accessed 2018). Managing Fuels in Northeastern Barrens. UMASS Amherst. https://www.umass.edu/nebarrensfuels/index.html

2000 US census Block Group 3, Census Tract 401.03, Newport County, Rhode Island

Appendix H: NOAA Space Weather Scales

NOAA Space Weather Scales

Category: Scale	Category: Descriptor	Effect (Duration of event will influence severity of effects)	Physical measure	Average Frequency (1 cycle = 11 years)
Geomagnetic Storms			Kp values* determined every 3 hours	Number of storm events when Kp level was met; (number of storm days)
G 5	Extreme	Power systems: widespread voltage control problems and protective system problems can occur, some grid systems may experience complete collapse or blackouts. Transformers may experience damage. Spacecraft operations: may experience extensive surface charging, problems with orientation, uplink/downlink and tracking satellites. Other systems: pipeline currents can reach hundreds of amps, HF (high frequency) radio propagation may be impossible in many areas for one to two days, satellite navigation may be degraded for days, low-frequency radio navigation can be out for hours, and aurora has been seen as low as Florida and southern Texas (typically 40° geomagnetic lat.).**	Kp=9	4 per cycle (4 days per cycle)
G 4	Severe	Power systems: possible widespread voltage control problems and some protective systems will mistakenly trip out key assets from the grid. Spacecraft operations: may experience surface charging and tracking problems, corrections may be needed for orientation problems. Other systems: induced pipeline currents affect preventive measures, HF radio propagation sporadic, satellite navigation degraded for hours, low-frequency radio navigation disrupted, and aurora has been seen as low as Alabama and northern California (typically 45° geomagnetic lat.).**	Kp=8, including a 9-	100 per cycle (60 days per cycle)
G 3	Strong	Power systems: voltage corrections may be required, false alarms triggered on some protection devices. Spacecraft operations: surface charging may occur on satellite components, drag may increase on low-Earth-orbit satellites, and corrections may be needed for orientation problems. Other systems: intermittent satellite navigation and low-frequency radio navigation problems may occur, HF radio may be intermittent, and aurora has been seen as low as Illinois and Oregon (typically 50° geomagnetic lat.).**	Kp=7	200 per cycle (130 days per cycle)
G 2	Moderate	Power systems: high-latitude power systems may experience voltage alarms, long-duration storms may cause transformer damage. Spacecraft operations: corrective actions to orientation may be required by ground control; possible changes in drag affect orbit predictions. Other systems: HF radio propagation can fade at higher latitudes, and aurora has been seen as low as New York and Idaho (typically 55° geomagnetic lat.).**	Kp=6	600 per cycle (360 days per cycle)
G 1	Minor	Power systems: weak power grid fluctuations can occur. Spacecraft operations: minor impact on satellite operations possible. Other systems: migratory animals are affected at this and higher levels; aurora is commonly visible at high latitudes (northern Michigan and Maine).**	Kp=5	1700 per cycle (900 days per cycle)

* Based on this measure, but other physical measures are also considered.
** For specific locations around the globe, use geomagnetic latitude to determine likely sightings (see www.swpc.noaa.gov/Aurora)

Scale	Descriptor	Effect	Physical measure	Average Frequency
Solar Radiation Storms			Flux level of ≥ 10 MeV particles (ions)*	Number of events when flux level was met**
S 5	Extreme	Biological: unavoidable high radiation hazard to astronauts on EVA (extra-vehicular activity); passengers and crew in high-flying aircraft at high latitudes may be exposed to radiation risk. *** Satellite operations: satellites may be rendered useless, memory impacts can cause loss of control, may cause serious noise in image data, star-trackers may be unable to locate sources; permanent damage to solar panels possible. Other systems: complete blackout of HF (high frequency) communications possible through the polar regions, and position errors make navigation operations extremely difficult.	10^5	Fewer than 1 per cycle
S 4	Severe	Biological: unavoidable radiation hazard to astronauts on EVA; passengers and crew in high-flying aircraft at high latitudes may be exposed to radiation risk.*** Satellite operations: may experience memory device problems and noise on imaging systems; star-tracker problems may cause orientation problems, and solar panel efficiency can be degraded. Other systems: blackout of HF radio communications through the polar regions and increased navigation errors over several days are likely.	10^4	3 per cycle
S 3	Strong	Biological: radiation hazard avoidance recommended for astronauts on EVA; passengers and crew in high-flying aircraft at high latitudes may be exposed to radiation risk.*** Satellite operations: single-event upsets, noise in imaging systems, and slight reduction of efficiency in solar panel are likely. Other systems: degraded HF radio propagation through the polar regions and navigation position errors likely.	10^3	10 per cycle
S 2	Moderate	Biological: passengers and crew in high-flying aircraft at high latitudes may be exposed to elevated radiation risk.*** Satellite operations: infrequent single-event upsets possible. Other systems: effects on HF propagation through the polar regions, and navigation at polar cap locations possibly affected.	10^2	25 per cycle
S1	Minor	Biological: none. Satellite operations: none. Other systems: minor impacts on HF radio in the polar regions.	10	50 per cycle

* Flux levels are 5 minute averages. Flux in particles·s^{-1}·$ster^{-1}$·cm^{-2} Based on this measure, but other physical measures are also considered.
** These events can last more than one day.
*** High energy particle (>100 MeV) are a better indicator of radiation risk to passenger and crews. Pregnant women are particularly susceptible.

Scale	Descriptor	Effect	Physical measure	Average Frequency
Radio Blackouts			GOES X-ray peak brightness by class and by flux*	Number of events when flux level was met; (number of storm days)
R 5	Extreme	HF Radio: Complete HF (high frequency**) radio blackout on the entire sunlit side of the Earth lasting for a number of hours. This results in no HF radio contact with mariners and en route aviators in this sector. Navigation: Low-frequency navigation signals used by maritime and general aviation systems experience outages on the sunlit side of the Earth for many hours, causing loss in positioning. Increased satellite navigation errors in positioning for several hours on the sunlit side of Earth, which may spread into the night side.	X20 ($2x10^{-3}$)	Fewer than 1 per cycle
R 4	Severe	HF Radio: HF radio communication blackout on most of the sunlit side of Earth for one to two hours. HF radio contact lost during this time. Navigation: Outages of low-frequency navigation signals cause increased error in positioning for one to two hours. Minor disruptions of satellite navigation possible on the sunlit side of Earth.	X10 (10^{-3})	8 per cycle (8 days per cycle)
R 3	Strong	HF Radio: Wide area blackout of HF radio communication, loss of radio contact for about an hour on sunlit side of Earth. Navigation: Low-frequency navigation signals degraded for about an hour.	X1 (10^{-4})	175 per cycle (140 days per cycle)
R 2	Moderate	HF Radio: Limited blackout of HF radio communication on sunlit side of the Earth, loss of radio contact for tens of minutes. Navigation: Degradation of low-frequency navigation signals for tens of minutes.	M5 ($5x10^{-5}$)	350 per cycle (300 days per cycle)
R 1	Minor	HF Radio: Weak or minor degradation of HF radio communication on sunlit side of the Earth, occasional loss of radio contact. Navigation: Low-frequency navigation signals degraded for brief intervals.	M1 (10^{-5})	2000 per cycle (950 days per cycle)

* Flux, measured in the 0.1-0.8 nm range, in W·m^{-2}. Based on this measure, but other physical measures are also considered.
** Other frequencies may also be affected by these conditions.

URL: *https://www.spaceweather.gov/noaa-scales-explanation*

December 11, 2023

Appendix I: Coastal Hazard Decision Tools in Rhode Island: Advancements, Opportunities, and User Needs

Coastal Hazard Decision Tools in Rhode Island: Advancements, Opportunities, and User Needs

Researchers from the University of Rhode Island, Brown University, and partners have led the development of several hyper-local hazard modeling, forecasting, and detection systems that are designed to assist Rhode Island communities. These tools are already in use for real-time forecasting and planning purposes to assist managers of emergency response, critical facilities, and many others across the state. These systems and tools are:

STORMTOOLS

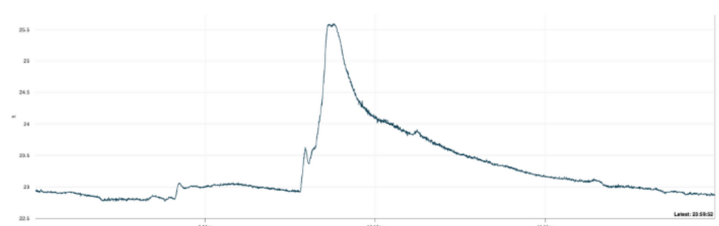
STORMTOOLS generates probabilistic flood predictions (e.g., 100-year storm) with and without sea level rise for RI's coasts. STORMTOOLS supports long-term planning across the state and is the foundation of the Rhode Island Coastal Resources Management Council's (RI-CRMC) risk-based permitting system. Additional tools include the Coastal Environmental Risk Index (CERI) that estimates building damage under various scenarios. The system is currently being expanded to inland areas of the state and is adding 500-yr flood projections that incorporate sea level rise to comply with the upgrades in the International Building Code (IBC) standards.

https://tinyurl.com/3enwprae

Access STORMTOOLS by scanning the QR code:

BEST

The Brown Environmental Sensing Technology (BEST) Network provides real-time monitoring of environmental conditions throughout Rhode Island. BEST is still growing but already includes water level and flooding data from 13 sensors deployed around Providence and Point Judith Pond which record and upload data at one-minute intervals. Future functionality for the BEST network will include the ability for emergency managers and interested parties to sign up for emergency alerts when the sensors detect rising floodwaters. In addition to flood sensors, the BEST network includes various meteorological and air quality sensors around Rhode Island and is expanding as needs grow.



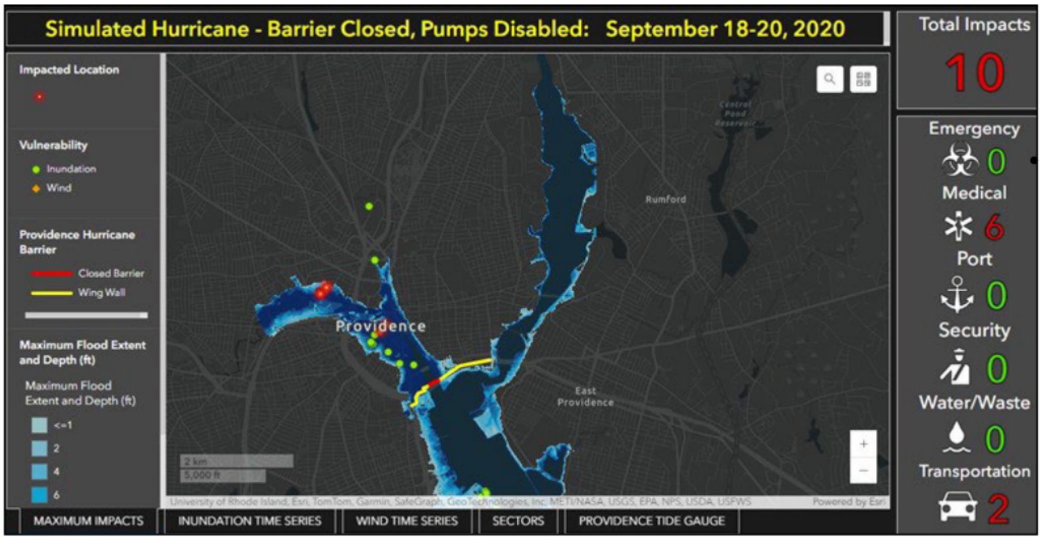
Example of a sensor detecting flood inundation during a major rainfall event

Access BEST by scanning the QR code:
http://mariners.neracoos.org

RI-CHAMP

RI-CHAMP provides early-warning alerts to RI Emergency Management Agency (RIEMA) and local EMAs, including coastal flooding and wind impacts caused by hurricanes and nor'easters—giving state agencies and coastal communities critical time to prepare. RIEMA and RIDEM also use RI-CHAMP as a planning and training tool to evaluate realistic storm scenarios that reflect today's extreme storm conditions.

RI-CHAMP is currently expanding its capabilities to include 24/7 real-time monitoring of flood and meteorological data from the BEST sensor network. This hyperlocal network of smart flood, wind, and rain sensors is strategically deployed around infrastructure and transportation routes which will enhance RI-CHAMP's ability to generate accurate, timely alerts.



The example RI-CHAMP web-based interactive dashboard highlights impacted assets from storms in red and delivers data to end users.

- https://tinyurl.com/4xdw48y7

Access RI-CHAMP by scanning the QR code:

MyCoast: Rhode Island

MyCoast: Rhode Island collects and analyzes crowdsourced photos of flooding and erosion across the Ocean State, capturing the impact of flood hazards and king tides today and thus illustrating future conditions resulting from increased storm activity and sea-level rise. Government agencies, business owners, practitioners, and residents use MyCoast reports to understand changing flooding patterns, validate flood models, and make informed decisions. A combination of state and private sector support allows the MyCoast team to engage in outreach, application, and technical assistance.

Credit: MyCoast RI Jan. 2024, Barrington

https://mycoast.org/ri

Access MyCoast RI by scanning the QR code: