CITY OF PROVIDENCE

HAZARD MITIGATION PLAN

2024

DRAFT PLAN

Acknowledgements

Mitigation planning has been successfully initiated in the City of Providence with the continuing support and resources provided by the Federal Emergency Management Agency via the Pre-Disaster Mitigation (PDM) Grant. The guidance and assistance provided by the Rhode Island State Hazard Mitigation Committee is essential for implementing the strategy presented in this Plan. The City of Providence is also grateful for the efforts of the Office of Sustainability, Department of Planning and Development, the Emergency Management Agency, and the Local Hazard Mitigation Committee in preparing this plan. The Providence Emergency Management Agency would also like to thank the community of Providence, especially City staff and those active community members who participated in the planning process.

Elected Officials

Dan McKee, Governor of Rhode Island
Brett Smiley, Mayor of the City of Providence

Rhode Island Emergency Management Agency

Marc R. Pappas, Director

City of Providence City Council

John Goncalves, Senior Deputy Majority Leader, Ward 1
Helen Anthony, Chair of Committee on Finance, Ward 2
Sue AnderBois, Ward 3
Justin Roias, Ward 4
Jo-Ann Ryan, Ward 5
Miguel Sanchez, Majority Whip, Ward 6
Ana Vargas, Ward 7
James Taylor, Majority Leader, Ward 8
Juan M. Pichardo, President Pro Tempore, Ward 9
Pedro Espinal, Ward 10
Mary Kay Harris, Deputy Majority Leader, Ward 11
Althea Graves, Ward 12
Rachel Miller, President, Ward 13
Shelley Peterson, Ward 14
Oscar Vargas, Ward 15

Local Hazard Mitigation Committee

Rae-Anne Culp, Mitigation Planning Supervisor/State Hazard Mitigation Officer, Rhode Island Emergency Management Agency
Clara Decerbo, Director, City of Providence Emergency Management Agency
David Radcliffe, Deputy Director, City of Providence Emergency Management Agency
Priscilla De La Cruz, Director, Office of Sustainability
James Moore III, Director, Department of Inspection and Standards
John Arzoomanian, Director, Department of Public Property
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Thomas Ferris, AVP of Safety and Compliance, Providence and Worcester Railroad
Jamie Lynch, Disaster Program Manager, American Red Cross
Margaret DeVos, Executive Director, Southside Community Land Trust
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Consultant Team

iParametrics

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Acronyms

Acronym	Full Word
ADCIRC	Advanced Circulation Model
ARC-RI	American Red Cross of Rhode Island
ATSDR	Agency for Toxic Substances and Disease Registry
CBP	County Business Patterns
CBRNE	Chemical, Biological, Radiological, Nuclear, and Explosives
CDC	Centers for Disease Control and Prevention
CSO	Combined Sewer Outflow
DIS	Department of Inspections and Standards
DOE	Department of Energy
DPW	Department of Public Works
EAS	Emergency Alert System
EC4	Executive Climate Change Coordinating Council
EOC	Emergency Operations Center
EOP	Emergency Operations Plan
EPA	Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-Know Act
ESF	Emergency Support Function
FCC	Federal Communications Commission
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Study
FPHB	Fox Point Hurricane Barrier
IBC	International Building Code
ICBD	Industrial and Commercial Buildings District
ICS	Incident Command System
LHMC	Local Hazard Mitigation Committee
LID	Low Impact Development
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
MOA	Memorandums of Agreement
MOU	Memorandums of Understanding
MS4s	Municipal Separate Storm Sewer Systems
NAWAS	National Warning System
NBC	Narragansett Bay Commission

Acronym	Full Word
NCEI	National Centers for Environmental Information
NFIP	National Flood Insurance Program
NOAA	National Oceanic and Atmospheric Administration
NPS	National Park Service
NRC	Nuclear Regulatory Commission
NRI	National Risk Index
NWS	National Weather Service
PAG	Protective Action Guidelines
PEMA	Providence Emergency Management Agency
PFD	Providence Fire Department
PRP	Providence Resilience Partnership
REJC	Racial and Environmental Justice Committee
RI-CHAMP	Rhode Island Coastal Hazards, Analysis, Modeling and Prediction
RIBA	Rhode Island Broadcasters Association
RICMRC	Rhode Island Coastal Management Resource Center
RIDEM	Rhode Island Department of Environmental Management
RIDOH	Rhode Island Department of Health
RIDOT	Rhode Island Department of Transportation
RIEMA	Rhode Island Emergency Management Agency
RIOER	Rhode Island Office of Energy Resources
RIPDES	Rhode Island Pollutant Discharge Elimination System
RIPTA	Rhode Island Public Transit Authority
SAMP	Special Area Management Plan
SFHA	Special Flood Hazard Area
STAB	Science and Technical Advisory Board
UCG	Urban Coastal Greenway
USACE	United States Army Corp of Engineers
USDA	United States Department of Agriculture
USDM	United States Drought Monitor
USFS	United States Forest Service
USGS	United States Geologic Survey
WRB	Water Resources Board

1 Introduction

1.1 What Hazard Mitigation Can Do for the City of Providence

Hazard mitigation is defined by the Federal Emergency Management Agency (FEMA) as "any sustained action taken to reduce or eliminate long-term risk to human life and property from a hazard event." The results of a 3-year, congressionally mandated independent study to assess future savings from mitigation activities provides evidence that mitigation activities are highly cost-effective. On average, each dollar spent on hazard mitigation saves the nation an average of $6 in future disaster costs in addition to saving lives and preventing injuries (National Institute of Building Sciences 2019).

Hazard mitigation planning is the process of determining how to reduce or eliminate the loss of life and property damage resulting from natural, human-caused, and technologic hazards such as floods, earthquakes, hurricanes, biological, chemical, or infrastructure failure. Hazard mitigation means to permanently reduce or alleviate injuries or the loss of life and property resulting from multi-hazards through long-term strategies. These long-term strategies include planning, policy changes, programs, projects, and other activities.

This plan update was prepared pursuant to the requirements of the Disaster Mitigation Act of 2000 (Public Law 106-390) and the implementing regulations set forth by the Interim Final Rule published in the Federal Register on February 26, 2002 (44 CFR § 201.6) and finalized on October 31, 2007 (hereafter, these requirements and regulations will be referred to collectively as the Disaster Mitigation Act). While the act emphasized the need for mitigation plans and more coordinated mitigation planning and implementation efforts, the regulations established the requirements that local hazard mitigation plans must meet for a local jurisdiction to be eligible for certain federal disaster assistance and hazard mitigation funding under the Robert T. Stafford Disaster Relief and Emergency Act (Public Law 93-288). Because the City of Providence is subject to many kinds of hazards, access to these programs is vital. This plan updates the City's 2019 Multi-Hazard Mitigation Plan. Notably, the update also brings the Plan into compliance with the Local Mitigation Planning Policy Guide (FP 206-21-0002) released on April 19, 2022 and effective on April 19, 2023.

The Providence Emergency Management Agency (PEMA), in collaboration with the Mayor's office, provided the lead in soliciting the participation of City departments, state agencies, universities, non-profits, and other stakeholders to form the City of Providence Local Hazard Mitigation Committee (LHMC) and undertaking a comprehensive planning process to update the 2019 Plan. The City of Providence, with the assistance of iParametrics, LLC, developed this update to the Multi-Hazard Mitigation Plan with funds provided through a Hazard Mitigation Assistance Grant from the Rhode Island Emergency Management Agency (RIEMA). Public input on community assets, vulnerabilities, preferred mitigation strategies, and the Plan was also solicited throughout the evolution of the project. As a result, this Plan represents the work of community members, elected and appointed officials, and other interested stakeholders in the City of Providence. This Plan demonstrates the City's commitment to reducing risks from hazards and serves as a tool to help decision makers direct and coordinate mitigation activities, resources, and policies.

1.2 Goals

The goals of this Plan include the following:

1. **Be Data-Driven:** Update hazard profiles to incorporate the latest data and scientific understanding with an emphasis on future projections to ensure readiness for evolving threats.
2. **Design Intelligently:** At a minimum, follow these steps before designing mitigation measures:
    a. Perform a root cause analysis
    b. Understand the design of legacy systems in the context of current and future capacity needs
    c. Leverage nationwide best practices
    d. Explore nature-based solutions
3. **Connect Systems and People:** Foster collaboration between different systems and agencies to create more cohesive and efficient mitigation opportunities.
4. **Be Forward Thinking:** Leverage emerging opportunities presented by new regulations (e.g. Executive Order 20-01: Advancing a 100% Renewable Energy Future for Rhode Island by 2030) and technological advancements, while concurrently mitigating the risks or challenges that they introduce. Tailor hazard mitigation strategies to align with the evolving landscape and its novel ramifications.
5. **Prioritize Our Community:** Increase public involvement in disaster preparedness through education and outreach programs. Lift up our community groups by encouraging community-driven ideas and solutions and providing resources to ensure success. Build up our community's financial resilience and provide aid after catastrophic losses.
6. **Adapt and Inform Policy and Investments:** Ensure that policy, building code, and investment decisions are proactive and adaptive, aligning with the current and future risk environment and mitigation best practices to safeguard communities.

1.3 Planning Process

A hazard mitigation plan should be considered a dynamic document that keeps pace with a community as it grows and changes. The Disaster Mitigation Act of 2000 places high priority on the continuation of the planning process after the initial submittal, requiring communities to seek and receive re-approval from FEMA in order to remain eligible for assistance. The evaluation, revision and update process are also a means to create an institutional awareness and involvement in hazard mitigation as part of daily activities.

This 2019 update allowed for academia, non-profits, representatives of state and city agencies, utility providers, and other interested stakeholders to be involved and bring their ideas to the table for incorporation into this update. Table 1-1 below lists the members of the 2024 City of Providence Local Hazard Mitigation Committee.

Table 1-1. Members of the 2024 City of Providence Local Hazard Mitigation Committee

Name	Position or Title	Department or Organization
Rae-Anne Culp	Mitigation Planning Supervisor/State Hazard Mitigation Officer	RI Emergency Management Agency
Clara Decerbo	Director	City of Providence Emergency Management Agency
David Radcliffe	Deputy Director	City of Providence Emergency Management Agency
Priscilla De La Cruz	Director	Department of Sustainability
James Moore III	Director	Department of Inspection and Standards
John Arzoomanian	Director	Department of Public Property
David Everett	Principal Planner	Department of Planning and Development
Stephen Houle	Chief	Providence Fire Department
Matt Mulligan	Detective	Providence Police Department
Sue AnderBois	Councilwoman	Ward 3
Bruce Lofgren	Coastal Policy Analyst	RI Coastal Resources Management Council
Emily Hall	Coastal Geologist	RI Coastal Resources Management Council
Peter LePage	Director of Engineering	Providence Water
Tony Araujo	Chief of Operations	Providence Water
Dave Aucoin	Safety Compliance Coordinator	Narragansett Bay Commission
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Peter Kazarian	Deputy Director of Facilities	PPSD
Yaniv Gal	Senior Plan Examiner	Department of Inspection and Standards
Rachel Gomes	Emergency Management Director	Johnson and Wales University
Seth Owusu	Assistant Director of Resiliency and Adaptation	Brown University

iParametrics, LLC conducted a series of meetings from January 9, 2024 through May 28, 2024. Meeting compositions varied throughout the project and included project team meetings with PEMA and City officials, meetings of the LHMC, and public workshops. All meetings were held in an open public forum and in accordance with R.I.G.L. 42-46-2(a) in complying with the requirements of the Federal Disaster Mitigation Act of 2000.

- January 9, 2024: The first LHMC meeting was conducted to review the scope and schedule, update the goals for this Plan and determine the list of hazards for this Plan.
- February 12, 2024: The second LHMC meeting was conducted to review and solicit additional feedback on the updated hazard list and goals list developed during the previous meeting, review the City profile (demographics and economy), and review the mitigation strategy.
- March 15, 2024: The third LHMC meeting was conducted to review the risk assessment and review the 2019 mitigation actions.
- April 5, 2024: A planning meeting was conducted between PEMA representatives and the project consultant to prepare for the public workshops. Preparation included coordinating the dates and times, locations, and agendas of the public meetings.
- April 29 to May 2, 2024: Multiple in-person public workshops were held on the following dates at locations throughout the City from 5:30 to 7:00 PM:
    - April 29, 2024 at Vincent Brown Recreation Center
    - April 30, 2024 at PEMA
    - May 1, 2024 at Rollins Recreation Center
    - May 2, 2024: Olneyville Resilience Hub at Joslin Recreation Center

  Flyers were created in English and Spanish and were distributed by email to City Councilmembers, City Council staff, partner organizations, such as the Woonasquatucket River Watershed Coalition, the Providence Resilience Partnership, and the Local Emergency Planning Committee, and the PEMA Public-Private Partner email distribution lists. The flyers were also posted on the digital bulletin board in City Hall and printed and posted in hard copy format at the City of Providence community libraries and recreation centers. The flyers are included in Appendix A. The presentation included an introduction to hazard mitigation as well as interactive discussions on the hazards in the City. Each workshop also included a brainstorming session to solicit mitigation actions from the participants.

Figure 1-1. Photos of participants from select in-person public meetings

- May 9, 2024: A meeting was conducted between PEMA representatives and the project consultant to discuss the City's capabilities for the capability assessment of the Plan.
- May 23, 2024: An online public workshop was held on May 23, 2024 from 6:00 to 7:30 PM through Zoom. Flyers were created in English and Spanish and were distributed by email to City Councilmembers, City Council staff, partner organizations, such as the Woonasquatucket River Watershed Coalition, the Providence Resilience Partnership, and the Local Emergency Planning Committee, and the PEMA Public-Private Partner email distribution lists. The flyers were also posted on the digital bulletin board in City Hall and printed and posted in hard copy format at the City of Providence community libraries and recreation centers. The presentation included an introduction to hazard mitigation as well as interactive discussions on the hazards in the City. The workshop also included a brainstorming session to solicit mitigation actions from the workshop participants.
- May 28, 2024: The fourth LHMC meeting was conducted to brainstorm and discuss new mitigation actions for this Plan.

With this information, iParametrics, LLC prepared the draft Plan update, which was available for review as follows:

- June 12, 2024 to June 19, 2024: The draft Plan was distributed to the LHMC for review and feedback.
- INSERT DATE to INSERT DATE: The draft Plan was open for public comment. An initial meeting through Zoom was held on INSERT DATE to introduce the Plan to the public; the Zoom meeting was also broadcasted at INSERT COMMUNITY CENTERS for an in-person broadcast option.
- INSERT DATE to INSERT DATE: The draft Plan was also forwarded to neighboring jurisdictions for comment:
    - INSERT JURISDICTIONS AND CONTACTS
- INSERT DATE: The draft Plan was submitted to RIEMA for review and consideration.

1.4 Literature Review

Throughout the planning process, this Plan was informed by existing plans, studies, reports, and technical information. The planning team reviewed the resources outlined in Table 1-2. Note that the "Area of Incorporation" column within the table lists the initial area of incorporations that may also inform subsequent sections of the Plan; for example, the State's Resilient Rhody plan was reviewed and documented during the capability assessment, which then helped inform the mitigation actions.

Table 1-2. Resources reviewed during the planning process to inform the Plan

Type	Name	Area of Incorporation
Handbook	Federal Emergency Management Agency *Local Mitigation Planning Handbook*	Entirety of Plan
Plan	City of Providence *Strategy for Reducing Risks From Natural, Human-Caused and Technologic Hazards in Providence, Rhode Island: A Multi-Hazard Mitigation Plan (2019)*	Entirety of Plan
Plan	State of Rhode Island *Hazard Mitigation Plan (2024)*	Entirety of Plan

Type	Name	Area of Incorporation
Dataset	Centers for Disease Control and Prevention *Social Vulnerability Index* *National Environmental Public Health Tracking Network*	City Profile (social vulnerability) Risk Assessment (extreme heat)
Dataset	Federal Emergency Management Agency *National Flood Hazard Layer* *National Flood Insurance Program* *National Risk Index* *OpenFEMA Disaster Declarations Summaries* *OpenFEMA Public Assistance Projects Details*	City Profile (historic declarations and obligations data) Risk Assessment (riverine flooding, hurricane, winter weather)
Dataset	United States Census Bureau *County Business Patterns* *Decennial Census*	City Profile (demographics and economy)
Dataset	Bureau of Transportation Statistics *National Bridge Inventory*	Risk Assessment (infrastructure/utility failure)
Dataset	Climate Mapping for Resilience and Adaptation	Risk Assessment (climate change projections)
Dataset	Iowa State University Iowa Environmental Mesonet *NWS Watch, Warning, and Advisories*	Risk Assessment (extreme cold, winter weather)
Dataset; Report	National Oceanic and Atmospheric Administration *Historical Hurricane Tracks* *National Center for Environmental Information Storm Events Database* *Nation Weather Service* *Sea Level Rise Technical Report (2022)*	Risk Assessment (extreme heat, coastal flooding and sea-level rise, riverine flooding, urban flooding, hurricane, severe storm, tornado, extreme cold, winter weather)
Report	Providence Fire Department *2023 Annual Report*	Risk Assessment (chemical, biological, radiological, nuclear, and explosives/hazardous materials release, conflagration)
Plan	PVD Tree Plan	Risk Assessment (extreme heat, infestation and invasive species) Capability Assessment
Dataset; Plan; Regulation	Rhode Island Coastal Resource Management Council *E911 Exposure Assessment* *Red Book* *Special Area Management Plans* *STORMTOOLS*	Risk Assessment (coastal flooding and sea-level rise) Capability Assessment
Project	Rhode Island Office of Energy Resources *Driving Rhode Island to Vehicle Electrification*	Risk Assessment (electrification)
Dataset; Report	Rhode Island Department of Environmental Management *Annual Report to the Governor on the Activities of the Dam Safety Program (2022)* *EPCRA Tier II Facilities*	Risk Assessment (infestation and invasive species, dam inundation, chemical, biological, radiological, nuclear, and explosives/hazardous materials release)
Dataset	Rhode Island Department of Health *COVID-19 Data Hub* *Infectious Disease Data*	Risk Assessment (infectious disease)

Type	Name	Area of Incorporation
Dataset	Rhode Island Geographic Information Systems *Land Use and Land Cover*	Risk Assessment (urban flooding)
Dataset	Stanford University *National Performance of Dams Program*	Risk Assessment (dam inundation)
Dataset	United States Army Corp of Engineers *Cold Regions Research and Engineering Laboratory*	Risk Assessment (winter weather)
Dataset	United States Department of Energy *Alternative Fueling Stations* *Electric Disturbance Events*	Risk Assessment (electrification, infrastructure/utility failure)
Dataset	United States Drought Monitor	Risk Assessment (drought)
Report	United States Forest Service *Rhode Island Forest Health Highlights*	Risk Assessment (infestation and invasive species)
Dataset	United States Geologic Survey *Earthquake Catalog* *National Seismic Hazard Maps*	Risk Assessment (earthquake)
Dataset	University of Rhode Island *Rhode Island Coastal Hazards, Analysis, Modeling and Prediction*	Risk Assessment (coastal flooding and sea-level rise)
Dataset	Vaisala *National Lightning Detection Network*	Risk Assessment (severe storm)
Plan; Regulation	City of Providence *Anti-Displacement and Comprehensive Housing Strategy* *Capital Improvement Plan (2024)* *Climate Justice Plan* *Code of Ordinances* *Harbor Management Plan* *Providence Tomorrow: The Comprehensive Plan* *Stormwater Management Plan*	Capability Assessment
Plan	Narrangansett Bay Commission *Emergency Operations Plan*	Capability Assessment
Plan	Providence Emergency Management Agency *Emergency Operations Plan*	Capability Assessment
Report	Providence Resilience Partnership *Towards a Resilient Providence*	Capability Assessment
Plan	Providence Water Supply Board *Water System Supply Management Plan*	Capability Assessment
Plan	Rhode Island Public Transit Authority *Climate Action Plan (2022)*	Capability Assessment
Plan	State of Rhode Island *Resilient Rhody*	Capability Assessment

1.5 Community Profile

1.5.1 Brief History

The history of the indigenous populations in the City of Providence traces back to the Narragansett people, who have lived in the region for thousands of years. The Narragansett were part of the larger Algonquian-speaking tribes that dominated the northeastern United States. They thrived on the land's rich resources, engaging in fishing, hunting, and agriculture. The arrival of European settlers in the early 17th century, particularly Roger Williams in 1636, marked the beginning of significant changes for the Narragansett.

The Providence area was first settled in 1636 by Roger Williams and was one of the original 13 colonies. Having been expelled from the Massachusetts Bay Colony for his religious views, Williams sought to resettle elsewhere and secure a title to the land from the local Narragansett natives around this time. Here he gave Providence its present name, in honor of "God's merciful Providence," which he believed had aided him in finding the location. Williams cultivated Providence as a refuge for persecuted religious dissenters, as he himself had been exiled from Massachusetts. Williams initially established a peaceful relationship with the Narragansett, securing land for the settlement through negotiations, but by the mid-17th century, the Narragansett faced considerable challenges due to European encroachment and the spread of diseases to which they had no immunity. Increasing tensions eventually led to King Philip's War between 1675 to 1676, which resulted in substantial loss of life, the destruction of many communities, and the near-annihilation of several Native American tribes.

Providence's growth was slow during the next quarter century. The first census of the colony, taken in 1708, recorded 1,446 residents. However, at the time of the second census, taken in 1730, the colony's population had almost tripled to 3,916. The Providence territory would become smaller as more of the land would become part of different towns, including Scituate and Johnston. The City's slow growth was also due to the rocky, hilly, and heavily wooded land which made farming difficult, as well as the tradition of dissent and independent-mindedness (Rhode Island was the first of the 13 colonies to declare independence from Great Britain). Residents often fought over land titles, politics, and religion.

The City of Providence is ideally located along the eastern seaboard of the United States. The City developed near a natural harbor, establishing a populated area along one of the earliest key trade routes. Today, this network includes the major northeastern cities: Boston, Providence, New York, Philadelphia, Baltimore, and Washington D.C. This northeast corridor runs 600 miles long and 30 miles wide, and the City of Providence is well situated within it. The City's location facilitated its development as a transportation center, offering access to both water and overland routes.

The City of Providence developed in a unique way compared to most older cities. Its settlers seemed to have no need for a common square or meetinghouse, and instead, Providence grew in a linear fashion, along the east side of the Providence River. The downtown area, typically the core of early development in a community, did not develop for a century after Providence's colonization. Known then as Weybosset Neck, the downtown area to the west of the river was dominated by steep hills, marshy lowlands, and muddy creeks. Not until 1771 was any kind of permanent link created between the east side and downtown.

Demand for a specialized commercial district in the City of Providence increased around the turn of the nineteenth century, as "downtown" started to develop west of the Providence River. Shipping and manufacturing became the key industries around the downtown area, as residential development continued along its fringes. By the end of the 1820s, what we know today as downtown was a thriving area. During this time, the jewelry industry grew most significantly of the manufacturing trades, later establishing the City of Providence as the jewelry capital of the region.

The City's growth and transformation from a small shipping town to the major economic center of the most highly industrialized state in the nation was rapid and dramatic. The City of Providence grew in population from 15,000 people to more than 175,000 at the turn of the 20th century. 40 years later, the City enjoyed its highest population ever at 253,504, as industries and businesses continued to migrate to the City of Providence's active harbor and commercial areas. The next 40 years, however, from 1940 to 1980, saw a significant decrease in population, as the 'suburbanization' phenomenon negatively impacted most of the older cities throughout New England. Urban renewal schemes and the construction of Routes 6 and 10 and Interstates 95 and 195 in the 1950s and 1960s destroyed a significant part of the City's urban fabric and isolated neighborhoods from each other and from downtown.

The City of Providence reached its lowest population count of the century in 1980, with 156,804 people. In the early 1980s, however, this trend began to reverse, and the City has since enjoyed a much-touted renaissance. According to the 2020 census, the City had 190,934 residents making it the third largest New England city behind Boston and Worcester.

1.5.2 Current Profile

The City of Providence is characterized by a number of outstanding features: its topography and open spaces; its waterways and shoreline; its unique scale in terms of buildings and population; the many respected private and public learning and health institutions; its history and historically significant architecture; and its proximity to a variety of economic, recreational, and cultural areas, including the cities of Boston and New York, the ocean, and the mountains in northern New England, all adding to the significance of the City of Providence as the capital city of the State of Rhode Island. The City of Providence is comprised of 25 neighborhoods (Figure 1-2), each with its own unique character and charm. Together, these neighborhoods forge a city that is rich in history, culture, and community spirit.

Figure 1-2. Neighborhoods within the City of Providence (City of Providence)

1.5.2.1 Environmental Setting

The City of Providence, the capital of Rhode Island, is in Providence County in the northeastern part of the State and is bordered by the communities of Pawtucket, North Providence, Johnston, and Cranston. The City of Providence is located at the head of Narragansett Bay along three rivers, the Woonasquatucket, Seekonk and Providence rivers.

Industrial and residential floodplain development has occurred extensively throughout the City. South of Glenbridge Avenue to the Providence River, the Woonasquatucket River floodplain is heavily developed with a mixture of industrial and residential development. North of Glenbridge Avenue, development along the river is generally confined to residential housing. The Moshassuck River floodplain is heavily developed with industries and residences from below the North Burial Ground to the confluence with the Woonasquatucket River. The areas surrounding the West River floodplain and the Upper Canada Pond Brook are generally in residential land use. The portion of the floodplain in the City of Providence affected by the Pocasset River consists generally of industrial development. The coastline along the Providence River is heavily developed with industrial facilities, as is the lower portion of the Seekonk River. The head of the Woonasquatucket River is in North Smithfield and flows into Providence from the west through the Town of Johnston. Along its course, it passes through many reservoirs and old mill ponds.

The Moshassuck River rises in Lincoln and continues south into Providence where it joins with the Woonasquatucket River to form the Providence River. Adjacent to the North Burial Ground and Interstate 95, the Moshassuck River enters a 0.5 mile-long culvert which terminates just north of the confluence of the West River. The West River enters the City from the northwest and is also characterized by several old mill ponds with heavy industrial development. Upper Canada Pond Brook enters the City of Providence in the

north from its headwaters in North Providence. The portion of this stream within the City is dominated by Upper Canada Pond. The Pocasset River flows from Johnston through the southwestern corner of the City of Providence at the Johnston-Cranston corporate limits.

Providence Harbor and the Providence River form the northern end of Narragansett Bay, ending at the Fox Point Hurricane Barrier. The Seekonk River branches from the Providence River and is tidally affected throughout its length in the City of Providence.

1.5.2.2 Demographic Profile

The City's population is ethnically and culturally diverse and varied, which creates a unique cultural and educational environment. As described above, the City of Providence has experienced a growth in population since the 1980s, making it the third largest New England city behind Boston and Worcester. According to the United States Census Bureau, between 2010 and 2020, the City saw a 7.2% increase in population. In 2020, the City of Providence had a population of 190,934. Figure 1-3 below shows the racial and ethnic breakdown of the population, while Figure 1-4 shows the breakdown by household income, home ownership, and age. The population growth of the City between 2010 and 2020 was accompanied by a greater diversification in the racial and ethnic makeup of the City's residents as well as an increase in the share of households with a household income greater than $50,000 and an increase in homeownership rates. The City did see a minimal trend towards an aging population.

Figure 1-3. Demographic trends (related to race, ethnicity, nativity) in the City of Providence (Census Bureau)

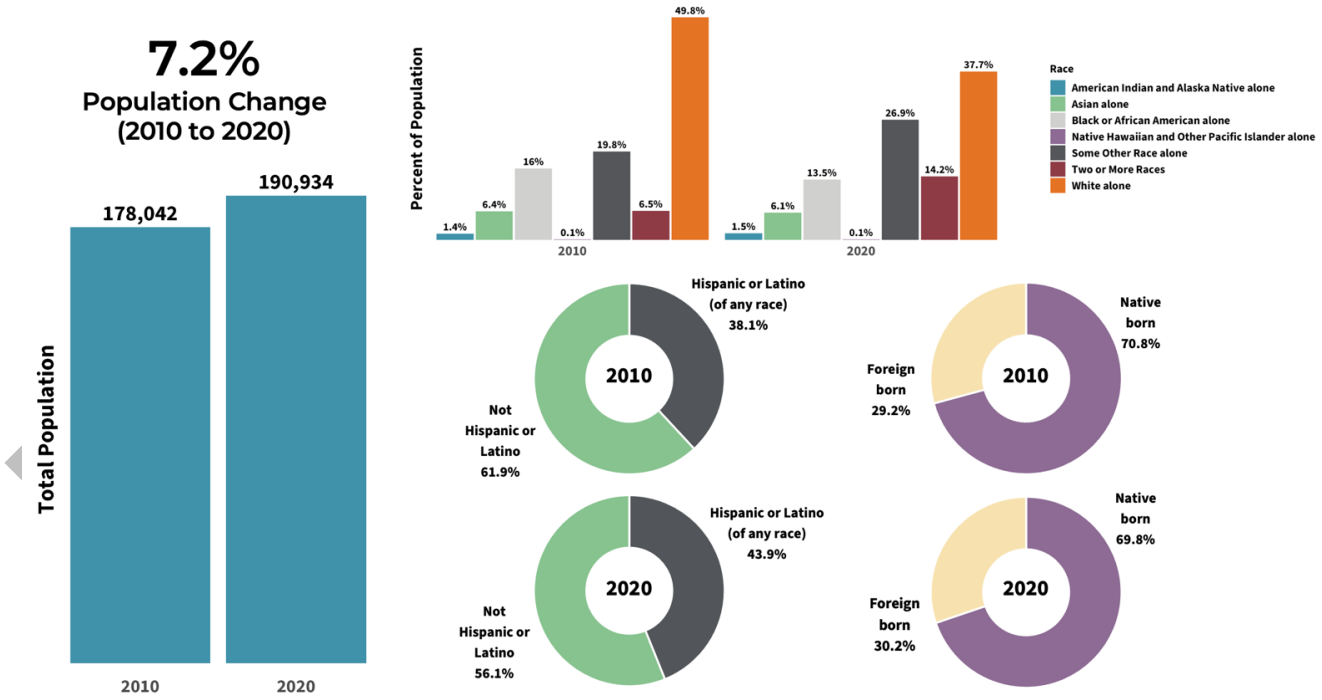
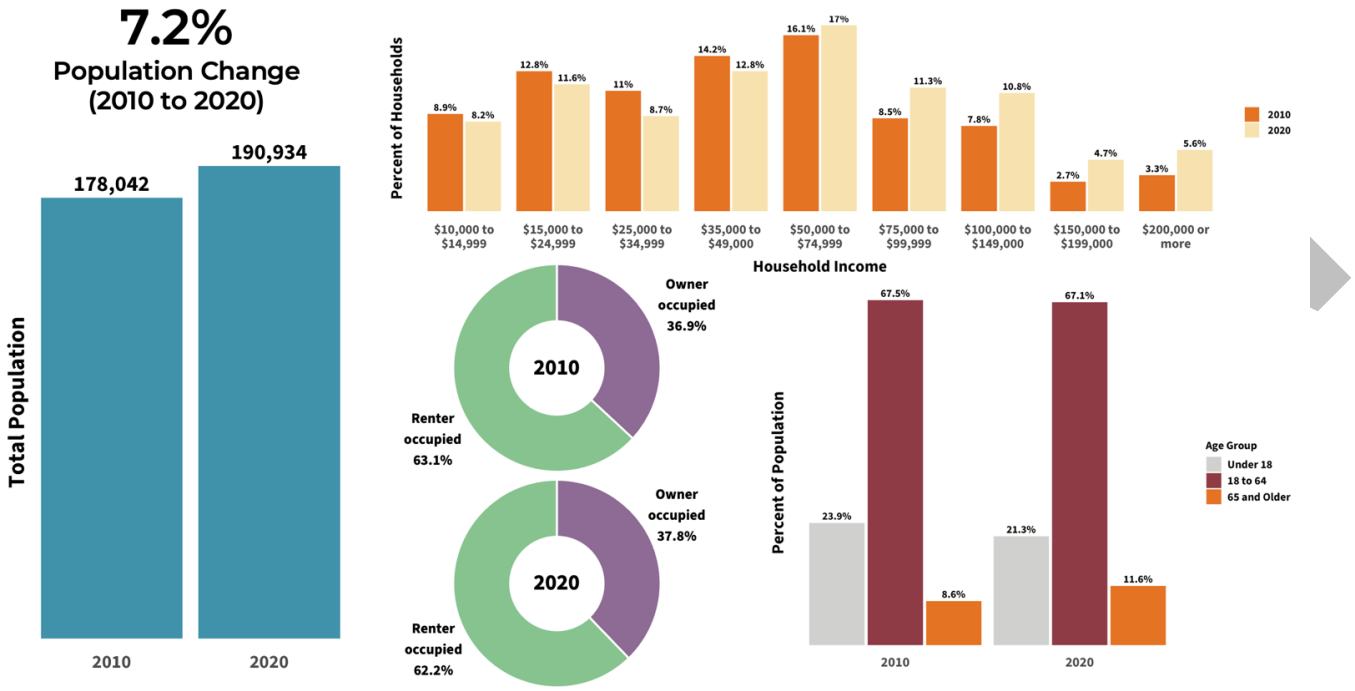
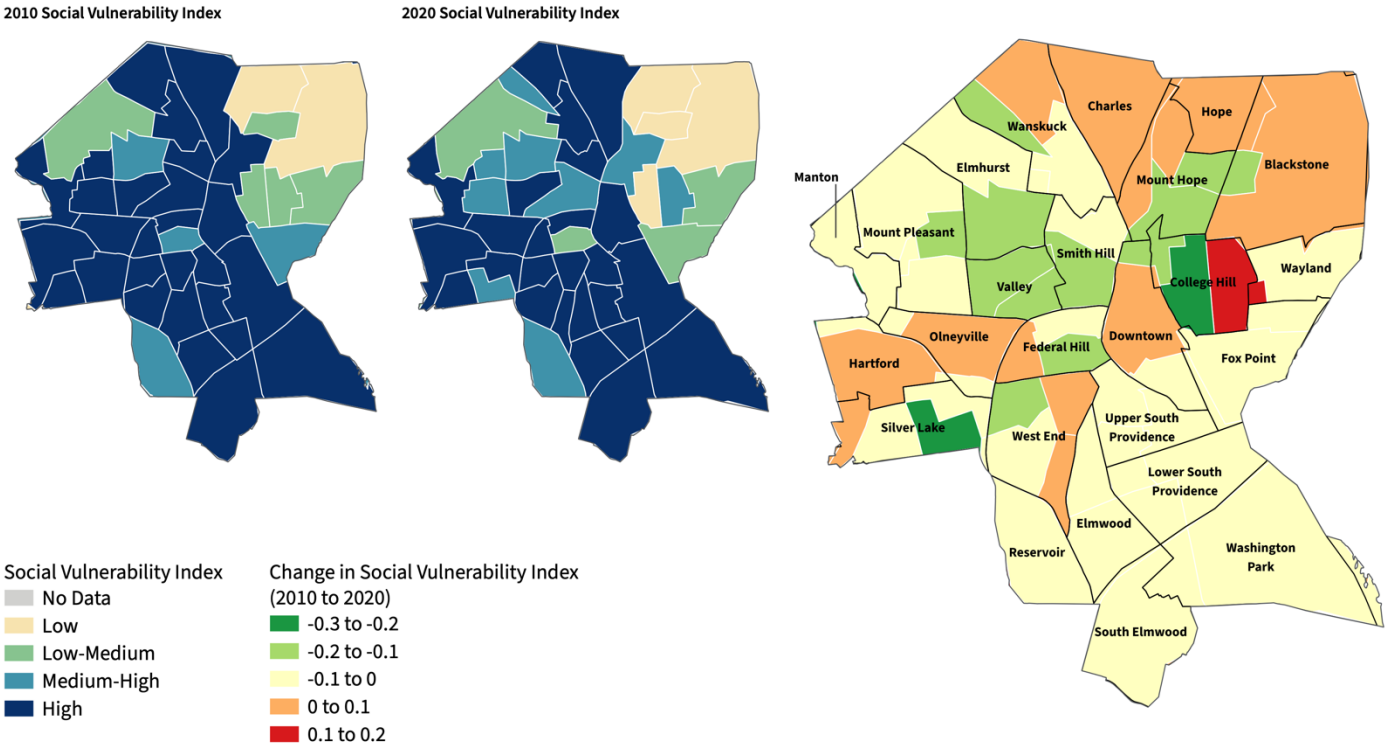


Figure 1-4. Demographic trends (related to income, home ownership, age) in the City of Providence (Census Bureau)



Hazardous events, whether a natural disaster like a tornado or disease outbreak, or a human-made event such as a harmful chemical spill, can pose a threat to a community's health. Socially vulnerable populations are especially at risk during public health emergencies because of factors like socioeconomic status, household characteristics, racial and ethnic minority status, or housing type and transportation. The Centers for Disease Control and Prevention (CDC) and Agency for Toxic Substances and Disease Registry (ATSDR) developed a social vulnerability index to measure the social vulnerability of communities nationwide. Figure 1-5 below maps the social vulnerability index throughout the City in 2010 and 2020 and highlights areas within the City where social vulnerability has increased and decreased.

Figure 1-5. Social vulnerability within the City of Providence (CDC, ASTDR)



1.5.2.3 Economic Profile

The City of Providence is notably home to numerous top hospitals, colleges, and universities, a key part of its economy, but the economic profile of the City can also be characterized by industry and enterprise size diversity. Based on data from the United States Census Bureau County Business Patterns (CBP) database, the Providence-Warwick, Rhode Island-Massachusetts metropolitan area is comprised of majority small businesses by number of firms, but majority large businesses by employment (Figure 1-6). Between 2010 and 2020, the metropolitan area saw an overall decrease of 1.3% in the number of firms, but an overall increase of 9.1% in employment. In 2020, the metropolitan area's greatest industries by number of firms included construction, other services (except public administration), retail trade, professional, scientific, and technical services, accommodation and food services, and health care and social assistance, while the greatest industries by employment included health care and social assistance, retail trade, accommodation and food services, and manufacturing (Figure 1-7 and Figure 1-8).

Figure 1-6. Breakdown of firms and employment by enterprise size for the Providence-Warwick, Rhode Island-Massachusetts metropolitan area (CBP)

-1.3%
Change in Number of Firms (2010 to 2020)

+9.1%
Change in Employment (2010 to 2020)

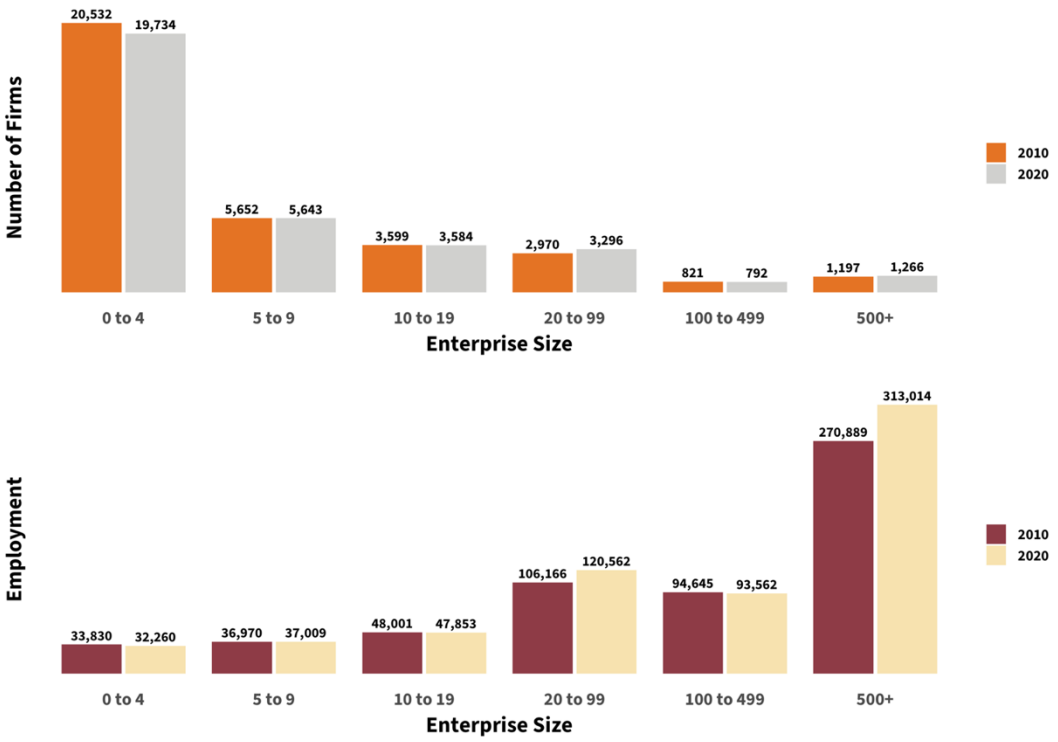


Figure 1-7. Number of firms by NAICS code in Providence-Warwick, Rhode Island-Massachusetts metropolitan area (CBP)

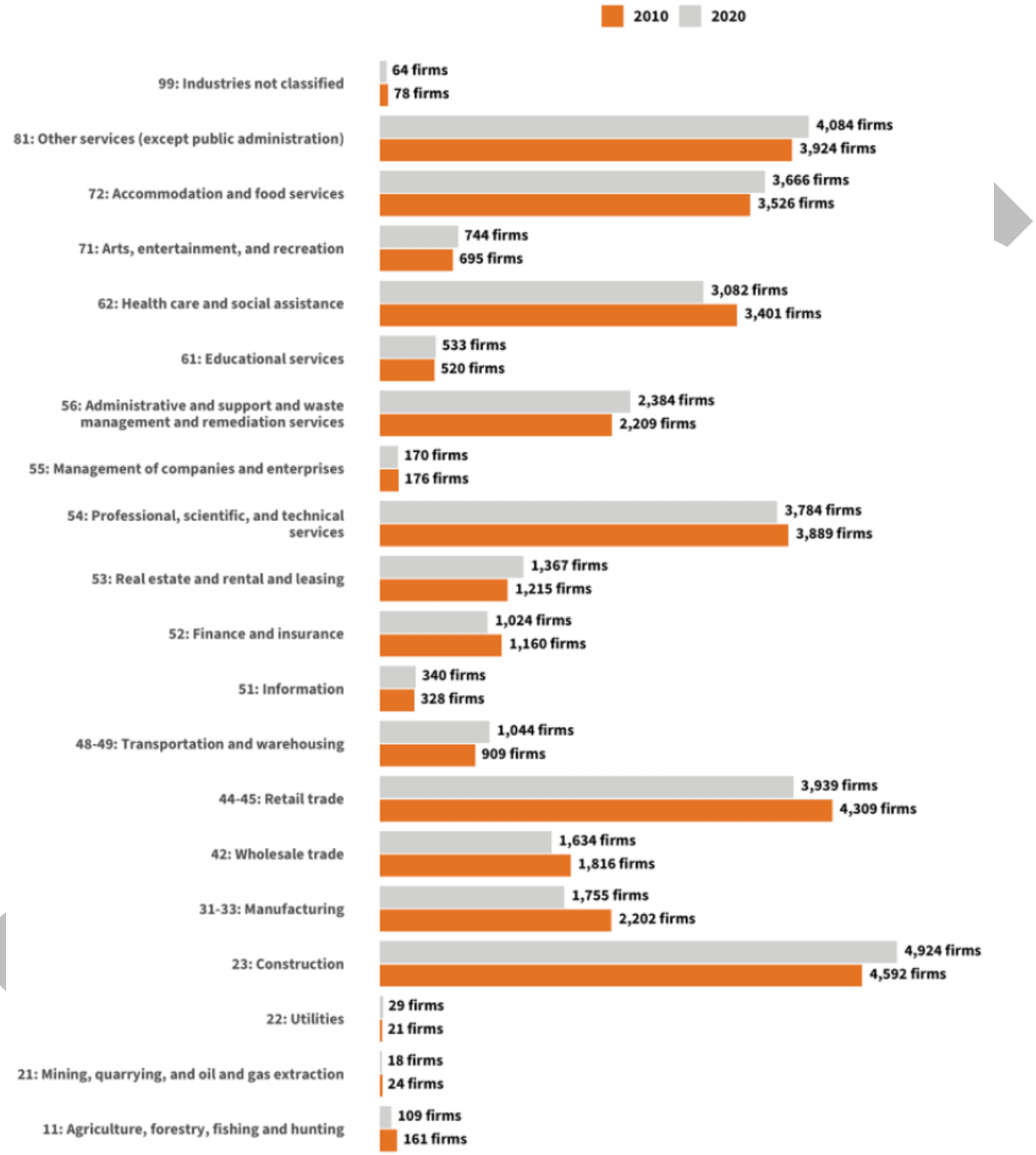
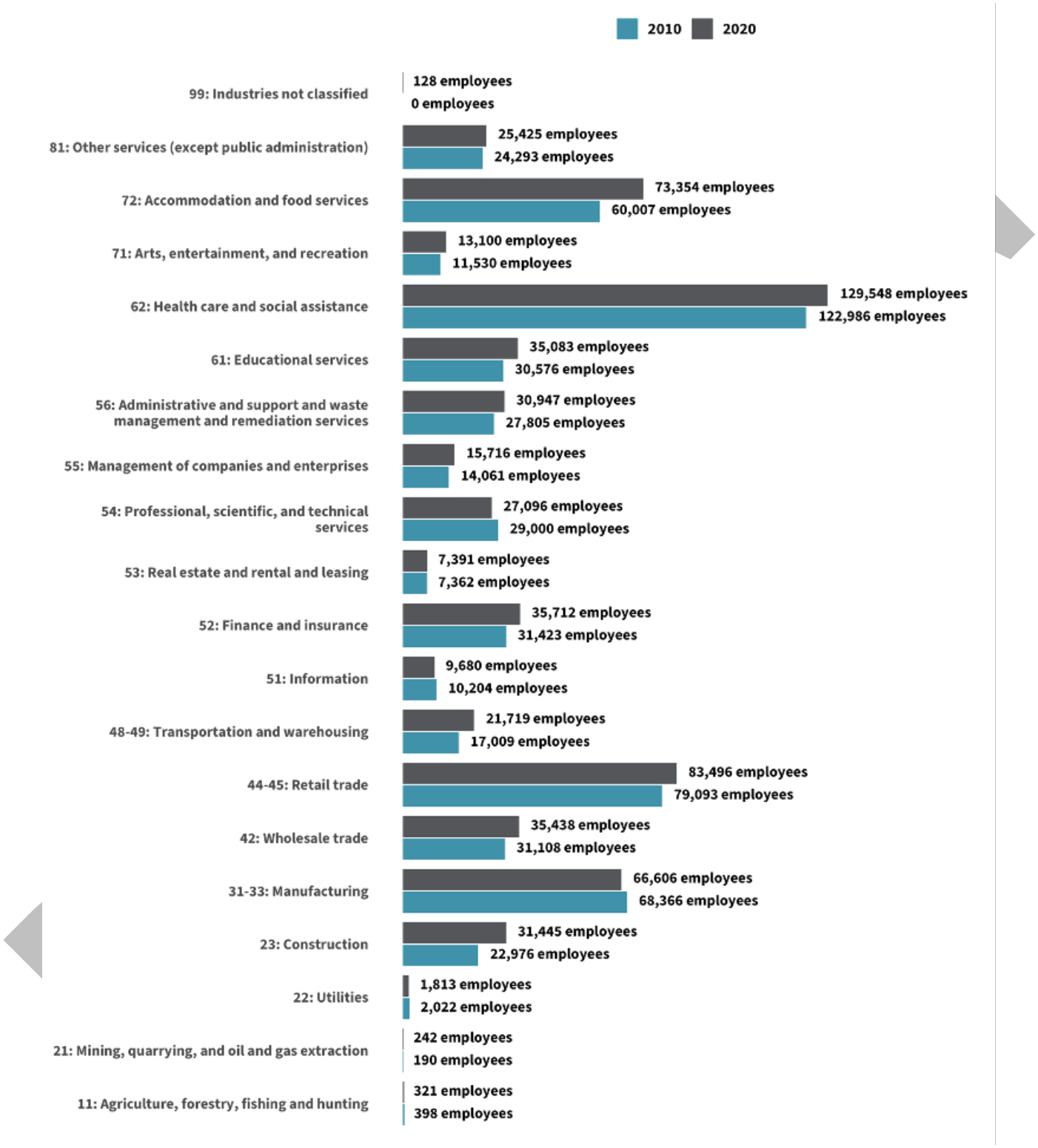


Figure 1-8. Employment by NAICS code in Providence-Warwick, Rhode Island-Massachusetts metropolitan area (CBP)



1.6 Disaster Declarations

1.6.1 History of Disaster Declarations

Since 1953, FEMA Region 1 (New England) has endured more than 300 federal emergency and disaster declarations. Table 1-3 lists the past federal emergency and disaster declarations for Providence County, including the City of Providence, from 1953 through 2018.

Table 1-3. FEMA emergency and major disaster declarations for Providence County (1953 to 2018) (FEMA)

Disaster Number	Declaration Type	Declaration Title	Declaration Date
4212	DR	April 3, 2015	Severe Winter Storm and Snowstorm
4107	DR	March 22, 2013	Severe Winter Storm and Snowstorm
3355	EM	October 29, 2012	Hurricane Sandy
4027	DR	September 3, 2011	Tropical Storm Irene
3334	EM	August 27, 2011	Hurricane Irene
3311	EM	March 30, 2010	Severe Storms and Flooding
1894	DR	March 29, 2010	Severe Storms and Flooding
3255	EM	September 19, 2005	Hurricane Katrina Evacuation
3203	EM	February 17, 2005	Record Snow
3182	EM	March 27, 2003	Snow
3123	EM	November 19, 1996	Major Water Main Break
1091	DR	January 24, 1996	Blizzard of 96 (Severe Snow Storm)
3102	EM	March 16, 1993	Blizzards, High Winds and Record Snowfall
3094	EM	September 16, 1992	Water Contamination
913	DR	August 26, 1991	Hurricane Bob
748	DR	October 15, 1985	Hurricane Gloria
548	DR	February 16, 1978	Snow and Ice
3058	EM	February 7, 1978	Blizzard and Snowstorms
39	DR	August 20, 1955	Hurricane and Flood
23	DR	September 2, 1954	Hurricanes

1.6.2 Recent Disaster Declarations

The communities of Providence County (including the City of Providence) have experienced significant losses during several recent events that have warranted FEMA to declare these incidents as disasters. The following lists the recent events (since the 2018 Plan) that have been declared as disasters by FEMA and which have affected the City of Providence. The list includes the total FEMA Public Assistance obligations by disaster that were obligated to the City of Providence (applicant identification: 007-59000-00) as of June 10, 2024. Table 1-4 below lists each obligation to the City of Providence by application.

- COVID-19 Pandemic (EM-3440 on March 13, 2020, DR-4505 on March 30, 2020)
    - Public Assistance obligations: $7,037,104.05
- Hurricane Henri (EM-3563 on August 21, 2021)
- Severe Winter Storm and Snowstorm (DR-4653 on May 12, 2022)
    - Public Assistance obligations: $916,617.30

- Severe Storms, Flooding, and Tornadoes (DR-4753 on January 7, 2024)
- Severe Storm and Flooding (DR-4765 on March 20, 2024)
- Severe Storm and Flooding (DR-4766 on March 20, 2024)

Table 1-4. Public Assistance projects obligated to the City of Providence for recent events (since the 2018 Plan) (FEMA)

Disaster Number	Project Worksheet	Application Title	Damage Category	Total Obligation	Obligation Date
4505	66	151286 - City of Providence COVID-19 PPE	B - Protective Measures	$212,327.96	January 19, 2021
4505	77	158100 - COVID-19 Quarantine Sheltering	B - Protective Measures	$7,164.34	December 4, 2020
4505	131	159467 - Providence COVID-19 Force Account Labor	B - Protective Measures	$555,605.04	March 1, 2021
4505	136	169486 - Providence Force Account Equipment - FD Apparat	B - Protective Measures	$87,751.62	March 2, 2021
4505	139	171752 - Providence Communication and Outreach #1	B - Protective Measures	$49,868.40	March 1, 2021
4505	273	159607 - Providence Force Account Materials (PRVFAM1)	B - Protective Measures	$143,161.57	November 9, 2021
4505	519	673237 - Providence COVID-19 PP July Dec 2020	B - Protective Measures	$252,581.21	June 27, 2023
4505	600	697589 - Providence PPSD Test Kits	B - Protective Measures	$1,579,077.60	April 10, 2023
4505	607	697598 - Providence PPSD Cleaning and Disinfection	B - Protective Measures	$3,957,996.25	February 16, 2023
4505	628	701059 - City of Providence Vaccine Facility Lease	B - Protective Measures	$79,143.75	July 10, 2023
4505	629	159623 - Providence Force Account Materials and Supplies (PRVFAM2)	B - Protective Measures	$34,374.48	August 8, 2023
4505	640	696488 - Providence Public Safety Police Q1 FY 2021	B - Protective Measures	$52,186.30	March 22, 2023
4505	641	696492 - Providence Public Safety Police Q2 2021	B - Protective Measures	$25,865.53	March 22, 2023
4653	71	686601 - APPCERT Emergency Protective Measures Snow Re	B - Protective Measures	$510,529.90	December 2, 2022
4653	136	679788 - APPCERT - Emergency Protective Measures Snow Re	B - Protective Measures	$348,798.81	March 2, 2023
4653	140	702034 - Management Cost (CAT-Z) from APP CERT - CAT-B City of Providence - PN 686601 and PN 679788	Z – State Management	$57,288.59	May 1, 2024

2 Risk Assessment

2.1 Introduction

Fundamentally, mitigation planning equips communities with strategies for diminishing the risks associated with hazards. To be effective though, mitigation planning requires a risk assessment as the fundamental step. The risk assessment allows for informed decision-making by providing a data-driven basis for determining how best to allocate finite resources to address what mitigation might take place. The risk assessment in this Plan includes the following components:

1. Hazard Identification: The Plan outlines the hazards of concern for the City of Providence.
2. Hazard Profile: For each hazard identified in Step 1, the Plan includes the following sections:
    a. Hazard Description: This section defines the hazard type and introduces any scales that may be used to classify the severity of the hazard.
    b. Location and Extent: This section details the geographic area within the City of Providence that could be affected by the hazard and the expected range of intensity.
    c. Previous Occurrences: This section lists any historical occurrences recorded in the City of Providence.
    d. Probability: This section evaluates the probability of each hazard using historical data as well as future condition data (e.g. climate change, population change, etc.). In some cases, probability levels were determined using the following scale:
        i. Unlikely: Occurring every 50 years or less
        ii. Somewhat Likely: Occurring every 20 to 50 years
        iii. Likely: Occurring every 5 to 20 years
        iv. Highly Likely: Occurring every 1 to 5 years
        v. Extremely Likely: Occurring every 1 year or more
    e. Impacts: This section details the likely impacts (e.g. to people, infrastructure, economy, etc.) given a hazard occurrence.
3. Vulnerability Summary: The above sections in the risk assessment evaluate the hazards, vulnerable assets and potential impacts and losses. This section summarizes the information to help the community understand its most significant risks and vulnerabilities. This section is key in informing the mitigation strategy.

2.2 Hazard Identification

The City of Providence Local Hazard Mitigation Committee (LHMC) worked to compile a consolidated, yet comprehensive list of natural, human-caused, and technological hazards that the Plan should include. The hazard list was created by (1) deliberating on any consolidations/removals from the 2019 Plan, and by (2) discussing any new hazards of concern to the City. For the purposes of the 2024 Plan, the City of Providence LHMC decided to include and organize the hazards as listed in Table 2-1 below.

Table 2-1. Natural, human-caused, and technological hazards groupings and identification

Natural Hazards	Human-Caused Hazards	Technological Hazards
Drought-Related • Drought • Extreme Heat	Civil Disturbance/Unrest	Electrification
Geologic-Related • Earthquake	Chemical, Biological, Radiological, Nuclear, and Explosives (CBRNE)/Hazardous Materials Release	Infrastructure/Utility Failure
Human and Natural Health-Related • Infectious Disease • Infestation and Invasive Species	Conflagration	
Water-Related • Coastal Flooding/Sea Level Rise • Dam Inundation • Riverine Flooding • Urban Flooding	Cyber Attack	
Wind-Related • Hurricane • Severe Storm (Hail, Lightning, High Wind) • Tornado	Terrorism/Active Threat	
Winter-Related • Extreme Cold • Winter Weather		

2.2.1 Hazard Identification Changes

In comparison the 2019 Plan, Table 2-1 above identifies and groups the hazards differently. The following changes and omissions were made:

- "Communicable Hazards" renamed to "Human and Natural Health-Related Hazards" to be more encompassing given the addition of "Infestation and Invasive Species" as a hazard
- "Flood-Related" renamed to "Water-Related" to be more encompassing
    - "Flash Flooding", "Heavy Rain, Inland/Urban Flooding", and "Riverine Flooding" were deemed to be repetitive (e.g. heavy rain is often associated with flash flooding, urban flooding can occur because of flash flooding, inland flooding can occur because of urban flooding or riverine flooding, etc.), so restructured into "Riverine Flooding" and "Urban Flooding"
- "Fire-Related" grouping, including "Wildfire" and "Urban Fire" removed
    - "Wildfire" was deemed very unlikely to affect the City

    - The 2024 Rhode Island State Hazard Mitigation Plan shows a “low” hazard index for Providence
    - The United States Department of Agriculture (USDA) and United States Forest Service (USFS) Wildfire Risk to Communities tool shows that Providence has a “low” risk of wildfire with no likelihood for majority of the City
    - No previous occurrences of wildfire in Providence
- “Severe Thunderstorms”, “Hail”, “Lightning”, and “High Winds” consolidated into “Severe Storm”
- “Heavy Snow” and “Ice Storm” consolidated into “Winter Weather” to be more encompassing – “Winter Weather” includes winter storm events in which the main types of precipitation are snow, sleet, or freezing rain
- “Terrorism” renamed to “Terrorism/Active Threat” to be more encompassing and switched from a hazard grouping to an individual hazard type
- “Terrorism – Biological”, “Terrorism – Chemical/Hazardous Materials Release”, “Terrorism – Explosive”, “Terrorism – Radiological/Nuclear” all removed from the “Terrorism” grouping and consolidated into “Chemical, Biological, Radiological, Nuclear, and Explosives (CBRNE)/Hazardous Materials Release” – these incidents could be intentional terrorism, but could also be accidental incidents
- “Terrorism – Cyber” removed from the “Terrorism” grouping and renamed to an individual hazard type, “Cyber Attack”
- “Terrorism – Civil Disturbance/Unrest” removed from the “Terrorism” grouping and switched to an individual hazard type
- “Other - Fire” removed from the “Other” grouping and renamed to an individual hazard type, “Conflagration”
- “Other – Mass Casualty Incident” removed – a mass causality incident is an impact from a different hazard, not a hazard itself
- “Other – Special/VIP Events” removed – a special/VIP event is not a mitigable hazard, but rather an event that requires preparedness
- “Other – Dam Inundation” removed – duplicate hazard already included under the “Water-Related” grouping
- “Infrastructure/Utility Failure – Communications”, “Infrastructure/Utility Failure – Emergency Services”, “Infrastructure/Utility Failure – Energy”, “Infrastructure/Utility Failure – Information Technology”, “Infrastructure/Utility Failure – Transportation Systems”, “Infrastructure/Utility Failure – Water/Wastewater Systems”, all removed from the “Infrastructure/Utility Failure” grouping and consolidated into an individual hazard type, “Infrastructure/Utility Failure” – “Communications”, “Emergency Services”, “Energy”, “Information Technology”, “Transportation Systems” and “Water/Wastewater Systems” are not hazards, but rather types of infrastructure or utilities that can fail in an “Infrastructure/Utility Failure”

2.3 Drought-Related Hazards

2.3.1 Drought

2.3.1.1 Hazard Description

A drought refers to a period of unusually persistent dry weather that endures for a significant time, leading to substantial issues like crop harm and/or shortages in water supply. Drought occurs in virtually all climatic zones, but varies significantly from one region to another, due to its relationship to normal precipitation in that specific region.

The United States Drought Monitor (USDM) identifies areas in drought on weekly-basis and labels them by intensity. The levels of intensity range from D0 – Abnormally Dry to D4 – Exceptional Drought. The USDM uses a convergence of evidence approach, blending objective physical indicators with insight from local experts, condition observations and reports of drought impacts – physical indicators incorporated in its analysis include precipitation, snowpack, humidity, evapotranspiration, lake and reservoir levels, streamflow, vegetation health, and soil moisture and groundwater. Table 2-2 below provides more information on drought levels and varying degrees of action.

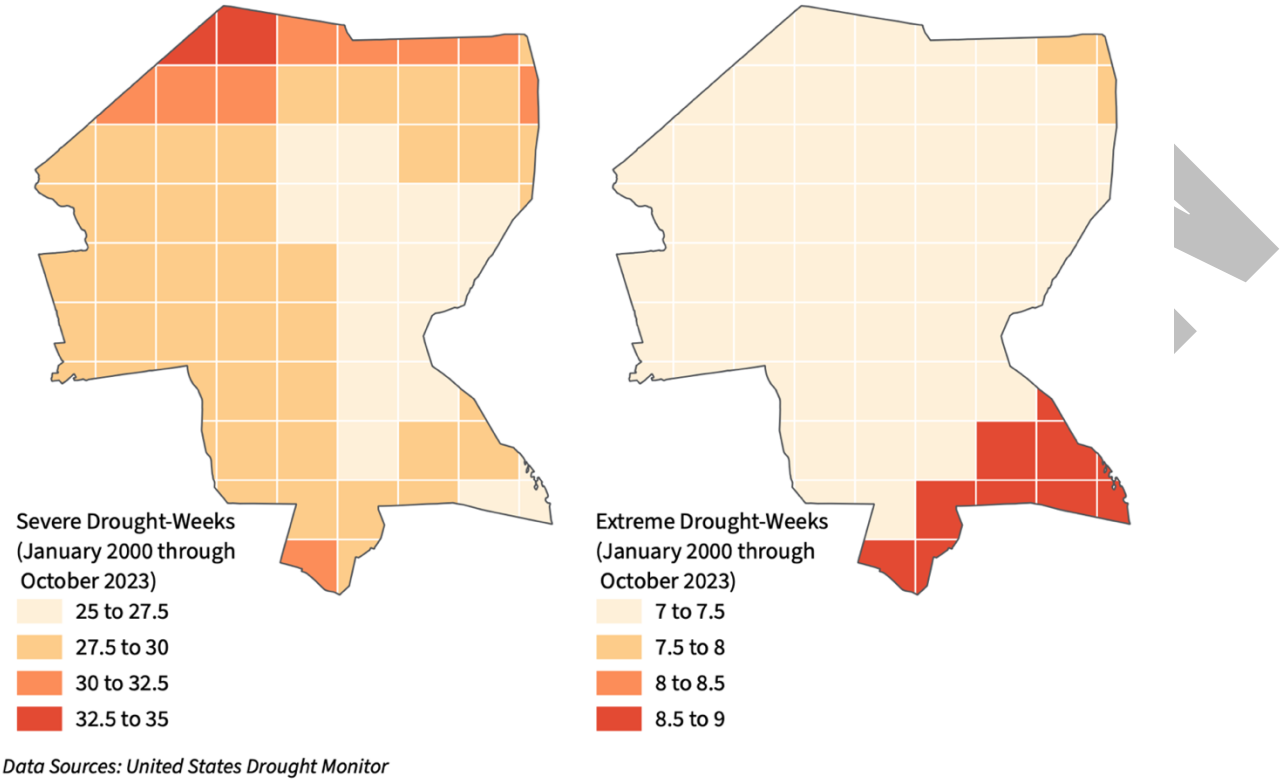
Table 2-2. USDM drought classifications

Category	Description	Example Percentile Range for Most Indicators	Values for Standard Precipitation and Precipitation-Evapotranspiration Indices
None	Normal or wet conditions	30.01 or Above	-0.49 or above
D0	Abnormally Dry	20.01 to 30.00	-0.5 to -0.79
D1	Moderate Drought	10.01 to 20.00	-0.8 to -1.29
D2	Severe Drought	5.01 to 10.00	-1.3 to -1.59
D3	Extreme Drought	2.01 to 5.00	-1.6 to -1.99
D4	Exceptional Drought	0.00 to 2.00	-2.0 or less

2.3.1.2 Location and Extent

Drought typically impacts entire regions rather than isolated parts of a jurisdiction, so the entire City of Providence can, and has, experienced drought. Based on historical data from the USDM, the City can expect to experience droughts up to D3 – Extreme Drought intensities.

Figure 2-1. Weeks of reported severe and extreme droughts in the City of Providence (January 2000 through October 2023) (USDM)



Data Sources: United States Drought Monitor

2.3.1.3 Previous Occurrences

The City of Providence has experienced drought days during 17 months between January of 2000 through October of 2023. The most intense and prolonged drought occurred between August 2020 and November 2020 – the drought lasted 14 weeks and with 7 of those weeks being classified as a D3 – Extreme Drought intensity.

Table 2-3. Previous occurrences of drought from January 2000 through October 2023 (USDM)

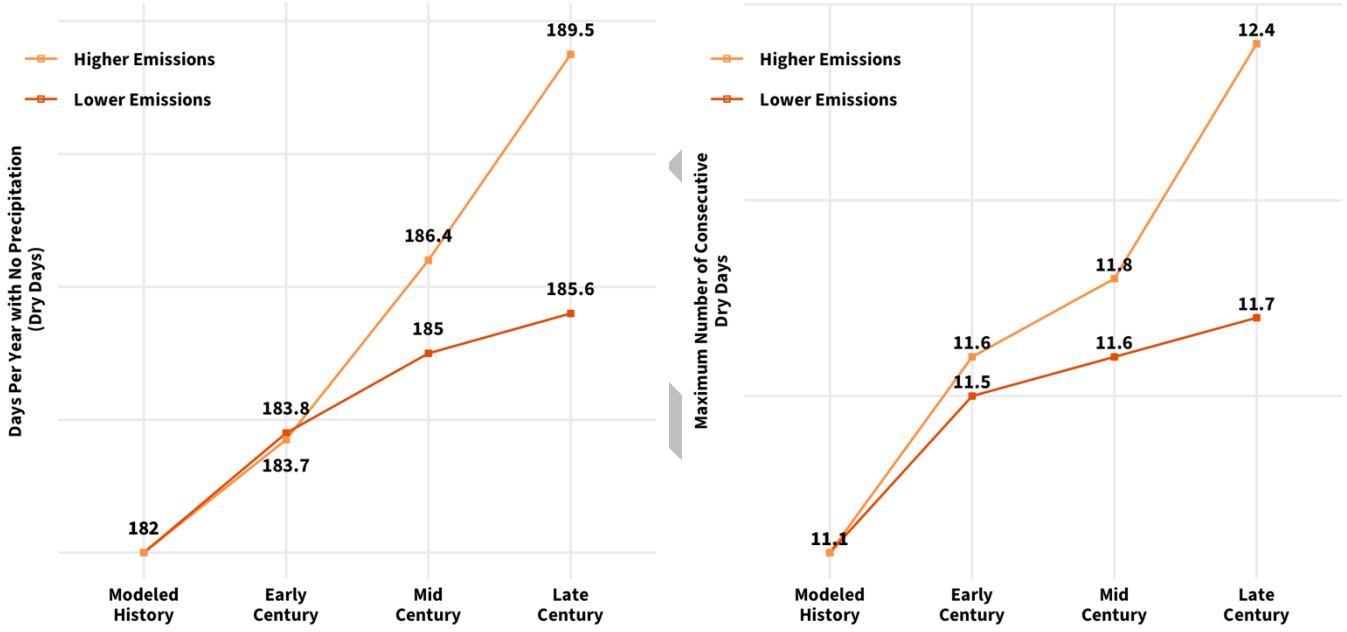
Month and Year	Duration	Category and Description
December 2001	1 week	D2 – Severe Drought
January 2002	1 week	D2 – Severe Drought
February 2002	2 weeks	D2 – Severe Drought
March 2002	3 weeks	D2 – Severe Drought
April 2002	2 weeks	D2 – Severe Drought
April 2012	2 weeks	D2 – Severe Drought
August 2016	5 weeks	D2 – Severe Drought
September 2016	4 weeks	D2 – Severe Drought
October 2016	4 weeks	D2 – Severe Drought

Month and Year	Duration	Category and Description
August 2020	2 weeks	D2 – Severe Drought
September 2020	2 weeks	D2 – Severe Drought
September 2020	3 weeks	D3 – Extreme Drought
October 2020	4 weeks	D3 – Extreme Drought
November 2020	3 weeks	D2 – Severe Drought
July 2022	1 week	D2 – Severe Drought
August 2022	2 weeks	D2 – Severe Drought
August 2022	3 weeks	D3 – Extreme Drought

2.3.1.4 Probability

Based on historical data, the probability of having a severe or extreme drought in the City is highly likely (occurring every 1 to 5 years). The probability and severity will likely increase though due to climate change. Based on the Climate Mapping for Resilience and Adaptation tool, the days per year with no precipitation is projected to increase by 1.7 to 1.8 days in the next 30 years regardless of the emissions scenario; by late-century, the increase is expected to be 3.6 days under lower emissions and 7.5 days under higher emissions. Further, the maximum number of consecutive dry days is projected to increase by 0.4 to 0.5 days in the next 30 years regardless of the emissions scenario; by late-century, the increase is expected to be 0.6 days under lower emissions and 1.3 days under higher emissions.

Figure 2-2. Drought-related climate projections (Climate Mapping for Resilience and Adaptation)



2.3.1.5 Impacts

Drought can cause losses to agriculture, affect domestic water supply, energy production, public health and wildfire, and contribute to wildfire. Impacts from droughts are unique to regions – no two states have the same experience during a drought. Table 2-4 below includes examples of historically observed impacts for Rhode Island.

Table 2-4. Examples of historically observed impacts in Rhode Island (USDM)

Category	Examples of Historically Observed Impacts
D0	Crop growth is stunted; planting is delayed
	Fire danger is elevated; spring fire season starts early

Category	Examples of Historically Observed Impacts
	Lawns brown early; gardens begin to wilt
	Surface water levels decline
D1	Honey production declines
	Irrigation use increases; hay and grain yields are lower than normal
	Trees and landscaping are stressed; fish are stressed
	Voluntary water conservation is requested; reservoir and lake levels are below normal capacity
	Wildfires and ground fires increase
D2	Fish kills occur; wildlife move to farms for food
	Golf courses conserve water
	Producers begin feeding cattle; hay prices are high
	Specialty crops are impacted in both yield and fruit size
	Trees are brittle and susceptible to insects
	Warnings are issued on outdoor burns; air quality is poor
	Water quality is poor; groundwater is declining; irrigation ponds are dry; outdoor water restrictions are implemented
D3	Crop loss is widespread; Christmas tree farms are stressed; dairy farmers are struggling financially
	Extremely reduced flow to ceased flow of water is observed; river temperatures are warm; wells are running dry; people are digging more and deeper wells
	Water recreation and hunting are modified; wildlife disease outbreak is observed
	Well drillers and bulk water haulers see increased business

Given the urban environment of the City, impacts to Providence from drought would likely be limited to water supply and fire danger impacts. As indicated in Table 2-4, Providence could see elevated fire danger with drought intensities as low as D0 – Abnormally Dry. Providence Water sells water to majority of households and businesses in the City and has six storage reservoirs in its system, ranging in size from 1 MGD to 43.4 MGD. With its diverse supply and large storage capacity, impacts to the City's water supply are not common in current conditions (Providence Water last approved any type of water restriction in 1994).

2.3.2 Extreme Heat

2.3.2.1 Hazard Description

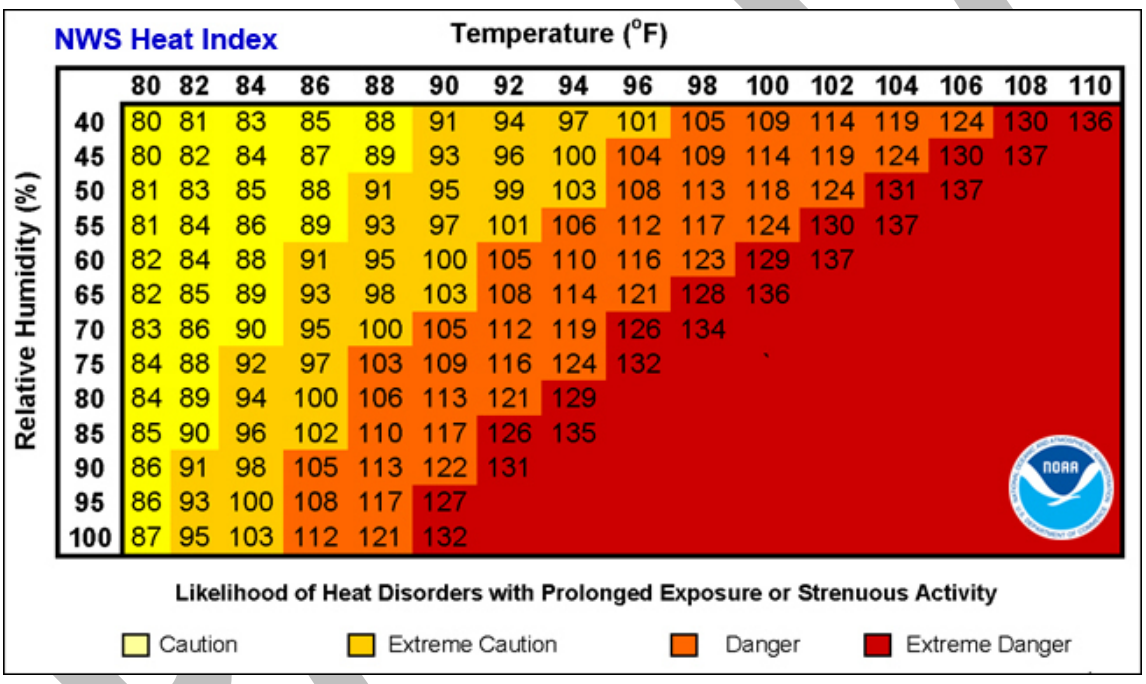
Extreme heat refers to periods of unusually high temperatures that can pose significant health risks and impact various aspects of society and the environment. While definitions may vary based on geographic location and climate norms, extreme heat events are generally characterized by temperatures that are

substantially higher than normal for a particular region and time of year. The National Weather Service (NWS)'s local weather forecast office that covers the City of Providence issues the following watches, warnings, and advisories related to extreme heat events:

- Heat Wave: Issued for non-criteria warning/advisory heat. A heat wave is defined as 3 or more days of ≥ 90°F temperatures.
- Heat Advisory: Daytime heat indices of 95°F-99°F for 2 or more hours over 2 consecutive days, or 100°F-104°F for 2 or more hours over 1 day.
- Excessive Heat Warning: Daytime heat indices of ≥ 105°F for 2 or more hours.

The heat index used as a criteria above is a measure of how hot it really feels when relative humidity is factored in with the actual air temperature. Figure 2-3 below shows the relationship between the temperature, relative humidity, and heat index.

Figure 2-3. Heat index chart (National Oceanic and Atmospheric Administration (NOAA))



2.3.2.2 Location and Extent

Extreme heat events are a City-wide hazard. The City's vulnerability is heightened by the urban heat island effect, which refers to the tendency for urban areas to experience higher temperatures than outlying rural areas. This is primarily due to the absorption and re-radiation of heat by buildings, roads, and other urban infrastructure. Figure 2-4 below demonstrates the urban heat island effect in the City.

Based on historical data, in the event of extreme heat, the severity in the City of Providence has the potential to reach a level of "Danger" (heat index ranging from 103°F to 124°F). Figure 2-5 below plots the maximum heat index per day between May and September that Providence County experienced between 1979 and 2021.

Figure 2-4. Average ambient air temperature in the afternoon (July 2020) in the City of Providence (CAPA Strategies)

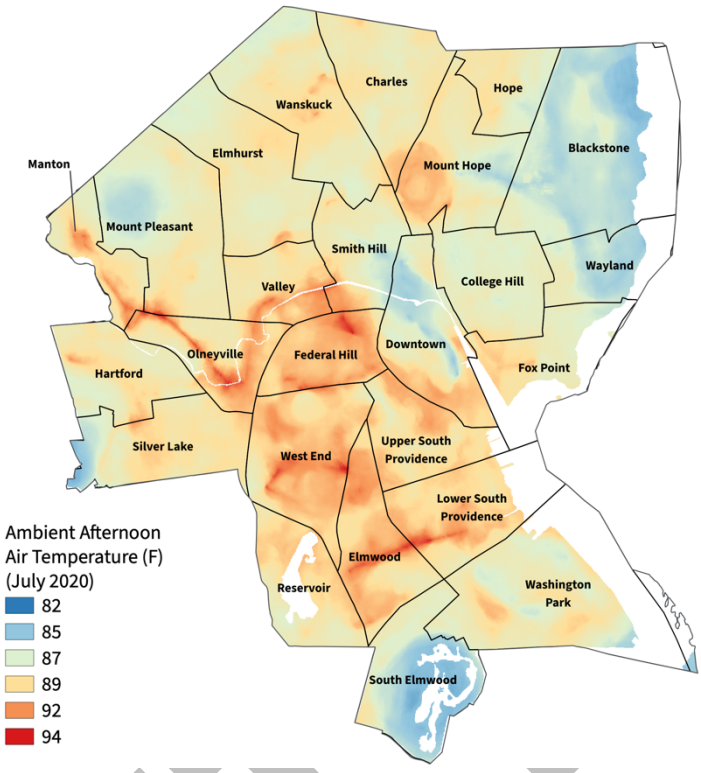


Figure 2-5. Daily maximum heat index (May through September) between 1979 and 2021 (Center for Disease Control and Prevention (CDC) National Environmental Public Health Tracking Network)

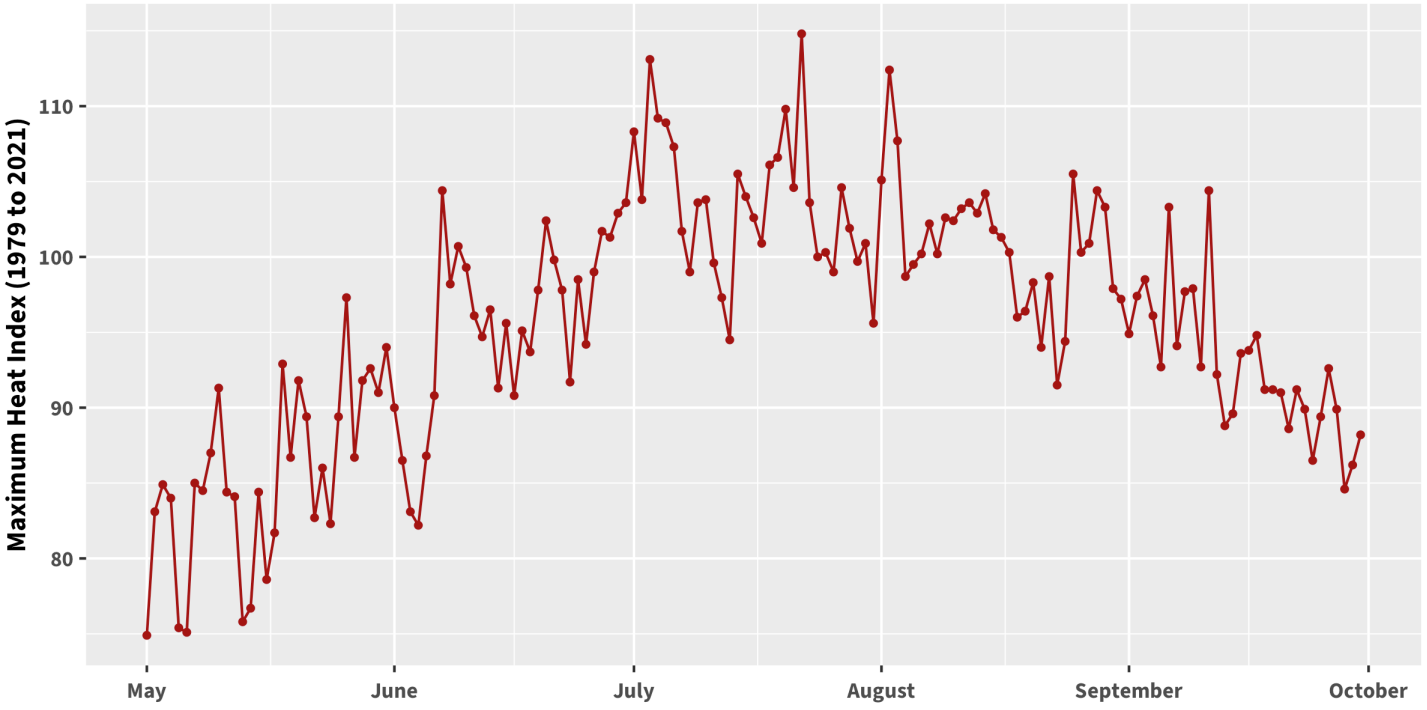
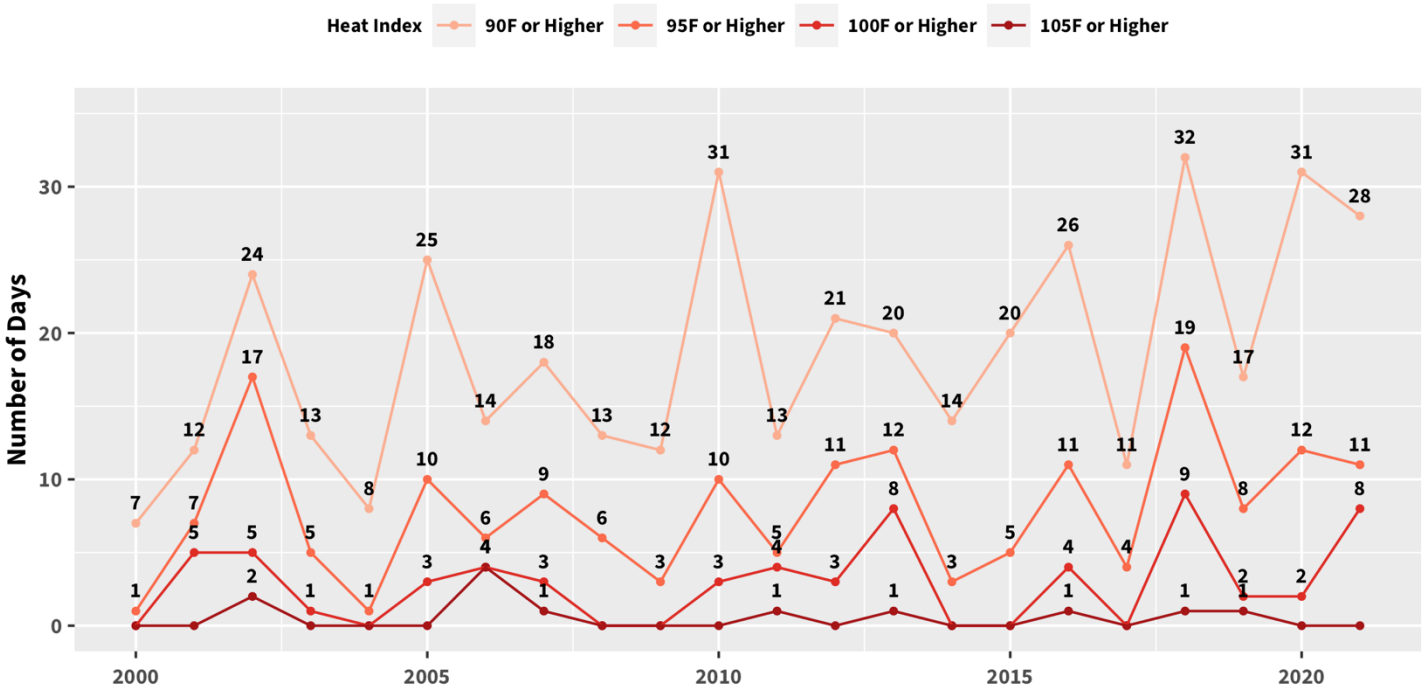


Figure 2-6. Annual number of extreme heat days (May through September) from 2000 through 2021 (CDC National Environmental Public Health Tracking Network)



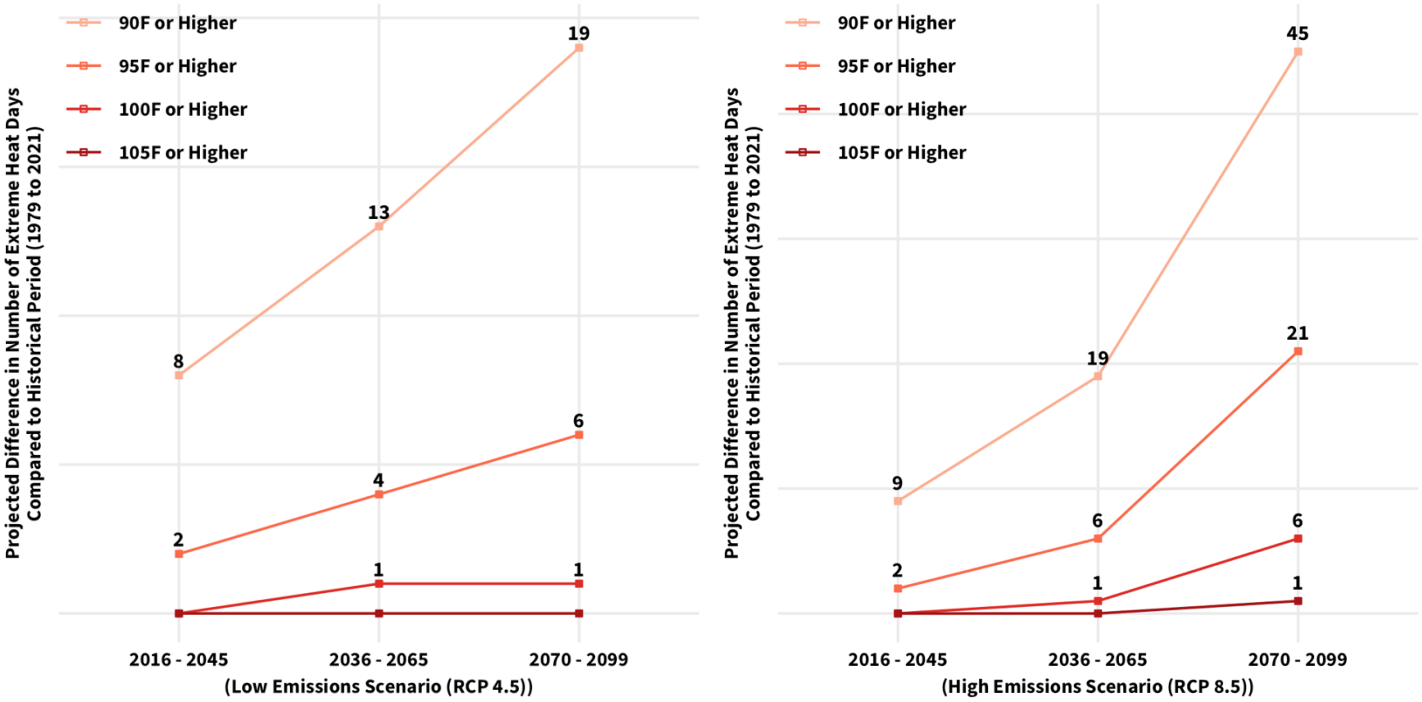
2.3.2.3 Previous Occurrences

Figure 2-6 above details the annual number of extreme heat days for the City of Providence from 2000 through 2021. The chart indicates that between 2000 and 2021, the City experienced at least one day with the heat index at or above 95°F, annually. Further, days with the heat index at or above 90°F were frequent with the City averaging over 18 days, annually and peaking in 2018 at 32 days. The most extreme heat days (heat index at or above 105°F) were not uncommon as at least one day was recorded in over 36% of the years.

2.3.2.4 Probability

Based on historical data, the probability of having an extreme heat event in the City is extremely likely (occurring every 1 year or more). The probability and severity will likely increase though due to climate change. Based on the CDC National Environmental Public Health Tracking Network (Figure 2-7), the number of extreme heat days (at or above 90°F) per year is projected to increase by 8 to 9 days in the next 20 years regardless of the emissions scenario; by late-century, the increase is expected to be 19 days under lower emissions and 45 days under higher emissions. Similarly, the number of extreme heat days (at or above 95°F) per year is projected to increase by 2 days in the next 20 years regardless of the emissions scenario; by late-century, the increase is expected to be 6 days under lower emissions and 21 days under higher emissions. While not as drastic, the number of extreme heat days (at or above 100°F) per year is also projected to increase beginning in mid-century.

Figure 2-7. Projected difference in number of extreme heat days compared to historical period (1979 to 2021) under low and high emissions scenarios (CDC National Environmental Public Health Tracking Network)



2.3.2.5 Impacts

The impacts from extreme heat are multifaceted, directly affecting human health, infrastructure, and the economy. The most direct impact of extreme heat is on human health, leading to heat-related illnesses, including conditions such as heat exhaustion, heatstroke, dehydration, and exacerbation of chronic diseases, and sometimes mortality. While the entire population is susceptible from extreme heat impacts, the CDC lists the following populations as disproportionately impacted:

- Older Adults (Aged 65+)
- Infants and Children
- People with Chronic Medical Conditions
- Low Income
- Athletes
- Outdoor Workers
- Pregnant Women

Extreme heat can also impact human health more indirectly through its impacts on water quality. For example, extreme heat promotes the growth and proliferation of cyanobacteria, as these organisms thrive in warmer temperatures, potentially leading to more frequent and intense blooms. Cyanobacteria, often referred to as blue-green algae, are a group of bacteria that obtain their energy through photosynthesis. They are found in almost all aquatic and terrestrial habitats, including oceans, fresh water, and damp soil. Cyanobacteria are known for their ability to thrive in various environmental conditions, especially in

nutrient-rich waters where they can form dense populations or blooms. These blooms can sometimes produce harmful toxins, known as cyanotoxins. These toxins can pose serious health risks to humans, animals, and ecosystems. They come in various forms, including neurotoxins, hepatotoxins, and dermatotoxins, affecting the nervous system, liver, and skin, respectively. Exposure to cyanotoxins can occur through drinking contaminated water, recreational activities in affected water bodies, or consuming contaminated fish or shellfish, leading to a range of health issues from mild skin irritations to severe neurological or liver damage.

In the context of infrastructure, in energy systems, the surge in electricity demand, primarily for air conditioning, can overburden power grids, potentially causing blackouts or brownouts. The transportation sector is also vulnerable, as extreme temperatures can lead to the expansion and buckling of roads, bridges, and railways, resulting in disruptions and escalating maintenance costs. Furthermore, buildings and urban infrastructure face increased thermal stress during heatwaves, driving up cooling expenses and posing potential structural challenges.

Extreme heat can also heighten the probability of other hazards, compounding impacts. Key ways in which extreme heat can influence other hazards include:

- Drought: The increase in temperatures, associated with extreme heat events, exacerbates conditions leading to drought. Higher temperatures increase evaporation rates, reduce soil moisture, and lower water levels in reservoirs and groundwater supplies, thereby intensifying drought conditions.
- Wildfire: Extreme heat is a critical factor in increasing the frequency and intensity of wildfires. Hotter conditions dry out vegetation, making it more flammable and susceptible to ignition. Consequently, extreme heat can lead to more severe and widespread wildfires.
- Invasive Species: The proliferation of invasive species is both directly and indirectly tied to extreme heat. Warmer temperatures can create favorable conditions for invasive species to thrive, outcompete native species, and disrupt ecosystems. This can lead to a cascade of effects, including increased erosion, changed hydrology, and the creation of fuel loads that exacerbate wildfire risks.
- Infectious Disease: There is a link between extreme heat and the spread of infectious diseases. Higher temperatures can expand the range of disease vectors, leading to an increase in the incidence of diseases.

2.4 Geologic-Related Hazards

2.4.1 Earthquake

2.4.1.1 Hazard Description

An earthquake is the sudden release of strain energy in the Earth's crust resulting in energy waves that radiate outward from the source. Earthquakes can occur along fault lines, fractures in the Earth's crust where two plates of crust move against each other. The energy released during an earthquake travels through the crust in the form of seismic waves, which are responsible for the ground shaking felt during an event. The severity of effects is dependent upon magnitude of energy released, proximity to the epicenter, depth to the epicenter, duration, geologic characteristics, and type of ground motion. Two primary scales are utilized to characterize seismic events. The Richter Scale measures the total energy released by an earthquake, while the Modified Mercalli Intensity (MMI) Scale assesses the extent of damage observed.

Table 2-5. Modified Mercalli Scale (United States Geologic Survey (USGS))

Mercalli Intensity	Description
I	Not felt except by very few under especially favorable conditions.
II	Felt only by a few persons at rest, especially on upper floors of buildings.
III	Felt quite noticeably by persons indoors, especially on upper floors of buildings.
IV	Felt indoors by many, outdoors by few during the day. At night some awakened. Dishes, windows, doors disturbed, walls make cracking sounds.
V	Felt by nearly everyone, many awakened. Unstable objects overturned.
VI	Felt by all, many frightened. Some heavy furniture moved. Damage slight.
VII	Damage negligible in buildings of good design and construction, slight to moderate in well-built structures, considerable damage in poorly built.
VIII	Damage slight in specially designed structures, considerable damage and partial collapse in standard buildings. Damage great in poorly built structures.
IX	Damage considerable in specially designed structures. Damage great in substantial buildings with partial collapse. Buildings shifted off foundations.
X	Some well-built wooden structures destroyed, most masonry and frame structures destroyed with foundations. Rails bent.

Table 2-6. Orders of magnitude on the Richter Scale and effects (National Park Service (NPS))

Richter Magnitude	Effects
1 to 3.5	Generally not felt, but recorded
3.5 to 5.4	Often felt, but rarely causes damage
Under 6.0	At most, slight damage to strong buildings
6.1 to 6.9	Destructive over 100km where people live
7.0 to 7.9	Major earthquake causing serious damage
8.0 or greater	Great earthquake causing damage over an area hundreds of kilometers across

2.4.1.2 Location and Extent

Earthquakes have the potential to affect the entire City of Providence given the extent of these hazard incidents. Rhode Island though, is located on the North Atlantic tectonic plate, an area of very low seismic activity. Additionally, the underlying geology of the State is largely composed of stratified sedimentary sequences and igneous plutonic units that are considered geologically stable and not prone to seismic amplification. Earthquakes that occur in the Rhode Island area often register on the Richter Scale as less than 3.5 and therefore are not felt.

2.4.1.3 Previous Occurrences

The USGS maintains a world-wide earthquake catalog (M4.5+ worldwide, M2.5+ United States). Table 2-7 below shows previous occurrences of earthquakes within 100 kilometers of the City of Providence since 1970.

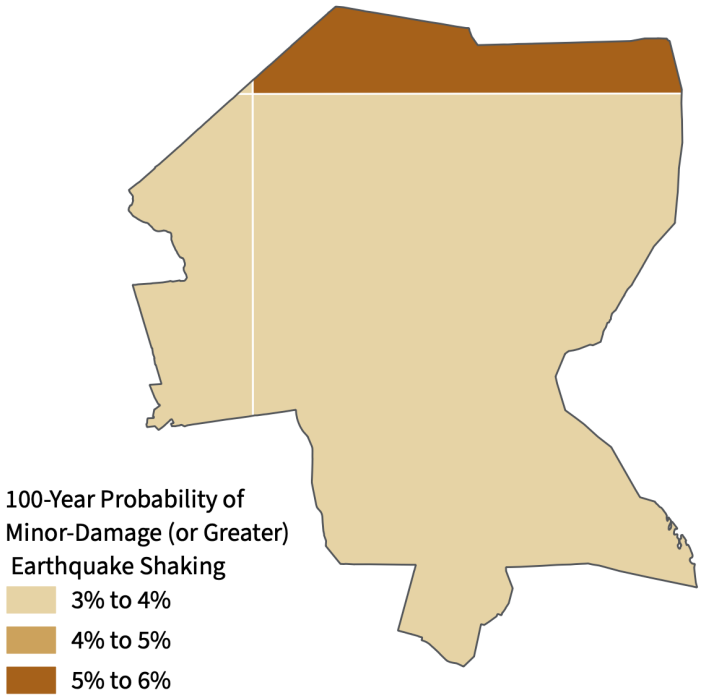
Table 2-7. Previous occurrences of earthquakes within 100 km of the City (USGS)

Date	Magnitude	Location
November 8, 2020	3.6	10 km S of Bliss Corner, Massachusetts
January 13, 2015	2.6	2 km E of Wauregan, Connecticut
January 12, 2015	3.3	0 km NE of Wauregan, Connecticut
August 14, 2014	2.66	6 km SW of Deep River Center, Connecticut
October 19, 2007	2.5	2 km WSW of Littleton Common, Massachusetts
November 17, 2005	2.5	4 km S of Plymouth, Massachusetts
June 7, 2002	2.5	3 km NNW of Hopedale, Massachusetts
October 13, 1999	2.7	2 km E of Littleton Common, Massachusetts
April 22, 1996	2.6	3 km NE of North Westport, Massachusetts
March 22, 1996	3.1	2 km NE of Bristol, Rhode Island
October 2, 1994	3.7	6 km W of Hardwick, Massachusetts
October 2, 1994	3.3	1 km NW of Hardwick, Massachusetts
October 11, 1990	2.7	5 km NNE of The Pinehills, Massachusetts
January 23, 1990	2.5	3 km NNW of Boxborough, Massachusetts
August 24, 1989	3	2 km S of Fairhaven, Massachusetts
October 15, 1985	3	2 km E of Boxborough, Massachusetts
June 17, 1982	3	6 km E of Moodus, Connecticut
January 27, 1982	3	2 km WNW of North Lakeville, Massachusetts
April 3, 1981	2.7	2 km ESE of Portsmouth, Rhode Island
November 23, 1980	2.5	2 km NW of Chelmsford, Massachusetts
September 3, 1978	2.8	10 km SE of Narragansett Pier, Rhode Island
December 20, 1977	3.1	7 km NW of White Island Shores, Massachusetts
May 10, 1976	2.7	9 km SW of Bliss Corner, Massachusetts
March 11, 1976	3.5	5 km SE of Portsmouth, Rhode Island
October 1, 1974	2.5	1 km E of West Warwick, Rhode Island

2.4.1.4 Probability

The USGS produces National Seismic Hazard Maps to quantify the potential frequency and severity of earthquakes. The maps compile all known earthquake sources (and proxies for unknown sources), their distance from the site in question, and other seismological and geological information to project potential maximum expected ground motions at a site over a particular period of time. Based on the National Seismic Hazard Maps, the City of Providence's 100-year probability of experiencing an earthquake of minor-damage shaking or greater is less than 6%. This probability is not expected to change due to climate change.

Figure 2-8. 100-year probability of minor-damage (or greater) earthquake shaking in the City (USGS)



2.4.1.5 Impacts

As detailed above, earthquakes in the City of Providence are infrequent, and historically, when they have transpired, they have been of such low magnitude that they did not result in any notable damage. The absence of a previous event does not preclude a large magnitude earthquake from happening in the future though. In a larger magnitude event in the City, the consequences of an earthquake could be dramatically amplified by the City's lack of specific preparations for seismic events. Impacts could include, infrastructure damage and collapse, which would likely be more severe compared to a similar event in active seismic zone as seismic protections are not commonly incorporated into building designs or mandated by building codes in the City. Such damage poses a direct threat to human safety, potentially resulting in injuries, fatalities, and the displacement of populations as homes and workplaces become uninhabitable. Moreover, the city's transportation network could be severely affected, with the possibility of compromised roads and bridges leading to widespread disruptions in movement, emergency services, and supply chains. Additionally, an earthquake could trigger cascading hazards, such as the release of hazardous materials or gas line ruptures and electrical shorts that can lead to fires, further compounding the initial disaster.

2.5 Human and Natural Health-Related Hazards

2.5.1 Infectious Disease

2.5.1.1 Hazard Description

An infectious disease is an illness caused by pathogens such as bacteria, viruses, fungi, or parasites. Diseases such as influenza, pertussis, tuberculosis, and meningitis are examples of infectious diseases that can pose a threat to a community's population. The spread of these diseases can occur through multiple pathways, including direct contact between individuals, airborne respiratory droplets, ingestion of contaminated food or water, bites from vector organisms like mosquitoes, or interaction with infected animals.

The extent of an infectious disease can be measured based on the following classification:

- An isolated case of a high-consequence disease: One or more cases of a particularly serious disease (e.g., botulism), whose further spread is unlikely, but place significant strain on the resources required to isolate and provide treatment for the infected.
- Institutional outbreak: Two or more cases of similar illness with a common exposure at an institution (e.g., a school, nursing home, correctional facility).
- Epidemic: An increase, often sudden, in the number of cases of a disease above what is normally expected in that population in that area.
- Pandemic: An epidemic that has spread over several countries or continents, usually affecting many people.

Novel transmissible diseases, diseases caused by newly identified pathogens, pose significant concern due to their ability to emerge and spread within human populations unexpectedly, reaching pandemic levels. The rise of novel transmissible diseases can be attributed to various factors, including shifts in human behaviors, urban development, deforestation, changes in climate, extensive global travel, and human encroachment into previously undisturbed natural areas. Key features of these diseases include:

- Emergence of a New Pathogen or Strain: Often, novel diseases arise from a pathogen or a new strain of a known pathogen that humans have not encountered before. These can emerge through genetic changes, transmission from animals to humans (zoonotic transmission), or when a pathogen enters a new area where it was not previously found.
- Capability for Human-to-Human Transmission: Novel diseases can spread among humans via various means such as direct physical contact, airborne droplets, contact with contaminated objects, and other transmission routes.
- Challenges in Control: The novelty of these diseases means there may be little to no pre-existing immunity in the human population, presenting significant hurdles for public health systems in terms of monitoring, diagnosing, managing, and curbing the spread of the disease.

2.5.1.2 Location and Extent

Infectious diseases pose a particularly significant threat to the densely populated urban landscape of Providence, where the close proximity of individuals can facilitate rapid transmission. The city's numerous institutions, such as colleges, universities, and nursing homes, are especially vulnerable due to their high concentrations of people and frequent social interactions, which can lead to swift outbreaks. The severity of

infectious disease incidents may remain limited to isolated cases or, in more severe scenarios, escalate to widespread pandemics. As detailed in the Rhode Island State Hazard Mitigation Plan, the extent of a transmissible disease can vary widely depending on several factors, including:

- Pathogen Characteristics: The biological properties of the infectious agent, such as its mode of transmission, incubation period, and virulence, play a significant role. Pathogens that are highly contagious and have a short incubation period are more likely to spread rapidly.
- Human Behavior: Human behavior and practices, such as hygiene, travel, and social interactions, can influence the extent of disease spread. For example, frequent travel and close interpersonal contact can facilitate the rapid transmission of infectious diseases.
- Public Health Measures: The effectiveness of public health measures, such as quarantine, isolation, contact tracing, and vaccination, can limit the extent of disease spread. Prompt and coordinated public health responses can be crucial.
- Geographic Factors: The geographic spread of a disease can be influenced by factors like population density, climate, and geographic barriers.
- Healthcare Infrastructure: The capacity of healthcare systems to detect, treat, and isolate cases can impact the extent of an outbreak. Overwhelmed healthcare systems can lead to a larger extent of disease.
- Pre-existing Immunity: If a portion of the population has pre-existing immunity to the disease, either due to prior exposure or vaccination, this can limit the extent of disease transmission.
- Global Travel: In an era of global travel, novel infectious diseases can quickly cross international borders, affecting multiple countries and regions.
- Vaccination: The availability and coverage of vaccines against the disease can significantly reduce the extent of an outbreak. High vaccination rates create herd immunity, protecting even those who are not vaccinated.
- Mutation and Variants: Some infectious agents may undergo mutations that affect their transmissibility or virulence. New variants can lead to changes in the extent and severity of the disease.
- Public Awareness and Compliance: Public awareness of the disease, willingness to follow public health guidance, and compliance with preventive measures can affect disease transmission rates.
- Timeliness of Response: The speed with which authorities and healthcare systems respond to an outbreak can have a substantial impact. Rapid detection and containment efforts can limit the extent of spread.

2.5.1.3 Previous Occurrences

The Rhode Island Department of Health (RIDOH) monitors the trends in incidence and prevalence of infectious diseases of public health importance – Table 2-8 details the incidence rates for select diseases between 2017 and 2022.

Table 2-8. Occurrences of select infectious diseases in Rhode Island from 2017 to 2022 (RIDOH)

Disease	2017	2018	2019	2020	2021	2022*	Five Year (2017 - 2021) Mean	Five Year (2017 - 2021) Median
Babesiosis	161	165	158	193	195	51	174	165
Campylobacteriosis	278	326	355	206	278	220	289	278
Chikungunya	0	0	1	0	0	0	0	0
Chlamydia	5,282	5,487	5,717	4,714	5,199	4,263	5,280	5,282
Coccidioidomycosis	3	4	1	0	1	1	2	1
COVID-19 (SARS-CoV-2)				86,882	140,322	199,714	N/A	N/A
CJD (non-variant)	3	4	3	0	0	0	2	3
Cryptosporidosis	33	90	63	23	34	60	49	34
Cyclosporiasis	5	3	31	4	4	2	9	4
EEE Virus	0	0	3	0	0	0	1	0
Ehrlichiosis / Anaplasmosis	225	228	196	110	155	56	183	196
Giardiasis	45	56	79	31	55	51	53	55
Gonorrhea	1,087	1,336	1,516	1,399	1,681	1,145	1,404	1,399
Haemophilus Influenzae, invasive	18	25	24	12	15	6	19	18
Hepatitis A	6	7	6	4	1	1	5	6
HIV (Human Immunodeficiency Virus)	81	72	73	54	67	59	74	74
Legionellosis	50	73	48	36	87	43	59	50
Listeriosis	7	7	2	5	6	4	5	6
Lyme Disease**	1,132	1,111	971	839	980	2,222	1,007	980
Malaria	13	12	13	2	7	9	9	12
Measles	0	0	0	0	0	0	0	0
Meningococcal Disease	2	1	3	0	0	0	1	1
Multisystem Inflammatory Syndrome Associated with COVID-19 (MIS-C)				12	18	6	N/A	N/A
Mumps	29	5	9	0	2	0	9	5
Pertussis	84	34	44	4	0	0	33	34

Disease	2017	2018	2019	2020	2021	2022*	Five Year (2017 - 2021) Mean	Five Year (2017 - 2021) Median
Invasive Pneumococcal Disease	64	59	85	51	32	53	58	59
Rocky Mountain Spotted Fever	15	9	0	0	1	0	5	1
Rubella (including congenital)	0	0	0	0	0	0	0	0
Salmonellosis	148	175	152	115	137	141	145	148
Shiga-toxin positive E. coli	14	45	48	28	45	39	36	45
Shigellosis	44	59	85	32	49	56	54	49
Streptococcus, Group A	39	43	53	34	30	32	40	39
Streptococcus, Group B	84	114	90	101	135	101	105	101
Syphilis (congenital)	0	0	0	1	2	4	1	0
Syphilis (late)	79	118	213	128	237	186	155	128
Syphilis (primary, secondary, and early latent)	142	167	210	186	328	162	207	186
Tuberculosis	13	19	14	7	17	15	14	14
Varicella	74	67	64	32	32	39	54	64
Vibriosis	15	13	12	10	13	12	13	13
West Nile Virus	2	1	0	0	2	1	1	1

* 2022 preliminary data was extracted from the RI National Electronic Disease Surveillance System (NEDSS) on December 14, 2022, and is subject to change.
** The CSTE Lyme disease case definition was changed for the start of the 2022 reporting year. Rhode Island is a high incidence state for Lyme disease and is reporting based on laboratory data per the new case definition.

The most widespread infectious disease in recent years in Rhode Island is COVID-19, also known as Coronavirus Disease 2019. COVID-19 is an infectious disease caused by the SARS-CoV-2 virus, first identified in a 2019 outbreak in Wuhan, China – the disease's spread led to a global pandemic affecting millions worldwide. It is characterized mainly by respiratory symptoms, but includes a range of symptoms including fever, cough, and shortness of breath, with the potential for loss of taste or smell. In more severe cases, it can lead to difficulty breathing, chest pain, and the need for hospitalization due to complications such as acute respiratory distress syndrome. The following figures detail the number of reported COVID-19 cases and the COVID-19 death rate (per 100,000 Rhode Island residents) in Rhode Island.

Figure 2-9. Reported COVID-19 cases in Rhode Island from March 2020 to January 2024 (RIDOH)

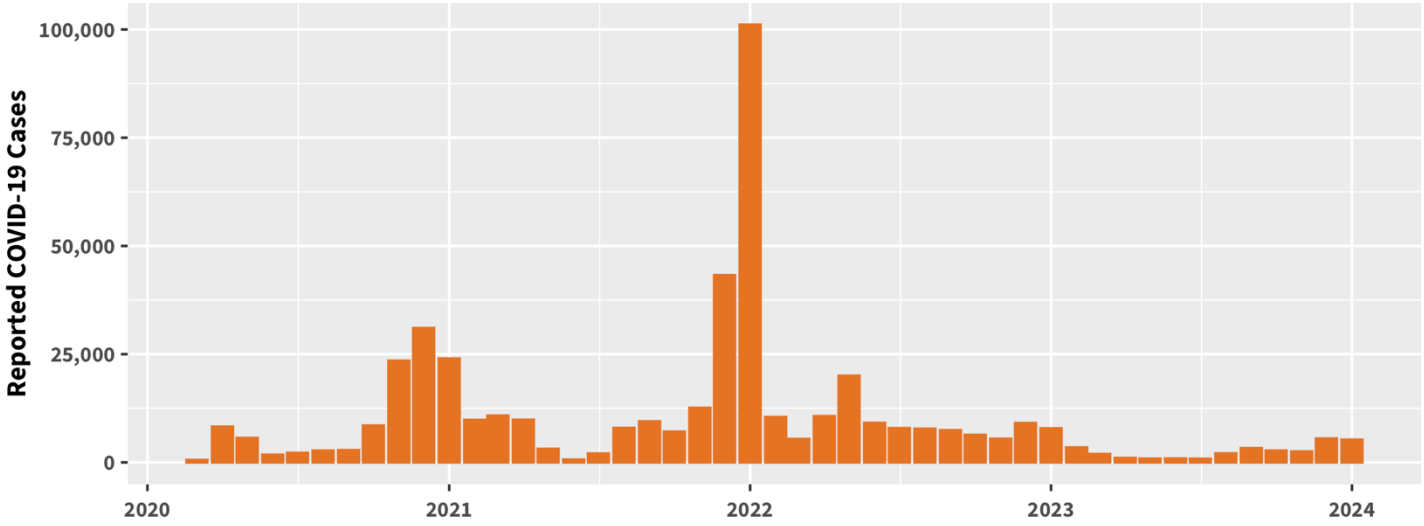
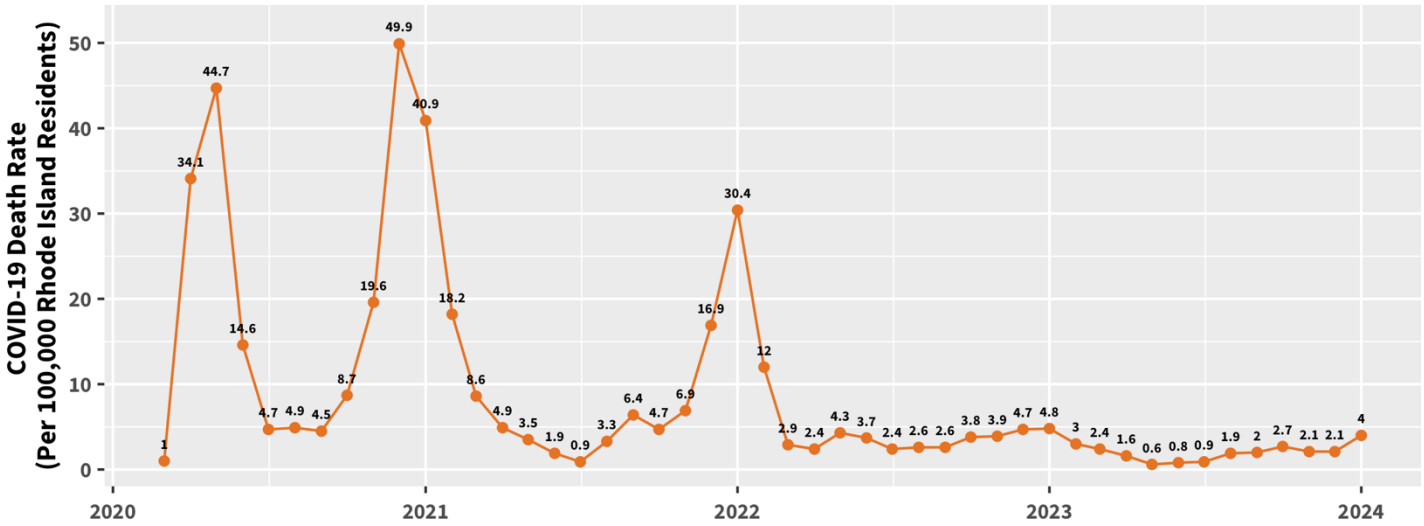


Figure 2-10. COVID-19 death rate (deaths per 100,000 residents) in Rhode Island from March 2020 to January 2024 (RIDOH)



2.5.1.4 Probability

Multiple infectious disease occurrences happen every year, making the probability extremely likely (occurring every 1 year or more). Infectious diseases are an annual certainty, yet their severity and reach are variables influenced by several evolving conditions – key future conditions that impact the frequency and extent of infectious disease events include:

- Climate Change
    - Shifts in temperature and rainfall can impact where and how disease carriers, such as mosquitoes and ticks, thrive. These changes may result in the spread of vector-borne diseases to regions previously unaffected.

    - Hotter temperatures can extend the transmission seasons for certain diseases.
    - Ecosystem, habitat and migration pattern changes caused by climate change can lead to increased interactions between humans, domestic animals, and wildlife, potentially facilitating the transmission of zoonotic diseases (diseases that originate in animals) to humans.
    - Climate-related stressors, such as extreme heat events, can weaken the immune systems of vulnerable populations, making them more susceptible to infectious diseases.
- Globalization: Disease transmission can be accelerated with increased travel and trade.
- Population Growth: Denser populations, particularly in urban environments, facilitate easier and faster transmission of diseases.

2.5.1.5 Impacts

Unlike other natural hazards, infectious disease events have limited impacts on infrastructure, but the hazard has significant short-term and long-term effects on people, the economy, and operations. Major impacts include:

- Immediate health consequences, including widespread illness and increased mortality rates.
- Post-recovery health issues such as long-term organ damage or chronic conditions.
- Mental health challenges including post-traumatic stress disorder (PTSD), depression, and anxiety disorders.
- Social disruption due to isolation and quarantine measures, as well as the need for social distancing.
- Economic slowdown due to decreased consumer spending, mandated business closures, and disrupted workforce participation.
- Strains on healthcare resources such as hospital beds, medical staff, and emergency services.
- Immediate closures of educational institutions and shifts to online learning with potential long-term educational gaps.

2.5.2 Infestation and Invasive Species

2.5.2.1 Hazard Description

An infestation refers to the uncontrolled, rapid spread of organisms, typically pests or parasites, within a particular area or habitat. An infestation occurs when a significant population of pest organisms colonizes an area, host surface, or soil, reaching densities that are damaging or problematic to the indigenous flora, fauna, and human populations. These pest organisms, which can include insects, mammals, birds, parasites/pathogens, fungi, and invasive species, pose a threat to the local ecosystem. They either compete for resources or act as vectors for diseases affecting humans, agricultural crops, and livestock, thereby disrupting the natural balance and health of their environments.

The Rhode Island Department of Environmental Management (RIDEM) currently includes the following insects and diseases in its list of threats to forest health within the State:

- Emerald Ash Borer
- Asian Longhorned Beetle
- Winter Moth

- Lymantria Dispar (LDD) (formerly gypsy moth)
- Hemlock Woolly Agelgid
- Southern Pine Beetle
- Oak Gall Wasps
- Spotted Lanternfly
- Beech Leaf Disease
- Beech Bark Disease
- Rhyzosphaera Needle Cast
- White Pine Needle Damage
- White Pine Blister Rust
- Sudden Oak Death

Invasive species are plants, animals, or pathogens growing and reproducing outside their native range, in habitats not managed by humans, at the expense of native species or natural communities. Once introduced to a new area, either intentionally or accidentally, invasive species often have no natural predators or controls. This lack of competition and natural enemies enables them to proliferate uncontrollably, outcompete native species for resources such as nutrients, water, and space, and disrupt local ecosystems. Environmentally, invasive species can lead to the decline or extinction of native species, alter habitats, and disrupt food webs, while economically, they can damage agriculture, forestry, and fisheries, leading to significant financial losses. Invasive species can also pose a threat to human health by spreading new diseases or increasing the prevalence of existing ones.

2.5.2.2 Location and Extent

Within the City of Providence, infestation and invasive species pose the greatest risk to the City's urban forest, the collection of all the trees in the City and all the living things that rely on them. The Providence Tree Plan cites that 27% of the City is covered by tree canopy, which equates to over 3,200 acres of land and more than 415,000 trees. While the distribution of trees within the City ranges, the hazard remains a City-wide hazard.

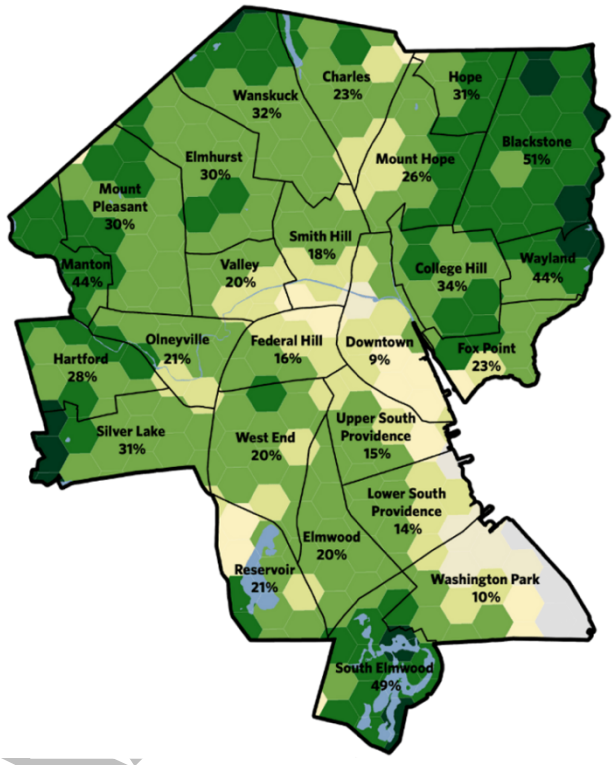
The extent of infestation is dependent of the distribution of tree and invasive species within the City as pests tend to have differing tree hosts. The 2017 Providence Street Tree Inventory showed the most dominant species in terms of population and leaf area in the City are London plane, Norway maple, and Callery pear (Table 2-9). The neighborhoods with the highest percentage of tree canopy cover are generally located along the outer limits of the City, such as Blackstone, South Elmwood, Wayland, and Manton (Figure 2-11).

Table 2-9. Most important tree species in the City of Providence (Providence Street Tree Inventory 2017)

Species Name	Percent Population	Percent Leaf Area	Importance (Sum of Population and Leaf Area Percentages)
London plane	7.7	16.6	24.3
Norway maple	8.3	15.4	23.6

Species Name	Percent Population	Percent Leaf Area	Importance (Sum of Population and Leaf Area Percentages)
Callery pear	12.3	5.8	18.1
Green ash	7.0	8.7	15.7
Red maple	7.3	6.9	14.2
Honeylocust	8.7	3.9	12.6
Littleleaf linden	5.2	5.0	10.1
Pin oak	3.2	6.5	9.7
Japanese zelkova	5.4	4.3	9.6
American elm	2.1	2.1	4.3

Figure 2-11. Percent tree canopy cover by neighborhood for the City of Providence (2018) (UVM Spatial Analysis Lab)



The insect and disease threats listed by the RIDEM of greatest concern to the tree species in the City include:

- Emerald Ash Borer (EAB): An introduced pest, originally discovered in Detroit in 2002, the EAB was found in Rhode Island in July 2018 and attacks ash trees of all species, and ultimately kills any infested ash tree.
- Lymantria Dispar (LDD) (formerly gypsy moth): LDD and their larvae (caterpillars) are always present in the environment. Usually unnoticed and causing little concern, their numbers are controlled by a naturally occurring virus, Nucleopolyhedrosis (NPV), and fungus, Entomophaga maimaiga (Entomophaga), which typically kills the majority of caterpillars before they reach adulthood. LDD

numbers can increase dramatically though, resulting in an "outbreak" that can cause severe defoliation of tree canopies, such as was experienced throughout Rhode Island in 2015 through 2017. While the exact cause of that outbreak was unknown, it is believed that successive years of warm, dry, spring weather was not conducive to the growth and spread of NPV or Entomophaga. This resulted in an increase in the number caterpillars surviving to adulthood (moth stage), and therefore a large number of eggs masses for successive generations. The caterpillars will consume leaves of many species of broadleaf trees and shrubs – such as oaks, aspen, apple, speckled alder, basswood, gray and river birch, and willow. Less desired but still attacked are maple, black, yellow, and paper birch, cherry, cottonwood, elm, black gum, hickory, hornbeam, larch and sassafras. Older LDD moths larvae devour foliage of several species that younger larvae normally avoid, such as hemlock, and pines and spruces native to the East.

- Winter Moth: Winter moth is an invasive defoliator from Europe that can be found throughout Long Island, New York, southeastern Connecticut, Rhode Island, Massachusetts, coastal areas of New Hampshire and Maine, and Nova Scotia. The larvae (caterpillars) of winter moth feed on the leaves of deciduous trees in early spring; preferred hosts include maple, oak, birch, apple, and blueberry. Outbreaks can lead to high levels of defoliation, and while heavily defoliated trees may try to put out a second flush of leaf growth in response to stress, multiple years of heavy defoliation can lead to branch dieback and mortality.
- Spotted Lanternfly (SLF): First detected in Rhode Island in August 2022 in Smithfield, there is a high likelihood that SLF will create a nuisance factor in residential and urban areas. The preponderance of the preferred host, Ailanthus altissima, particularly along railway lines (and former railway lines) provides a corridor for population expansion through the eastern/central portion of Rhode Island, including within the City of Providence.

2.5.2.3 Previous Occurrences

Forest Health Highlights is an annual report produced by Rhode Island's Forest Health staff. These reports review the status and trends of forest health conditions within the State. The following threats were recorded in the annual reports from 2020 through 2022:

- 2020 Rhode Island Forest Health Highlights
  - EAB infestations reported with some northern areas of the City in the "generally infested" areas
  - Southern Pine Beetle (SPB) trappings identified a small population in Rhode Island's pitch pine forest
  - A declining Beech tree was identified as being infested with Beech Leaf Disease (BLD) in Washington County
  - A half-acre site in Washington County reported a Kudzu infestation with no further plans found in the surrounding areas
- 2021 Rhode Island Forest Health Highlights
  - Orange striped oakworm was present in many locations checked during ground surveys, especially in Washington County; however, little defoliation occurred, except in Newport County, where there was 44 acres of light, mappable defoliation

  - LDD egg surveys yielded a single egg mass, a clear sign that the LDD outbreak of the last few years is over; however, neighboring states reported increasing populations
  - The EAB trap program yielded 53 adults (two were captured in Newport County, a new county find)
  - SPB were collected from 9 of the 10 traps, up from 7 of 10 in 2020; the traps captured 117 beetles, a 468% increase from 2020, but no outbreak had occurred
  - Rhode Island echoed the seemingly rapid spread of BLD in other states, with multiple reports and finds throughout Rhode Island
- 2022 Rhode Island Forest Health Highlights
  - There was a significant increase in damage to the forest canopy from winter moth; more than 12,500 acres (combined aerial and ground surveys) were affected (compared to 148 acres in 2021)
  - For the first time in the State, mappable Ash mortality due to EAB was observed; 99% of the 3,392 acres of mortality occurred in Providence County
  - Black turpentine beetle caused severe crown discoloration in a single 34 acre stand of pitch pine in Washington County
  - Caliciopsis canker caused moderate crown discoloration in a single 48 acre stand of Eastern white pine in Washington County
  - White pine needle damage caused 50 acres of mortality in one site, while an additional 386 combined acres experienced moderate to severe crown discoloration
  - 1,064 acres of American beech trees have become moderately to severely infected from BLD
  - Orange striped oakworm was present in many locations checked during ground surveys (nineteen municipalities); acres affected increased from 44 acres of light, defoliation in 2021 to 1,468 acres of light to moderate defoliation, portending increased probability of a significant outbreak in the near future
  - LDD egg surveys yielded 3 plots with egg masses: 1 egg mass each in 2 adjacent plots in Coventry, and 2 egg masses in a single plot in Richmond
  - 229 SPB adults were collected from 10 sites compared to 117 adults from the same 10 sites in 2021
  - In August, a population of SLF was detected for the first time in Rhode Island along Route 7 in Smithfield; subsequent outreach resulted in additional, verified reports of SLF in nearby communities (North Smithfield, Providence, Pawtucket, and Lincoln)

2.5.2.4 Probability

Invasive species and infestation incidents are actively occurring in the City of Providence and are a continual process of nature. While reports and trappings of insect threats are typical every year, confirmed outbreaks are less frequent, with the probability being highly likely (occurring every 1 to 5 years).

Despite its urban setting, the City of Providence has made dedicated efforts to increasing its tree canopy for benefits, such as better air quality, cooler summer temperatures, reduced flooding, improved mental health – this increase does increase the probability of infestation incidents. Between 2007 and 2018, the City gained

183 more acres of trees (canopy increase from 23% to 27%). Further, as detailed in the Providence Tree Plan, the City aims to cover an additional 4% of the City's land area with tree canopy in the next 25 years, especially in areas with low canopy levels, currently.

Climate change is also expected to increase the probability of infestations in urban forests. Warmer temperatures fostered by climate change can not only lengthen the breeding seasons of many pests, leading to increased population densities, but also enable their expansion into previously uninhabitable areas due to cold limitations. Additionally, altered precipitation patterns, ranging from droughts to heavy rainfall, can stress trees, making them more susceptible to pests; drought reduces trees' natural defenses by limiting water availability, while excessive moisture can create optimal conditions for certain pests and diseases. Urban forests, already stressed by pollution, soil compaction, and spatial constraints, face increased vulnerability due to these climate-induced stresses.

2.5.2.5 Impacts

Invasive species and infestation pose a direct threat to urban forests, primarily through the mortality of trees. Decreases in tree populations and canopies with the City though can result in cascading impacts related to the environment, health, and aesthetics. The multiple benefits gained from urban forests, like heightened aesthetics and community spaces, better air quality, cooler summer temperatures, reduced flooding, and improved physical and mental health, can lessen due to tree mortality. Further, the loss of trees affects the resilience of the City to climate change by reducing the natural cooling effect provided by urban canopies and compromising the structural integrity of landscapes, potentially leading to increased soil erosion and reduced water quality.

2.6 Water-Related Hazards

2.6.1 Coastal Flooding/Sea-Level Rise

2.6.1.1 Hazard Description

Coastal flooding is the abnormal rise in water level caused by one or a combination of storm surge, wind-driven waves, sea-level rise, or seasonal high tides. Storm surge and wind-driven waves are often caused by hurricanes, extra-tropical storms, and Nor'easters.

Sea-level rise refers to the increase in the level of oceans, primarily caused by two factors linked to climate change: the thermal expansion of seawater as it warms, and the addition of water from the melting of ice sheets and glaciers. As global temperatures rise, glaciers and ice caps melt at an accelerated rate, and the expanded volume of warmer water leads to higher sea levels.

2.6.1.2 Location and Extent

The City of Providence's eastern boundary from Washington Park in the south to Blackstone in the north is coastal, making it particularly susceptible to coastal flooding and sea-level rise.

The Rhode Island Coastal Resources Management Council's (RICRMC) STORMTOOLS product maps storm inundation for varying return period storms that covers all of Rhode Island's coastal waters. The maps show the extent and depth at any given point for nuisance storms (1, 2, 3, 5, and 10-year recurrence intervals (e.g. nor'easters)) and extra/tropical 25, 50, 100- year storm scenarios (e.g. tropical depressions, storms, and hurricanes). The flood extents and water depths are presented at the 95% confidence interval, illustrating the models are 95% confident that water levels will not exceed what is shown in the maps. Figure 2-12 below shows the potential location and extent of 10, 50, and 100-year recurrence storms with no sea-level rise. STORMTOOLS does not account for the Fox Point Hurricane Barrier (FPHB) though. Between 1960 and 1966, the FPHB was built to protect the central business district and high-rise buildings of downtown from the effects of coastal surge from a hurricane or storm event. The design storm for the FPHB is a water elevation of 22.18 feet above mean low water. The top of the FPHB is 26.68 feet above MLLW.

The Rhode Island Coastal Hazards, Analysis, Modeling and Prediction (RI-CHAMP) forecast system does account for the FPHB in forecasting coastal and inland flooding in the City though. RI-CHAMP incorporates numerical modeling to predict the physical hazards associated with coastal storms. Storm surge modeling is performed using the ADvanced CIRCulation (ADCIRC) hydrodynamic model, which can be used alone or coupled with a wave model for enhanced predictions in wave-dominated regions. RI-CHAMP currently provides a public dashboard mapping the extent and depth of flooding from a hypothetical hurricane, Hurricane Ram (Figure 2-13). The Hurricane Ram scenario involves a major hurricane that starts near the Bahamas and propagates northward close to the East Coast. While staying close to the coast (like Hurricane Carol (1954)), it moves more quickly. Ultimately, the storm makes landfall in eastern Long Island and then in Rhode Island, as a strong Category 3 hurricane causing a significant storm surge in Narragansett Bay and along the south shore of Rhode Island. Then, shortly after its landfall, the storm slows down, producing heavy rainfall, reaching more than 18 inches in some areas causing massive river flooding in Rhode Island, like Hurricane Diane (1955) and the March 2010 floods.

Figure 2-12. Potential inundation extent and depth from coastal flooding under various return period storms and no sea-level rise (RICMRC)

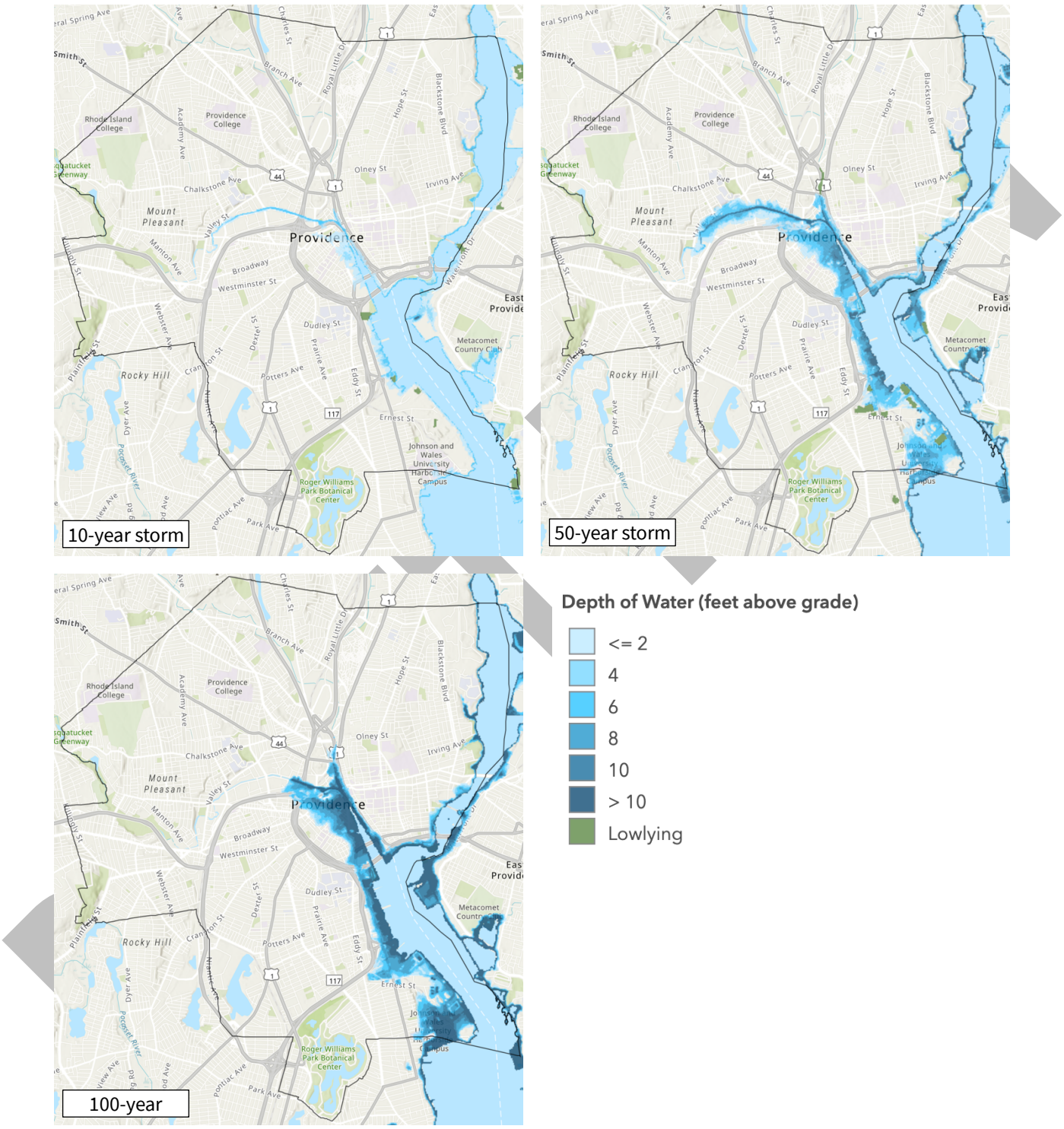
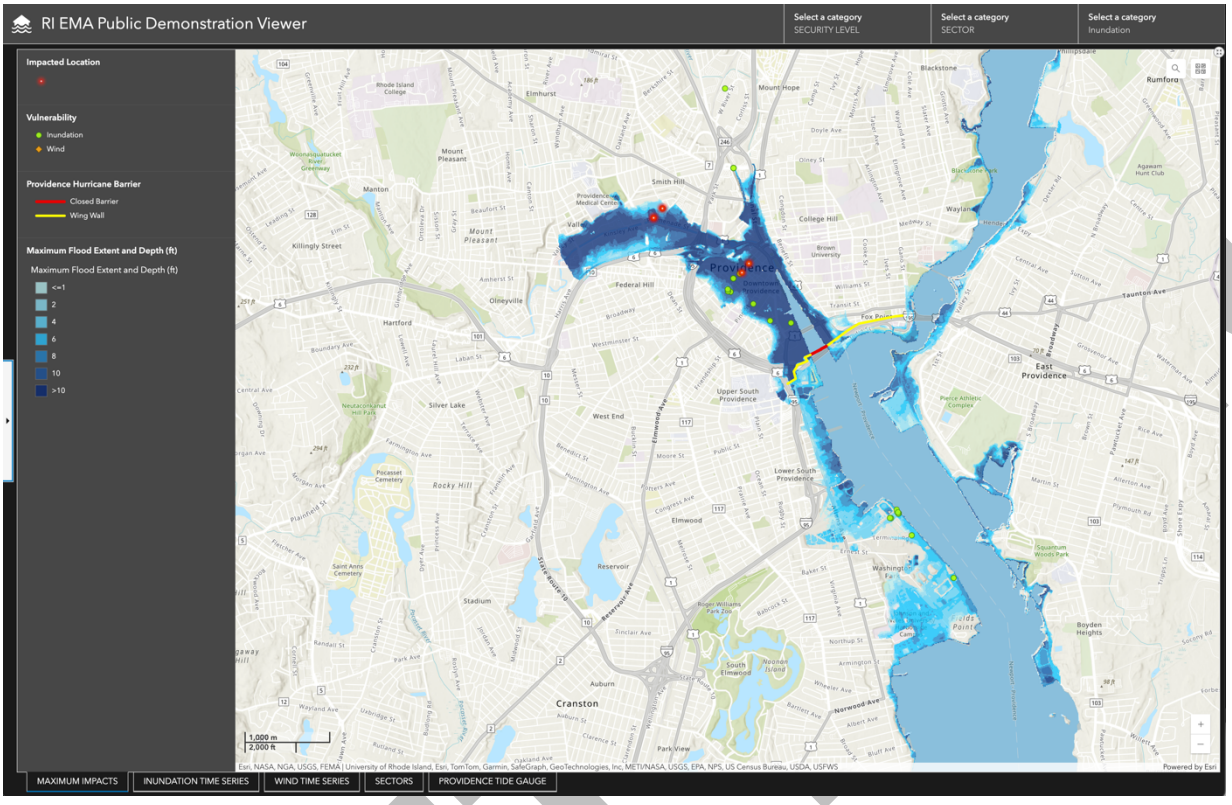


Figure 2-13. Maximum extent and depth of flooding for hypothetical Hurricane Ram (RI-CHAMP)



The extent of sea-level rise projected in the future is dependent on multiple factors, especially the global emissions scenario. NOAA details projected sea-level rise values in the 2022 Sea Level Rise Technical Report under various emissions scenarios and by region. Table 2-10 shows the projected, median rise in sea-level in the Northeast in 2050, 2100, and 2150 relative to a baseline of 2000. Section 145 of RICRMC's Coastal Resources Management Program "Red Book" identifies 7 feet of sea-level rise as the planning target for 2100 based on United States Army Corps of Engineers' (USACE) Sea Level Change Curve Calculator and NOAA's projections of sea-level rise in the future (using "high" scenario). **Error! Not a valid bookmark self-reference.** below shows the potential inundation from sea-level rise with 1 and 7 feet of rise.

The rise in sea-level will inevitably affect the extent and depth of coastal flooding from storm events. As sea-levels rise, the baseline for coastal waters increases, which means that storm surges do not have to be as high as before to cause significant flooding. This elevation in sea-level, compounded with storm events, leads to more extensive and deeper floodwaters, penetrating further inland than previously experienced. In addition, regions that were already classified as flood-prone in the past could face an increased risk of periodic inundation. Below show the potential location and extent of 10, 50, and 100-year recurrence storms with 7 feet of sea-level rise.

Figure 2-14. Projected inundation from sea-level rise under 1 and 7 feet of rise (RICMRC)

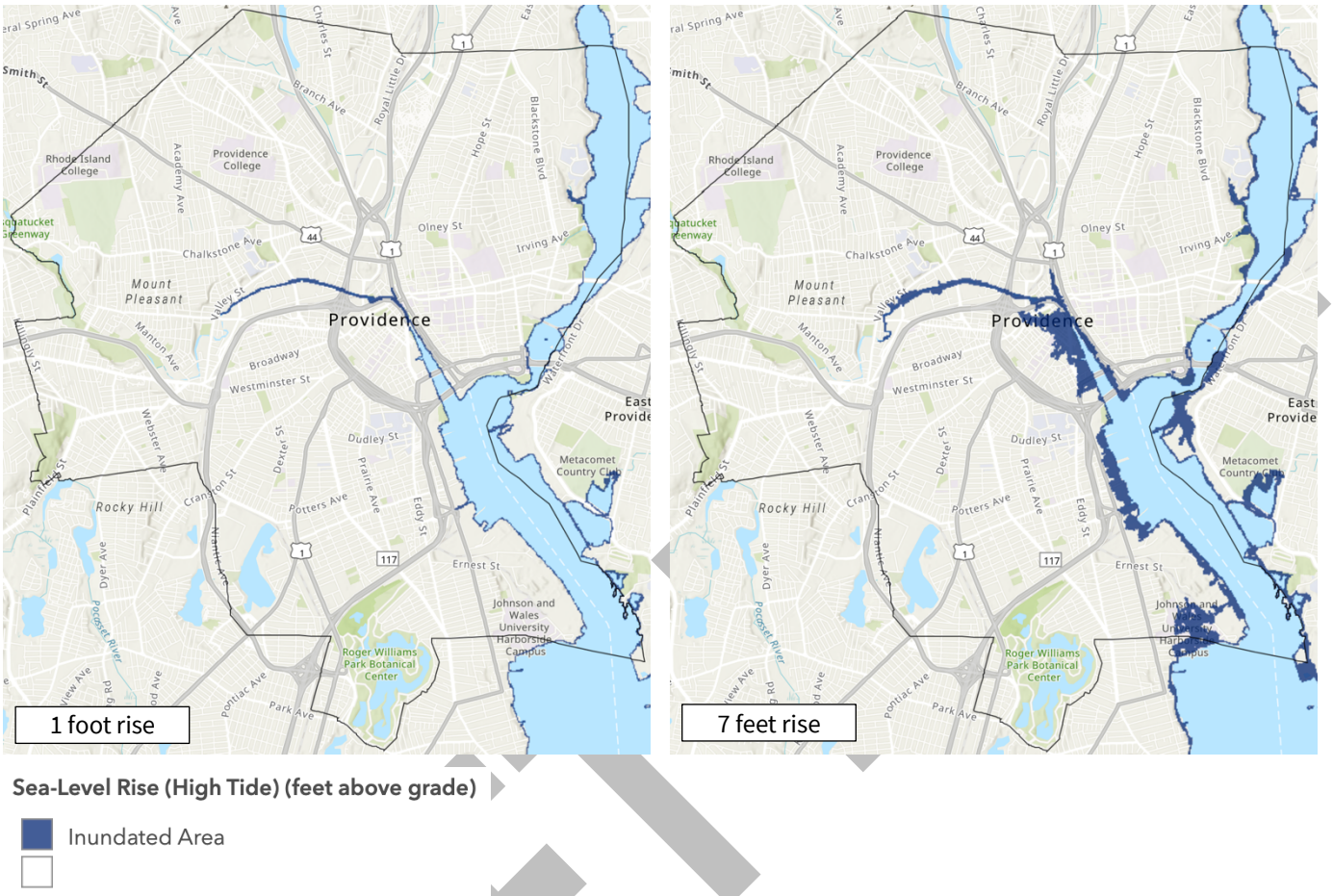
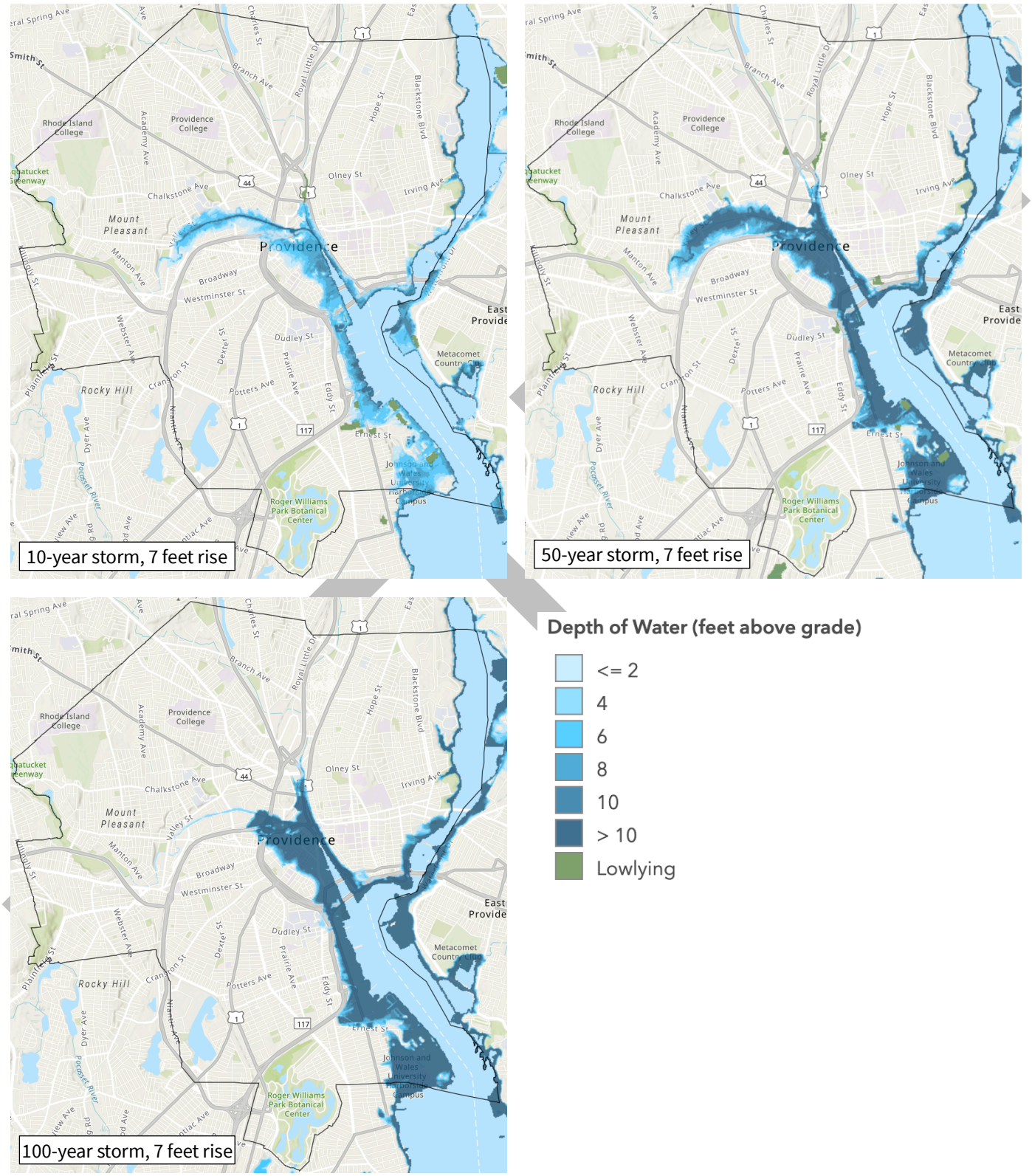


Table 2-10. Projected, median sea-level rise in the Northeast under various emissions scenarios relative to 2000 (NOAA)

	2050	2100	2150
Low	0.36 m | 1.18 ft	0.6 m | 1.97 ft	0.9 m | 2.95 ft
Intermediate-Low	0.4 m | 1.31 ft	0.8 m | 2.62 ft	1.3 m | 4.27 ft
Intermediate	0.43 m | 1.41 ft	1.3 m | 4.27 ft	2.3 m | 7.55 ft
Intermediate-High	0.49 m | 1.61 ft	1.6 m | 5.25 ft	2.7 m | 8.86 ft
High	0.54 m | 1.77 ft	2.1 m | 6.89 ft	3.7 m | 12.14 ft

Figure 2-15. Potential inundation extent and depth from coastal flooding under various return period storms and 7 feet of sea-level rise (RICMRC)



2.6.1.3 Previous Occurrences

NOAA's National Centers for Environmental Information (NCEI) maintains a database of storm events; the official publication documents the occurrence of storms and other significant weather phenomena having sufficient intensity to cause loss of life, injuries, significant property damage, or disruption to commerce. Table 2-11 includes the coastal flooding events in the City of Providence from the NOAA NCEI database.

Table 2-11. Previous occurrences of coastal flooding in the City of Providence (1950 to 2023) (NOAA)

Date	Zone	Narrative
April 15, 2007 April 16, 2007	Southeast Providence	An unusually strong and slow moving coastal storm for mid April tracked to western Long Island Sound on April 16th before weakening slowly and drifting offshore. This storm brought a variety of impacts, including damaging winds in excess of 60 mph, widespread river and stream flooding, and significant coastal flooding through several high tide cycles. East to northeast winds gusted as high as 60 mph. The highest gusts reported were 62 mph in Middletown, 61 mph at T.F. Green Airport in Warwick, and 60 mph in downtown Providence. There were widespread reports of downed trees, large branches, and power lines, especially in southern Rhode Island and as far inland as Providence. Rainfall totals of 3 to 5 inches, combined with wet antecedent conditions, resulted in widespread river and stream flooding, as well as significant flooding of urban areas. Minor to moderate flooding affected the Blackstone and Pawtuxet Rivers. The highest rainfall total reported was 5.00 inches in Little Compton. Many small streams throughout Rhode Island also rose out of their banks and flooded nearby areas, including roadways. Minor to moderate coastal flooding occurred along the coastline of Rhode Island through several high tide cycles, due to the combination of strong onshore winds, high seas, and astronomically high tides. Along the South Coast, the worst coastal flooding occurred with the morning high tide on the 16th, where flood waters and debris closed several shore roads. Large boulders that washed ashore had to be removed with snow plows, according to media reports.
December 23, 2022	Southeast Providence	Low pressure deepened rapidly as it tracked through the eastern Great Lakes. The storm produced damaging southeast to south winds across much of southern New England and minor to moderate coastal flooding the east and south coasts. Two to 3.5 inches of rain fell across much of RI and interior MA. The total water level at the Fox Point Barrier reached 9.37 feet - which was a 3 to 4 foot surge above astronomical tide. This caused the barrier to be shut down (6.7 feet is their threshold). Other area streets in Providence had several inches of coastal flooding.

NOAA also maintains records of sea-level measurements within its Tides and Currents database. The sea-level around the City of Providence has risen by approximately 10 inches since 1938.

2.6.1.4 Probability

The probability of sea-level rise and coastal flooding is extremely likely (occurring every 1 year or more). Despite monthly fluctuations, NOAA's Tides and Currents database shows that the sea-level has historically trended upwards, overall, at 0.1 inches per year. The speed of rise has and expected to continue to accelerate though due to climate change and is now rising by over an inch every 8 years. Further, the RI CMRC shows areas of inundation in the City in 1-year recurrence storm events, which increase in extent and

inundation level with higher intensity nuisance storms and extra/tropical storms. The severity and extent of coastal flooding is expected to worsen due to climate change primarily because of sea-level rise and more extreme storms. The higher baseline sea level allows storm surges to reach further inland, increasing the frequency and severity of coastal flooding events. Additionally, the more intense and frequent extreme weather events lead to more higher storm surges and coastal flooding.

Climate change is also expected to have significant effects on the efficacy of the FPHB, which can dramatically impact the frequency and severity of flooding in the City. The Barrier was designed for and has been effective in reducing impacts from storm surge, but the design did not account for accelerating sea-level rise. Studies from the University of Rhode Island cited in the Providence Resilience Partnership's report, "Towards a Resilient Providence," found that the Barrier is likely to to be overtopped during a 100-year storm with 7 feet of sea-level rise.

2.6.1.5 Impacts

Coastal flooding and sea-level rise present significant impacts for the City of Providence related to the City's landscape, infrastructure, population, and economy. The hazards can significantly impact people by damaging homes and displacing residents, sometimes leading to temporary or permanent relocation. Coastal flooding also poses a threat to public health, as floodwaters can contaminate drinking water and spread waterborne diseases, while the emotional and psychological stress from the aftermath of flooding events can have lasting effects on individuals and communities. The economic implications are substantial, with potential damage to commercial and public properties. Additionally, critical infrastructure such as roads, utilities, and sewage systems could be at risk of inundation, leading to service disruptions that can affect daily life and business continuity. The interruption of transportation networks due to flooding can impede emergency services and evacuation efforts, further endangering public safety during storm events.

RICMRC's Rhode Island E911 Exposure Assessment summarizes all exposed structures in each of the 21 coastal municipalities in the State from sea-level rise projections and costal storm events. Table 2-12 shows a selected portion of the output of the E911 Exposure Assessment for the City of Providence,

Table 2-12. Exposed buildings in the City of Providence under varying storm events and sea-level rise scenarios (RICMRC)

		10-Year Storm, No SLR	100-Year Storm, No SLR	7 ft SLR	10-Year Storm, 7 ft SLR	100-Year Storm, 7 ft SLR
Site	Description	Exposed Buildings				
98	Misc.	0	1	0	0	3
99	No Gate	0	0	0	0	0
A1	Accessory Building	2	25	3	14	46
A2	Abandoned	0	17	0	14	23
A3	Group Mailbox	0	0	0	0	0
A9	Access Point	0	0	0	0	0
B2	Airport	0	0	0	0	0

		10-Year Storm, No SLR	100-Year Storm, No SLR	7 ft SLR	10-Year Storm, 7 ft SLR	100-Year Storm, 7 ft SLR
Site	Description	Exposed Buildings				
B4	Campground	0	0	0	0	0
C1	Commercial	93	629	145	495	822
C9	Other Commercial	16	136	50	121	167
CF	Commercial Farm	0	0	0	0	0
CL	Lodging	0	2	1	2	4
DV	Development Site	1	3	2	2	4
ED	Dry Hydrant	0	0	0	0	0
ET	Public Telephone	0	0	0	0	0
G1	Gated w/o Building	0	7	2	6	9
G2	Gated w/Building	0	0	0	0	0
H1	Hanger	0	0	0	0	0
I1	Industrial	0	8	1	6	16
P0	Cemetery	0	0	0	0	0
P1	Government	0	14	2	13	28
P2	Health Care Facility	0	3	0	1	4
P3	Church	0	4	0	3	8
P4	Educational	2	45	4	39	65
P5	Cultural	0	0	0	0	0
P6	Police	0	0	0	0	0
P7	Fire Stations	0	1	0	1	1
P8	Public Gathering	0	2	1	2	2
P9	Ambulance House	0	0	0	0	0
R1	Single Family	0	11	0	2	63
R2	Multi Family	0	73	2	21	232
R3	Mobile Home	0	0	0	0	0
R4	Other Residential	1	12	4	12	16
R5	Camp	0	0	0	0	0
R6	Seasonal Home	0	0	0	0	0
R8	N/A	0	0	0	0	0
U1	Utility	0	3	2	3	3
XX	N/A	0	0	0	0	0
TOTALS		**115**	**996**	**219**	**757**	**1516**

2.6.2 Dam Inundation

2.6.2.1 Hazard Description

A dam is any artificial barrier with the ability to impound water, wastewater, or any liquid-borne material for the purpose of storage or water control. Dams can range in type (e.g. embankment, concrete) and size, and serve a number of purposes and provide essential benefits, including drinking water, irrigation, hydropower, flood control, and recreation.

Dam inundation or failure can be a catastrophic type of failure characterized by the sudden, immediate, and uncontrolled release of impounded water, or the likelihood of such an uncontrolled release with secondary impacts to downstream structures within the inundation zone. Dams fail in two ways, a controlled spillway release done to prevent full failure, or the partial or complete collapse of the dam itself. Possible reasons for dam failure include but are not limited to:

- Sub-standard construction materials/techniques
- Geological instability caused by changes to water levels during filling or poor surveying
- Sliding of a mountain into the reservoir
- Poor maintenance, especially of outlet pipes
- Human, computer, or design error
- Internal erosion, especially in earthen dams
- Earthquakes
- Terrorism

A three-tiered hazard classification has been developed by the State of Rhode Island Dam Safety Program and rates each dam based upon the probable consequences of failure or miss operation of the dam. This system includes:

- High Hazard: Denotes a dam where failure or miss operation will result in a probable loss of life
- Significant Hazard: Denotes a dam where failure or miss operation results in no probable loss of human life but can cause major economic loss, disruption of lifeline facilities, or impact other concerns detrimental to the public's health, safety, or welfare. Examples of major economic loss include but are not limited to washout of a state of federal highway, washout of two or more municipal roads, loss of vehicular access to residences (e.g. a dead-end road whereby emergency personnel could no longer access residences beyond the washout area), or damage to a few structures
- Low Hazard: Denotes a dam where failure or miss operation results in no probable loss of human life and low economic losses.

Dams are also rated according to their condition by the Dam Safety Program during a visual inspection:

- Good: Defined as meeting minimum guidelines, where no irregularities are observed and the component appears to be maintained properly
- Fair: Defined as a component that requires maintenance
- Poor: Defined as a component that has deteriorated beyond a maintenance issue and requires repair; the component no longer functions as it was originally intended

- Unsafe/May Be Unsafe: Defined as the condition of a regulated dam is such that an unreasonable risk of failure exists that will result in a probable loss of human life or major economic loss; among the conditions that would result in this determination are: excessive vegetation that does not allow the Dam Safety Program to perform a complete visual inspection of a dam, excessive seepage or piping, significant erosion problems, inadequate spillway capacity, inadequate capacity and/or condition of control structure(s) or serious structural deficiencies, including movement of the structure or major cracking

2.6.2.2 Location and Extent

There are 9 dams within the City of Providence (7 low hazard, 2 significant hazard). In addition to the dams located within the City, there are 5 dams outside of the City with inundation areas inside the City – all 5 dams are high hazard dams. Based on the RIDEM 2022 Annual Report to the Governor on the Activities of the Dam Safety Program, all dams within the City of Providence had condition ratings better than "Unsafe/May be Unsafe," but the Almy Reservoir dam within Johnston, whose inundation area includes a small area in southwest Providence, was rated as "Unsafe" with the following reasoning, "Vegetation prohibited inspection, spillway not functioning properly, low level outlet inoperable."

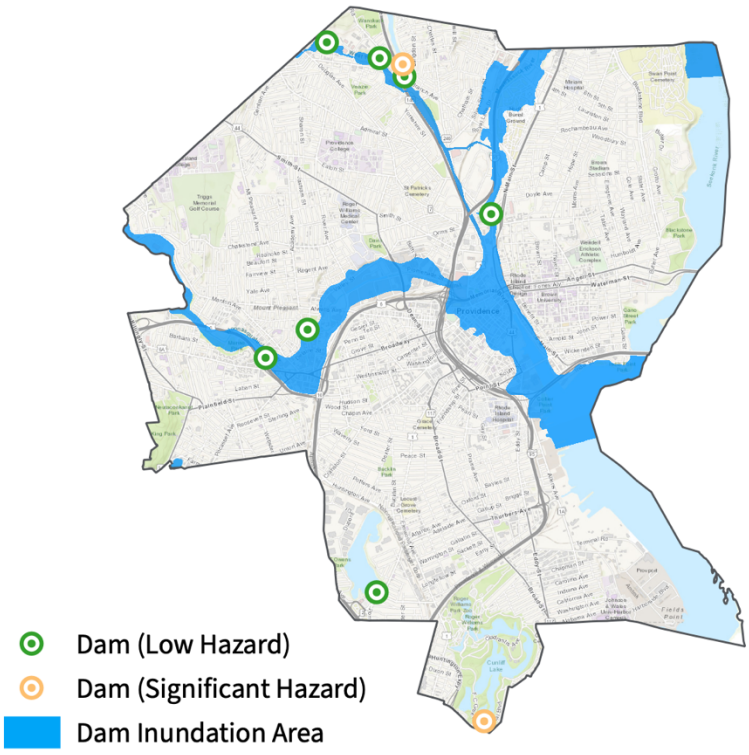
Table 2-13. Inventory of dams within the City of Providence (RIDEM)

City/Town	River/Stream	Dam Name	State ID	Hazard Rating
Providence	West River	Whipple Pond	090	Low
Providence	West River	Wanskuck Pond	091	Low
Providence	West River-Trib	Canada Upper Pond	093	Significant
Providence	West River	Canada Lower Pond	094	Low
Providence	Moshassuck River	American Screw	106	Low
Providence	Woonasquatucket River	Atlantic Mills Pond	138	Low
Providence	Woonasquatucket River	Rising Sun Pond	140	Low
Providence	Mashapaug Brook	Mashapaug Pond	174	Low
Providence	Mashapaug Brook	Cunliff Pond	300	Significant

Table 2-14. Inventory of dams outside the City of Providence with inundation areas within the City (RIDEM)

City/Town	River/Stream	Dam Name	State ID	Hazard Rating
Cumberland	Burnt Swamp Brook	Diamond Hill Reservoir	077	High
North Providence	West River	Wenscott Reservoir	084	High
Lincoln	Threadmill Brook	Olney Pond	102	High
Smithfield	Woonasquatucket River	Georgiaville Pond	126	High
Johnston	Dry Brook	Almy Reservoir	169	High

Figure 2-16. Dams and inundation areas within the City of Providence (RIDEM)



2.6.2.3 Previous Occurrences

Data from the National Performance of Dams Program at Stanford University indicates that there have been 5 dam incidents (for dams located in or with inundation areas located in the City of Providence) listed in the reporting database. All of the reported incidents were minor, resulting in no reported deaths, injuries, or damage to property.

Table 2-15. Previous occurrences of dam incidents for dams located in or with inundation areas located in the City of Providence (National Performance of Dams Program at Stanford University)

Date	City/Town	Dam Name	Incident Type
May 28, 1999	Providence	Canada Upper Pond	Vegetation
September 14, 1999	North Providence	Wenscott Reservoir	Leakage
September 24, 1999	Johnston	Almy Reservoir	Biological Attack (i.e. bush, tree growth)
January 28, 2001	Smithfield	Georgiaville Pond	Biological Attack (i.e. bush, tree growth)
July 25, 2002	Lincoln	Olney Pond	Embankment Erosion

2.6.2.4 Probability

Given the lack of major previous occurrences and hazard and condition ratings for the dams within the City of Providence, the probability of a dam inundation event is unlikely (occurring every 50 years or less). The

probability may be affected by impacts from climate change, such as increased precipitation levels and flooding that heighten the chance of dam failure, especially considering that dams are typically based on historic water flows and known hydrology. Further, greater periods of drought conditions and extreme heat that could lead to ground cracking, a reduction of soil strength, erosion, and subsidence in earthen dams.

2.6.2.5 Impacts

In the event of a dam failure, the immediate consequence could be a sudden release of large volumes of water, leading to catastrophic flooding downstream – the impacts of flooding events are discussed in the various flooding hazard profile. While the severity of impacts is dependent on the volume of water released and location of the dam, impacts to the population could include loss of life and long term displacement, while impacts to the dam itself and property downstream could include structural and equipment damage and disruption of operations for critical infrastructure.

2.6.3 Riverine Flooding

2.6.3.1 Hazard Description

Riverine flooding happens when rivers, streams, or any water bodies overflow onto nearby land. This type of flooding is typically caused by prolonged rainfall, rapid melting of snow, or sudden heavy downpours that lead to the water in rivers or streams exceeding their capacity. The severity and impact of riverine flooding can depend on various factors, including the amount and intensity of the rainfall, the characteristics of the river basin (such as its size, shape, and slope), and human interventions, like dams and levees.

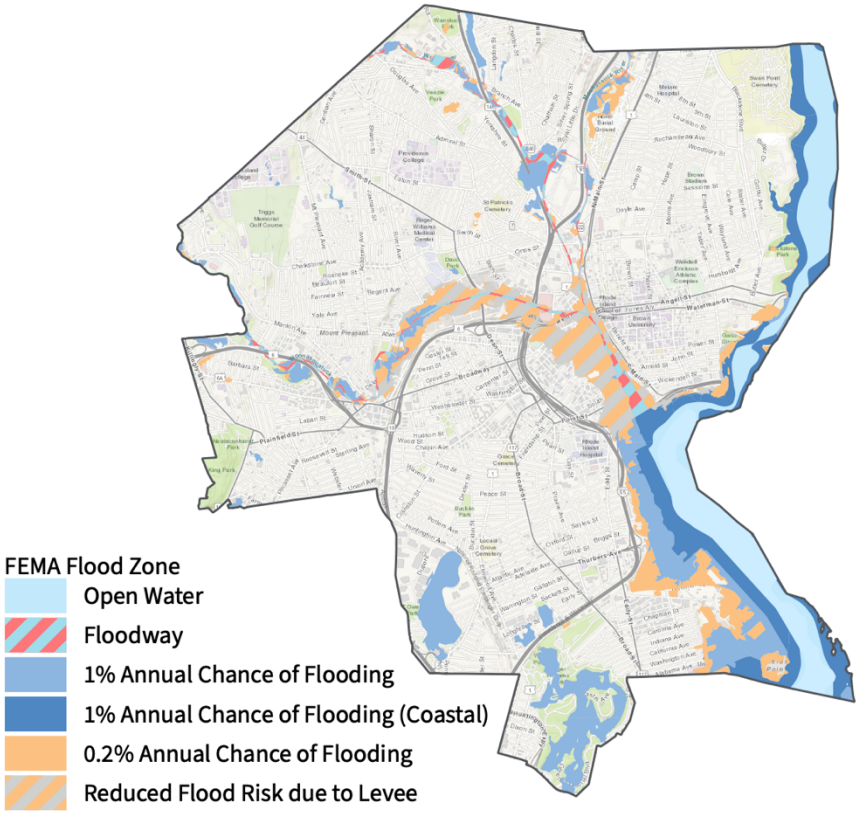
2.6.3.2 Location and Extent

Providence is located at the head of Narragansett Bay and is intersected by several rivers, including the Woonasquatucket, Moshassuck, and Providence Rivers, making it susceptible to riverine flooding. For the purposes of this plan, flooding caused by undersized culverts is discussed under Urban Flooding. The Federal Emergency Management Agency (FEMA) National Flood Insurance Program's Flood Insurance Rate Maps designate areas or zones likely to experience flooding as high risk or moderate to low risk. The delineations for the City of Providence are mapped in Figure 2-17.

Table 2-16. Areas within identified flood zones in square miles (2024 Rhode Island State Hazard Mitigation Plan)

County	Zone A	Zone AE	Zone AO	Zone AH	Zone VE	Zone X	Percentage Total
Providence	2.9	3.3	0	0.008	2.5	6.0	11.4%

Figure 2-17. The City of Providence flood zones (FEMA)



2.6.3.3 Previous Occurrences

Table 2-17 includes the flooding events in Providence County from the NOAA NCEI database. Due to data restrictions, this table may include events that impacted the County, but not the City of Providence. Further, the database does not specifically identify riverine flooding events, and instead, includes all events classified as "flood", "flash flood", and "heavy rain", which could all cause riverine flooding; the table does denote if river flooding was specifically mentioned in the event narrative.

Table 2-17. Previous occurrences of riverine flooding in Providence County (1950 to 2023) (NOAA)

Zone	Date	Event Type	River Flooding in Narrative	Urban Flooding in Narrative
Southeast Providence	January 12, 1996	Flash Flood		Yes
Southeast Providence	April 17, 1996	Flood	Yes	
Providence County	July 13, 1996	Heavy Rain; Flash Flood		
Providence County	September 18, 1996	Heavy Rain		
Southeast Providence	October 20, 1996	Heavy Rain		
Providence County	December 7, 1996	Heavy Rain		
Southeast Providence	November 1, 1997	Heavy Rain		
Providence County	January 24, 1998	Flash Flood		Yes

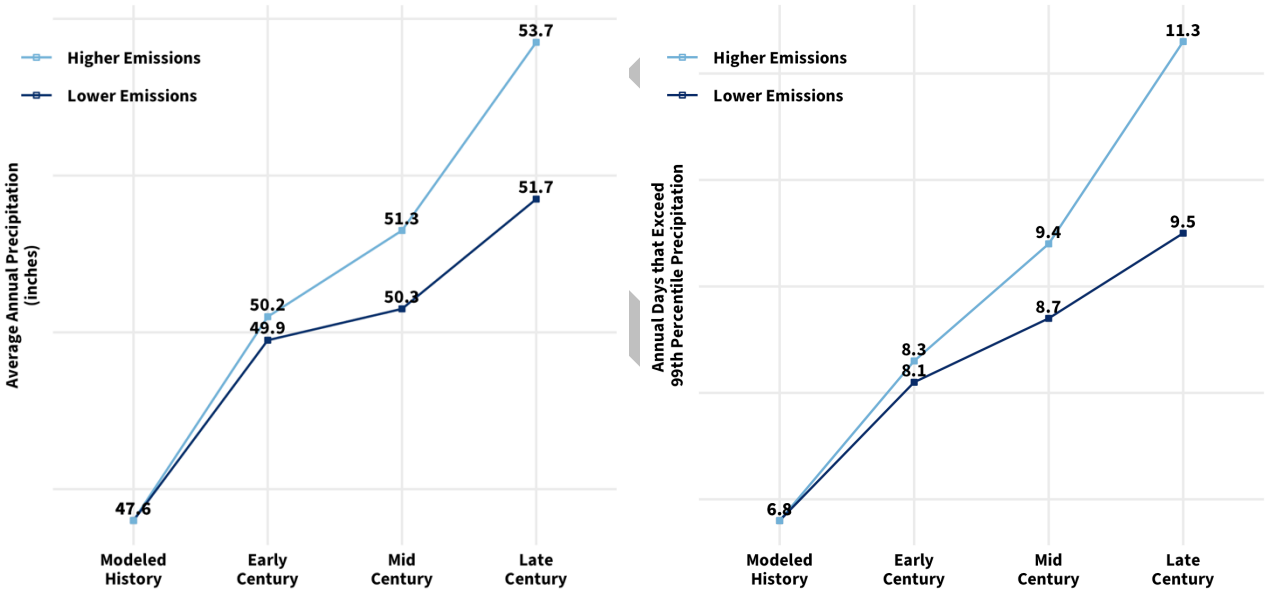
Zone	Date	Event Type	River Flooding in Narrative	Urban Flooding in Narrative
Southeast Providence	February 18, 1998	Heavy Rain	Yes	Yes
Southeast Providence	February 23, 1998	Heavy Rain		
Southeast Providence	March 8 to 10, 1998	Heavy Rain; Flood	Yes	Yes
Providence County	June 13 to 14, 1998	Heavy Rain; Flash Flood; Flood	Yes	
Providence County	June 30, 1998	Flash Flood	Yes	
Providence County	July 1, 1998	Flash Flood	Yes	
Providence County	October 8, 1998	Heavy Rain		
Providence County	January 3, 1999	Heavy Rain		
Providence County	January 15, 1999	Heavy Rain		Yes
Providence County	February 2, 1999	Heavy Rain		
Providence County	August 26, 1999	Flash Flood	Yes	Yes
Providence County	September 10, 1999	Heavy Rain; Flash Flood	Yes	
Providence County	September 16, 1999	Heavy Rain; Flash Flood	Yes	
Providence County	April 22, 2000	Flash Flood	Yes	Yes
Providence County	March 22, 2001	Flash Flood; Flood	Yes	
Providence County	March 30 to 31, 2001	Flash Flood; Heavy Rain; Flood	Yes	
Providence County	April 1, 2001	Flash Flood	Yes	
Providence County	May 29, 2001	Flash Flood		
Providence County	June 17, 2001	Flash Flood		Yes
Providence County	September 15, 2002	Heavy Rain		Yes
Providence County	September 22, 2002	Heavy Rain		Yes
Providence County	March 29, 2003	Heavy Rain		Yes
Providence County	May 26, 2003	Heavy Rain		Yes
Southeast Providence	April 14, 2004	Flood	Yes	
Southeast Providence	March 28 to 19, 2005	Flood	Yes	Yes
Providence County	August 14, 2005	Flash Flood		Yes
Providence County	September 15, 2005	Flash Flood		Yes
Southeast Providence	October 15, 2005	Flood	Yes	
Providence County	June 7, 2006	Flood	Yes	Yes
Providence County	October 28, 2006	Flood	Yes	Yes
Providence County	November 24, 2006	Flood	Yes	Yes
Providence County	March 2, 2007	Flood	Yes	Yes
Providence County	April 15, 2007	Flood	Yes	
Providence County	February 13, 2008	Heavy Rain; Flood	Yes	Yes
Providence County	March 8, 2008	Flood		Yes
Providence County	June 24, 2008	Flash Flood		Yes
Providence County	July 23, 2008	Flash Flood		Yes
Providence County	September 6, 2008	Flood		Yes
Providence County	December 12, 2008	Flood	Yes	Yes
Providence County	July 2, 2009	Flash Flood		Yes
Providence County	August 5, 2009	Flood		Yes

Zone	Date	Event Type	River Flooding in Narrative	Urban Flooding in Narrative
Providence County	March 29, 2010	Flood	Yes	Yes
Providence County	April 1, 2010	Flood	Yes	Yes
Providence County	July 14, 2010	Flash Flood		Yes
Providence County	September 8, 2011	Flash Flood; Flood	Yes	Yes
Providence County	July 28, 2012	Flood; Flash Flood		Yes
Providence County	August 10, 2012	Flash Flood		Yes
Providence County	August 15, 2012	Flood		Yes
Providence County	June 7, 2013	Flood		Yes
Providence County	July 11, 2013	Flood		Yes
Providence County	July 20, 2013	Flood		Yes
Providence County	September 2, 2013	Flood; Flash Flood		Yes
Providence County	January 11, 2014	Flood		Yes
Providence County	June 13, 2014	Flood		Yes
Providence County	August 13, 2014	Flash Flood		Yes
Providence County	October 22, 2014	Flood		Yes
Providence County	May 31, 2015	Flash Flood		Yes
Providence County	June 21, 2015	Flood		Yes
Providence County	July 7, 2016	Flood		Yes
Providence County	July 17, 2016	Flood		Yes
Providence County	August 6, 2016	Flood		Yes
Providence County	August 12 to 13, 2016	Flood		Yes
Providence County	September 30, 2017	Flood		Yes
Providence County	January 13, 2018	Flood		Yes
Providence County	July 6, 2018	Flood		Yes
Providence County	August 4, 2018	Flood		Yes
Providence County	September 25 to 26, 2018	Flood		Yes
Providence County	August 7, 2019	Flood		Yes
Providence County	September 2, 2019	Flood		Yes
Providence County	June 28, 2020	Flash Flood; Flood		Yes
Providence County	December 1, 2020	Flood		Yes
Providence County	December 25, 2020	Flood		Yes
Providence County	July 17, 2021	Flood		Yes
Providence County	November 12, 2021	Flood		Yes
Providence County	June 13, 2022	Flood		Yes
Providence County	August 23, 2022	Flood; Flash Flood		Yes
Providence County	September 5, 2022	Heavy Rain; Flash Flood	Yes	Yes
Providence County	July 4, 2023	Flash Flood		Yes
Providence County	July 10, 2023	Flood		Yes
Providence County	July 16, 2023	Flash Flood		Yes
Providence County	September 10 to 11, 2023	Flood; Flash Flood	Yes	
Providence County	September 13, 2023	Flash Flood		Yes

2.6.3.4 Probability

Riverine flooding is an extremely likely hazard for the City of Providence (occurring every 1 year or more). The probability and severity will likely increase though due to climate change, which is projected to increase precipitation levels and storm frequencies and intensities. Based on the Climate Mapping for Resilience and Adaptation tool, the average annual precipitation is projected to increase by 2.3 to 2.6 inches in the next 30 years regardless of the emissions scenario; by late-century, the increase is expected to be 4.1 inches under lower emissions and 6.1 inches under higher emissions. Further, the annual days that exceed 99th percentile precipitation is projected to increase by 1.3 to 1.5 days in the next 30 years regardless of the emissions scenario; by late-century, the increase is expected to be 2.7 days under lower emissions (40% increase) and 4.5 days under higher emissions (66% increase). The impacts of climate change on storms are detailed in the respective hazard profiles.

Figure 2-18. Precipitation-related climate projections (Climate Mapping for Resilience and Adaptation)



2.6.3.5 Impacts

Like most hazards detailed in this Plan, riverine flooding has a multifaceted impact, affecting the City's infrastructure, economy, and residents. Riverine flooding can cause extensive physical damage to infrastructure, including to homes, businesses, roads, bridges, and utility systems. Flooding disrupts transportation, with waterlogged roads and damaged bridges impeding movement and emergency services, potentially isolating communities. The utility infrastructure, such as water and sewage treatment plants, can also be compromised, leading to public health concerns. Additionally, the flooding of commercial areas hampers local businesses, leading to economic losses, both from direct damage and the loss of business activity during recovery periods.

Table 2-18. Addresses (E 911) within flood prone areas in the City of Providence

		FEMA Flood Zone					
Site Type	Description	A	AE	AE (Floodway)	VE	X (0.2 % Annual Chance Flood)	X (Area with Reduced Flood Risk due to Levee)
98	Misc.	1					1
A1	Accessory Building		7		1	5	7
A2	Abandoned		9			5	7
A9	Access Point		1				
C1	Commercial	6	74	16	8	43	351
C9	Other Commercial		14			4	111
CL	Lodging						7
DV	Development Site						2
EH	Hydrant	3	61	2	5	41	251
G1	Gated w/o Building	1	3		1	3	
I1	Industrial	1	3			1	3
P1	Government	2				7	12
P2	Heath Care Facility						1
P3	Church						4
P4	Educational		3		1	17	33
P7	Fire Stations						1
P8	Public Gathering	5					1
R1	Single Family	13	1			19	25
R2	Multi Family	9	9		1	56	67
R4	Other Residential				1		13
U1	Utility	1	1				2

The National Flood Insurance Plan (NFIP) is a federal program, managed by FEMA, which exists to provide flood insurance for property owners in participating communities, to improve floodplain management practices, and to develop maps of flood hazard areas. The City of Providence is a participating community with 521 policies in force amounting to $145,878,000 in total coverage. The 2024 Rhode Island State Hazard Mitigation Plan prioritizes the mitigation of, and/or the reduction of losses to, Repetitive Loss (RL) and Severe Repetitive Loss (SRL) structures. The NFIP defines a RL property as:

- Any insurable building for which two or more claims of more than $1,000 were paid by the NFIP within any rolling 10-year period, since 1978. At least two of the claims must be more than 10 days apart.

The definition of severe repetitive loss as applied to this program was established in section 1361A of the National Flood Insurance Act, as amended, 42 U.S.C. 4102a. An SRL property is defined as a residential property that is covered under an NFIP flood insurance policy and:

- That has at least four NFIP claim payments (including building and contents) over $5,000 each, and the cumulative amount of such claims payments exceeds $20,000; or

- For which at least two separate claims payments (building payments only) have been made with the cumulative amount of the building portion of such claims exceeding the market value of the building.

For both of the above, at least two of the referenced claims must have occurred within any ten-year period and must be greater than ten days apart.

Table 2-19. RL and SRL property and claim data for the City of Providence Rhode Island Emergency Management Agency)

Type	Number of Properties	Number of Claims	Building and Contents Payments
Repetitive Loss	24	104	$8,466,811
Severe Repetitive Loss	7	60	$7,030,289

Beyond the immediate physical and economic repercussions, riverine flooding in the City can also have significant environmental and health consequences. Flooding can lead to the contamination of water supplies with pollutants and hazardous materials, impacting local ecosystems and posing health risks to the population. For example, flooding can significantly affect cyanobacteria (blue-green algae) populations and the distribution of cyanotoxins they produce: Flooding can introduce a large influx of nutrients, such as nitrogen and phosphorus, from agricultural runoff and urban wastewater into water bodies. These nutrients fuel the growth of cyanobacteria, potentially leading to blooms. Additionally, flooding can increase water volume and alter the physical boundaries of water bodies, providing new or expanded habitats for cyanobacteria. This expansion can lead to the colonization of previously unaffected areas by cyanobacteria, further spreading their presence. Moreover, the conditions that promote the growth of cyanobacteria also enhance the production of cyanotoxins, which are harmful to humans, animals, and aquatic ecosystems. The abundance of nutrients during flood events can increase both the biomass of cyanobacteria and the concentration of toxins they produce. Flooding can also disperse these cyanotoxins more widely within and across water bodies, escalating the risk of exposure. This dispersion can affect larger areas, contaminating drinking water sources and recreational waters, and posing serious health risks.

With regards to impacts to the population, one of the primary dangers of flooding is the loss of life, as it is among the top causes of weather-related deaths globally, often due to drowning and other accidents caused by rapidly rising waters. Individuals affected by floods may also sustain injuries, including those from waterborne diseases, exposure to debris, and incidents occurring during evacuations or rescue efforts. The displacement of residents is a frequent consequence, with many needing emergency shelters or alternative housing, leading to both emotional and financial distress. Vulnerable groups such as the elderly, children, individuals with disabilities, and those facing economic hardships are particularly at risk, often suffering more due to their limited ability to respond and recover from the disaster.

The 2024 Rhode Island State Hazard Mitigation Plan includes estimates of displaced populations and shelter needs for Providence County that were determined using Hazus-MH, Version 2.2 SP1 (Table 2-20). The analysis was conducted using the risk assessment data and maps for a 1% annual chance flood event. The reported losses are based upon essential facility and census data as part of Hazus. Hazus determines the displaced population based on the inundation area, not necessarily impacted buildings. As a result, there

may be a population vulnerable to displacement even if the structure is not vulnerable to damage. Further, Hazus determines the sheltering need based on the displaced population with modification factors accounting for income and age. Displaced people using shelters will most likely be individuals with lower incomes and those who do not have family or friends within the immediate area.

Table 2-20. Hazus flood scenario output of displaced population and shelter needs (2024 Rhode Island State Hazard Mitigation Plan)

County	Displaced Population	Person Seeking Shelter
Providence	9,247	1,770

2.6.4 Urban Flooding

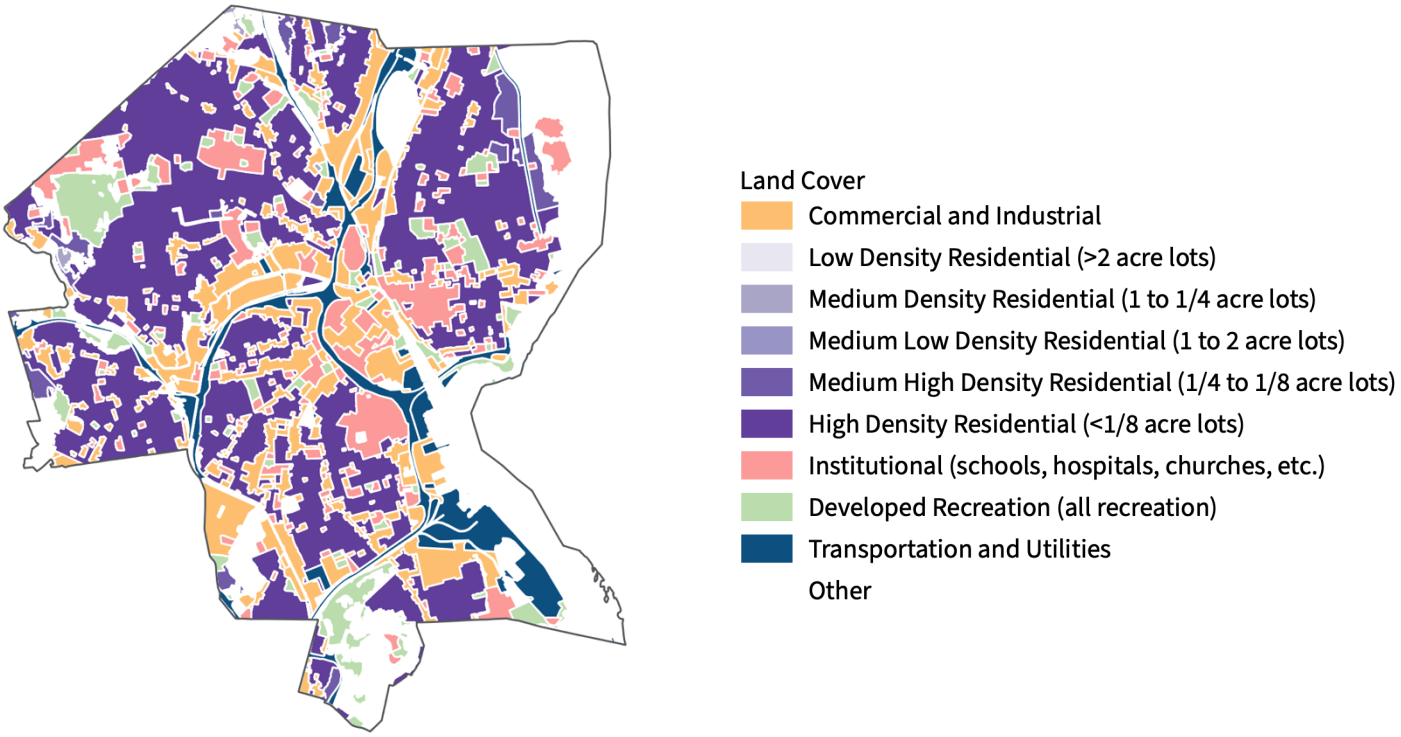
2.6.4.1 Hazard Description

Urban flooding is the inundation of land or property in a build environment that occurs when the volume of water from heavy rain, flash flooding, riverine flooding, snowmelt, or storms overwhelms the capacity of drainage systems. This kind of flooding is most common in densely populated areas where the landscape has been significantly altered by human development; cities often have large expanses of impermeable surfaces, such as concrete and asphalt, which prevent water from naturally soaking into the ground. Instead, water runs off these surfaces quickly and accumulates in streets and other low-lying areas. Urban flooding is exacerbated by inadequate or outdated infrastructure or clogged drainage systems.

2.6.4.2 Location and Extent

Urban flooding is a City-wide hazard. Unlike riverine and coastal flooding, urban flooding is not more common in areas adjacent to bodies of water. Instead, urban flooding is more prone to happen near stormwater collection sites that are undersized, at locations of blockages in the stormwater system, or in areas with a high concentration of impervious surfaces with extensive concrete and asphalt; the City of Providence's land cover is primarily high density residential (Figure 2-19) and the vast majority of the State's storm drainage infrastructure was designed based on rainfall frequencies that were derived in the early 1960s. Additionally, low-lying neighborhoods are at risk, as these can become catch basins for the overflow when the drainage capacity is exceeded. The topography of the city, combined with the built environment, dictates the likelihood of urban flooding, making it a concern for a wide array of locales throughout the City.

Figure 2-19. 2020 land use and land cover ground conditions for the City of Providence (Rhode Island GIS)



2.6.4.3 Previous Occurrences

Table 2-17 above includes the flooding events in Providence County from the NOAA NCEI database. Due to data restrictions, this table may include events that impacted the County, but not the City of Providence. Further, the database does not specifically identify urban flooding events, and instead, includes all events classified as “flood”, “flash flood”, and “heavy rain”, which could all cause urban flooding; the table does denote if urban flooding was specifically mentioned in the event narrative.

2.6.4.4 Probability

Urban flooding is an extremely likely hazard for the City of Providence (occurring every 1 year or more). The probability and severity will likely increase though due to climate change, which is projected to increase precipitation levels and storm frequencies and intensities. The projections from the Climate Mapping for Resilience and Adaptation tool detailed above for riverine flooding (Figure 2-18) are also relevant for urban flooding. The impacts of climate change on storms are detailed in the respective hazard profiles. The City of Providence is already highly-developed, but further development and population growth will also increase the probability of urban flooding with additional conversion of permeable land into impermeable surfaces.

2.6.4.5 Impacts

The impacts of urban flooding closely mirror the impacts of riverine flooding detailed above, affecting infrastructure, economy, and residents. Urban flooding is especially impactful to transportation and roadways which hinders emergency access and can often lead to vehicle stalls or strandings. Further, the

threat of mold is more prevalent due to the high density built environment that urban flooding commonly occurs in. The environmental consequences of urban flooding are also notable. Overflowing drainage systems can lead to the discharge of untreated sewage into local waterways, contaminating them with pathogens and pollutants. The spread of hazardous materials from flooded industrial areas can further exacerbate this contamination. Stormwater runoff from urban flooding can introduce a large influx of nutrients from urban wastewater into water bodies, fueling the growth of cyanobacteria and potentially leading to blooms.

2.7 Wind-Related Hazards

2.7.1 Hurricane

2.7.1.1 Hazard Description

A hurricane is a powerful tropical cyclone characterized by a low-pressure center, spiraling rain bands, and strong winds that can exceed 74 miles per hour (119 kilometers per hour). Hurricanes typically form over warm ocean waters near the equator, where the heat from the sea surface is abundant enough to fuel their intensity. The engine of a hurricane is the release of the heat energy from the ocean waters through condensation of water vapor into water droplets, a process that occurs in the towering thunderclouds that make up the storm system. The Earth's rotation causes the developing system to spin, leading to the formation of the distinct cyclonic shape with a calm eye at its center.

Hurricanes are categorized by the Saffir-Simpson Hurricane Wind Scale, which ranges from Category 1 (least severe, with winds 74-95 mph) to Category 5 (most severe, with winds exceeding 157 mph). The strength of a hurricane is determined by its sustained wind speeds, but hurricanes can also bring heavy rain and storm surge, leading to inland and coastal flooding. As flooding (coastal, riverine, and urban) was detailed above, this section will focus on the wind component of hurricanes.

Table 2-21. Saffir-Simpson Hurricane Wind Scale (NOAA)

Category	Wind (mph)	Potential Damage
Tropical Depression	< 38	-
Tropical Storm	39 to 73	-
1	74 to 95	Minimal: Damage is primarily to shrubbery and trees, mobile homes, and some signs. No real damage is done to structures.
2	96 to 110	Moderate: Some trees topple, some roof coverings are damaged, and major damage is done to mobile homes.
3	111 to 130	Extensive: large trees topple, some structural damage is done to roofs, mobile homes are destroyed, and structural damage is done to small homes and utility buildings
4	131 to 155	Extreme: Extensive damage is done to roofs, windows and doors; roof systems on small buildings completely fail; and some curtain walls fail.
5	> 156	Catastrophic: Roof damage is considerable and widespread, window and door damage are severe, there are extensive glass failures, and entire buildings could fail.

2.7.1.2 Location and Extent

Due to the large extent of the hazard and given the costal location of the City, hurricanes are a City-wide hazard. Hurricane-force storms are possible, and have occurred, in the City of Providence, but they are not as prevalent in the City compared to other coastal and southern cities.

2.7.1.3 Previous Occurrences

NOAA's Historical Hurricane Tracks tool shows that no historical hurricane tracks have intersected the City of Providence, but a tropical depression did in 2021, Henri. While no tropical storms or hurricanes have gone directly through the City, storms in close proximity with notable effects have been recorded.

In the past century, the City of Providence experienced the greatest impacts from the Great New England Hurricane of 1938 and from Hurricane Carol in 1954:

- Great New England Hurricane (1938): The Great New England Hurricane made landfall on Long Island on September 21, 1938 as a category 3 storm. The hurricane continued to track north throughout New England at a forward speed of 47 mph. The City of Providence recorded sustained winds of 100 mph with gusts to 125 mph. The hurricane also led to destructive storm tides throughout the region – Narrangansett Bay experienced storm surge of 12 to 15 feet and Downtown Providence was submerged under a storm tide of nearly 20 feet. The hurricane killed 250 people in the region, causing about $120 million in damage in the City of Providence alone.
- Hurricane Carol (1954): Hurricane Carol developed from a tropical wave near the Bahamas and eventually made landfall on Long Island as a category 3 storm before crossing the island and making a second landfall at Old Saybrook, Connecticut. The storm has sustained winds between 80 and 100 mph with a 135 mph gust recorded at Block Island. Storm surge caused water levels in Downtown Providence as high as 8 feet and resulted in over $41 million in damage.

In addition, NOAA's NCEI database of storm events includes 4 records of tropical storms reported for the City's forecast zone (Southeast Providence) (Table 2-22). Providence County has also received 5 major disaster declarations and 4 emergency disaster declarations from FEMA (Table 2-23).

Table 2-22. Previous occurrences of tropical storms in forecast zone Southeast Providence (1950 to 2023) (NOAA)

Date	Zone	Narrative
September 6, 2008	Southeast Providence	Tropical Storm Hanna made landfall near the North Carolina/South Carolina border at 320AM EDT September 6. Hanna then moved north/northeast across the Mid-Atlantic states and southern New England September 6 and 7. Storm total rainfall in southeast Providence County ranged from four to five inches. The highest sustained wind of 25 knots (29 mph) and gust of 35 knots (40 mph) were recorded at T.F. Green Providence Airport. The lowest sea level pressure was 996.0 mb at T.F. Green Providence Airport. A coastal storm surge of 2 feet above normal tide was experienced at Providence, RI. No coastal flooding was reported. Several trees, wires, and a transformer were blown down in southeastern Providence County. All of the associated effects of Hanna in southeastern Providence County resulted in $13K in property damage, all from wind.
August 28, 2011	Southeast Providence	Hurricane Irene formed east of the Caribbean island of Dominica on the afternoon of August 20. Irene moved through the Caribbean and up the east coast of the United States making landfall twice. She first made landfall as a Category 1 Hurricane near Cape Lookout, North Carolina around 7:30am on August 27, then moved offshore again during the evening. She then made a 2nd landfall, again as a Category 1 Hurricane at 540am on August 28 near Little Egg Inlet in New Jersey. She moved over New York City and then into southeastern New York State and Connecticut as a Tropical Storm a few hours later. By the

		end of the evening of the 28th, Irene was crossing the U.S./Canada border having produced significant amounts of rain, storm surge, inland and coastal flooding, and wind damage across southern New England and much of the east coast of the United States. In Southern New England, the minimum surface pressure recorded was 976.9mb taken at Barnes Municipal Airport in Westfield, Massachusetts. The storm surge experienced along the coast was generally in the 2 to 4 foot range with a high of 4.78 feet at Fox Point in Providence. The highest sustained windspeed was 54 knots (62 mph) at the Physical Oceanographic Real Time System station at Conimicut Light in Narragansett Bay. The highest sustained wind speed on land was 38 knots (44 mph) recorded on the Automated Surface Observing Systems at both Barnstable Municipal Airport in Hyannis, MA (KHYA) and Logan International Airport in Boston, MA (KBOS). Rainfall amounts ranged from nearly 0 (0.03 at Nantucket Memorial Airport) to nearly 10 inches (9.92 in Conway, MA). Despite the relatively low wind speeds, sustained winds over a 6 to 12 hour long duration resulted in widespread tree damage and resulted in power outages to roughly half a million customers throughout the state. Some of these customers did not get their power back until the Friday following the storm (some five days later). During the passage of Tropical Storm Irene, the winds resulted in $0.19M in property damages. The collective effects of Tropical Storm Irene on August 28, resulted in 1 fatality, 0 injuries, and $127.3M in property damage in the following counties: Barnstable, Bristol, Essex, Franklin, Hampden, Hampshire, Middlesex, Nantucket, Norfolk, Plymouth, Suffolk, and Worcester (all in MA), Hartford, Tolland, and Windham (all in CT), Cheshire and Hillsborough (all in NH), and Bristol, Providence, Kent, Washington, and Newport (all in RI).
August 4, 2020	Southeast Providence	Tropical Storm Isaias moved from coastal Virginia eastern New York state, near the CT/MA border on Tuesday, August 4. As the storm reached the New York City area, southerly winds were maximizing across southern New England, causing widespread wind damage. In Providence at 340 PM EDT, a tree was split in half on North Main Street; at 410 PM EDT a tree was down on Charles Street; at 426 PM EDT, a tree and wires were down on South Court Street, damaging a house; at 503 PM EDT, wires were down on Modena Avenue. In North Providence at 425 PM EDT, a trained spotter reported a wind gust to 59 mph.
August 22, 2021	Southeast Providence	Tropical Storm Henri made landfall in southwest Rhode Island around noon on August 22nd, then moved slowly northwestward and westward across northern Connecticut and weakened. Henri brought strong wind gusts and flash flooding. The strongest gusts -- to 70 mph -- occurred along the Rhode Island coast. In North Providence at 1109 AM EST, police reported isolated downed trees across town. At 1136 AM EST, a NOS site at Fox Point recorded a wind gust to 44 mph.

Table 2-23. Historical hurricane FEMA disaster declarations for Providence County (FEMA)

Disaster Number	Declaration Type	Declaration Date	Declaration Title
3563	EM	August 21, 2021	Hurricane Henri
3355	EM	October 29, 2012	Hurricane Sandy
4027	DR	September 3, 2011	Tropical Storm Irene
3334	EM	August 27, 2011	Hurricane Irene
3255	EM	September 19, 2005	Hurricane Katrina Evacuation
913	DR	August 26, 1991	Hurricane Bob
748	DR	October 15, 1985	Hurricane Gloria
39	DR	August 20, 1955	Hurricane & Flood
23	DR	September 2, 1954	Hurricanes

2.7.1.4 Probability

As noted in the 2024 Rhode Island Hazard State Hazard Mitigation Plan, accurate predictions of tropical storm return periods and severities are extremely difficult due to the large number of variables. While not available on the City-level, NOAA does provide expected return periods for hurricanes and major hurricanes (category 3 or higher) discernable at the State-level. The return period in Rhode Island is 17 years for a hurricane and 52 years for a major hurricane (category 3 or higher).

NOAA model projections for the 21st century nor analyses of trends in Atlantic hurricane and tropical storm activity support the notion that climate change will lead to large increases in either tropical storm or overall hurricane numbers in the Atlantic. Climate change is expected to alter the characteristics of hurricanes though by amplifying their intensity. The impact of climate change on ocean temperatures could fuel more powerful storms. Warmer waters enhance evaporation rates, feeding hurricanes more energy and leading to stronger winds and heavier precipitation. Additionally, climate change contributes to sea-level rise, which exacerbates the potential for devastating storm surges.

2.7.1.5 Impacts

The multiple elements of a hurricane, heavy rain, strong winds, storm surges, can impact the City's infrastructure, population, and economy. The impacts from the water-related components (e.g. heavy rain and storm surge) can cause coastal and inland flooding and are detailed in the water-related hazards section above.

The strong winds, especially of major hurricane strength, can reach speeds that are capable of causing substantial damage to the City's infrastructure. Buildings, particularly older structures not designed to withstand such forces, may suffer from damaged roofs, broken windows, and structural failure. Areas with large trees are at risk of downed branches or fallen trees, which can damage homes, vehicles, and power lines, leading to widespread power outages.

Moreover, the high winds can disrupt transportation by blocking roads and bridges with debris, making it difficult for emergency services to navigate the City during and immediately after the storm. Public infrastructure and utilities, such as power lines, communication networks, and street signs, are also vulnerable, with repairs often requiring significant time and resources to restore full functionality. The economic impact of these winds can be felt through business interruptions, as damaged facilities and power outages halt operations, affecting the local economy and livelihoods of the City's residents.

2.7.2 Severe Storm (Hail, Lightning, High Wind)

2.7.2.1 Hazard Description

NOAA defines a thunderstorm as a rain storm with lightning. A severe storm is a thunderstorm that produces:

- A tornado (covered individually below)
- Winds of at least 58 mph, and/or
- Hail at least 1" in diameter

Lightning is an intense electrical discharge generated between electrically charged regions within clouds, between clouds, or between a cloud and the Earth during thunderstorms. It occurs when the electric field in the atmosphere becomes strong enough to overcome the air's resistance, leading to a visible flash and the rapid heating of the air, which produces the sound of thunder. This natural phenomenon results from the separation of positive and negative charges within storm clouds, driven by the collision of water droplets and ice particles in updrafts. There is currently no scale to measure the severity of lightning strikes.

Straight-line winds are powerful outflow winds that emanate from a thunderstorm, moving in a straight path at the surface, distinct from the rotational winds of a tornado. These winds result from the rapid downward movement of cool air hitting the ground and spreading out in all directions. The Beaufort Scale is commonly used to measure wind speed and potential damage correlations.

Table 2-24. Beaufort Scale (NOAA)

Beaufort Number	Wind Speed (mph)	Effects on Land	Effects on Water
0	Under 1	Calm, smoke rises vertically	Sea surface smooth and mirror-like
1	1-3	Smoke drift indicates wind direction, vanes do not move	Scaly ripples, no foam crests
2	4-7	Wind felt on face, leaves rustle, vanes begin to move	Small wavelets, crests glassy, no breaking
3	8-12	Leaves, small twigs in constant motion. Light flags extended.	Large wavelets, crests begin to break, scattered whitecaps
4	13-18	Dust, leaves, and loose paper raised up; small branches move	Small waves (1-4 feet) becoming longer, numerous whitecaps
5	19-24	Small trees begin to sway	Moderate waves (4-8 feet) taking longer form, many whitecaps, some spray
6	25-31	Large branches of trees in motion, whistling heard in wires	Larger waves (8-13 feet), whitecaps common, more spray
7	32-38	While trees in motion, resistance felt in walking against the wind	Sea heaps up, waves 13-19 feet, white foam streaks off breakers
8	39-46	Twigs and small branches broken off trees	Moderately high (18-25 feet) waves of greater length, edges of crests begin to break into spindrift, foam blown in streaks
9	47-54	Slight structural damage occurs, slate blown from roofs	High waves (23-32 feet), sea begins to roll, dense streaks of foam, spray reduces visibility
10	55-63	Seldom experienced on land, trees broken, structural damage occurs	Very high waves (29-41 feet) with overhanging crests, sea white with densely blown foam, heavy rolling, lowered visibility
11	64-72	Very rarely experienced on land, usually with widespread damage	Exceptionally high (37-52 feet) waves, foam patches cover sea, visibility more reduced
12	73 or higher	Violence and destruction	Air filled with foam, waves over 45 feet, sea completely white with driving spray, visibility greatly reduced

Hail is a form of solid precipitation consisting of balls or irregular lumps of ice, known as hailstones, that form inside thunderstorm updrafts. It occurs when updrafts in thunderstorms carry raindrops upward into extremely cold areas of the atmosphere, where they freeze into ice. Hailstones can grow by colliding with supercooled water droplets that freeze on contact, becoming large enough to fall to the ground when the thunderstorm's updraft can no longer support their weight.

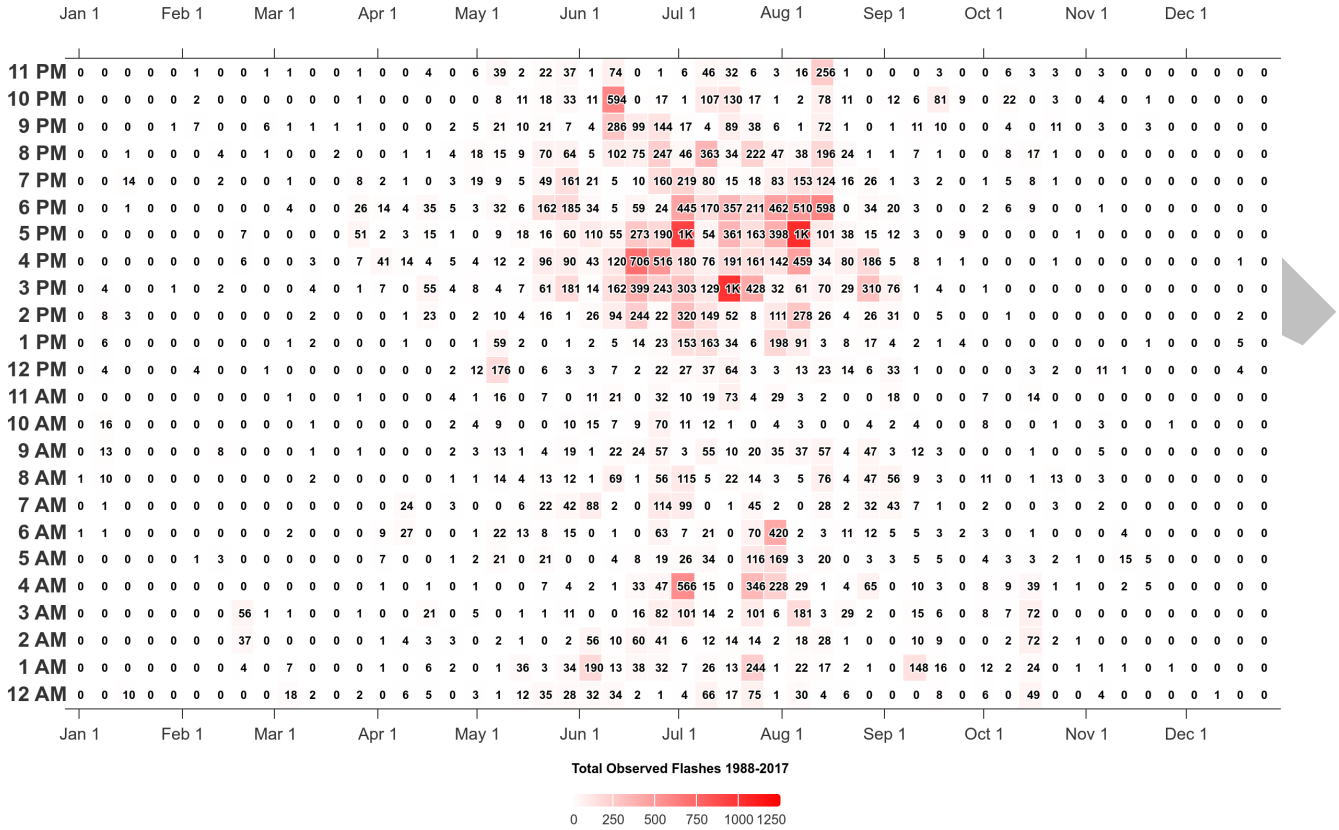
Table 2-25. Typical damage experienced with varying hailstone sizes (Tornado and Storm Research Organization)

Intensity Category	Diameter (inches)	Size Description	Typical Damage Impacts
Hard Hail	0.2-0.4	Pea	No damage
Potentially Damaging	0.4-0.6	Mothball	Slight general damage to plants, crops
Significant	0.6-0.8	Grape	Significant damage to crops and vegetation
Severe	0.8-1.2	Walnut	Severe damage to crops, damage to glass and plastic, paint and wood scored
Severe	1.2-1.6	Ping pong ball	Widespread glass damage, vehicle bodywork damage
Destructive	1.6-2.0	Golf ball	Wholesale destruction of glass, damage to tiled roofs, significant risk of injuries
Destructive	2.0-2.4	Hen's egg	Bodywork of grounded aircraft dented, brick walls pitted
Destructive	2.4-3.0	Baseball	Severe roof damage, risk of serious injuries
Super Hailstorms	3.6-3.9	Large orange	Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open
Super Hailstorms	4.0+	Grapefruit	Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open

2.7.2.2 Location and Extent

Severe storms are a City-wide hazard for the City of Providence – unlike hazards, such as coastal flooding, severe storms are not localized to a specific area in the City. Severe storms occur 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 (Figure 2-20). Thunderstorms affect a smaller area compared with hurricanes, but the storms can have very short warning times, forming in as little as 30 minutes.

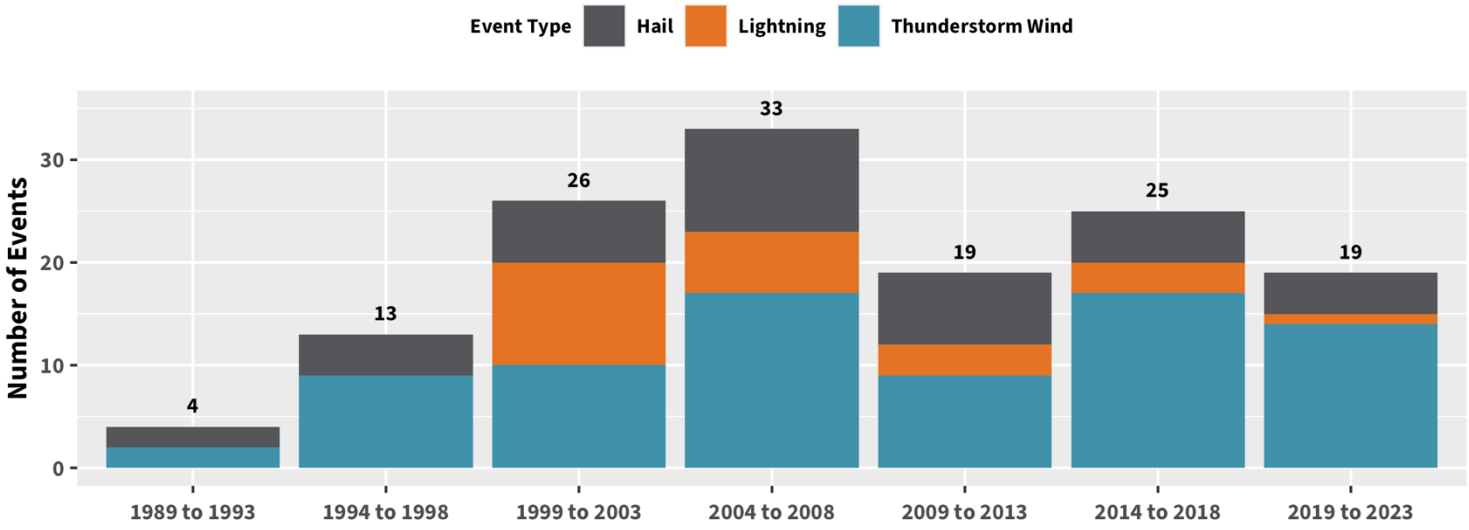
Figure 2-20. Total cloud to ground lightning flashes in Providence County (1988 to 2017) (Vaisala NLDN)



2.7.2.3 Previous Occurrences

Figure 2-21 plots the severe storm events in Providence County from the NOAA NCEI database. Due to data restrictions, this table may include events that impacted the County, but not the City of Providence.

Figure 2-21. Previous occurrences of severe storm in Providence County (1989 to 2023) (NOAA)



2.7.2.4 Probability

Severe storms in the City of Providence are high frequency, low consequence events compared to other storms, like hurricanes and winter storms. The probability of severe storms is extremely likely for the City of Providence (occurring every 1 year or more). Further, climate change is anticipated to influence the occurrence and severity of severe thunderstorms. Research indicates that higher temperatures boost convective available potential energy (CAPE), a critical factor necessary for the development of severe thunderstorms alongside strong wind shear—the variability in wind speed or direction over a short distance. Warming surface temperatures and increased evaporation contribute to higher CAPE levels, which can fuel more powerful thunderstorms, characterized by stronger winds, heavier rainfall, and a higher likelihood of hail. Climate change may also alter the timing and seasonality of severe thunderstorms. In some cases, this may mean more thunderstorms occurring earlier or later in the year.

2.7.2.5 Impacts

Severe storms pose the largest risk to critical infrastructure and the residents of the City of Providence. High winds and lightning are especially dangerous for utilities and communications. Electrical infrastructure can suffer extensive damage, leading to widespread power outages that affect homes, businesses, and vital services like hospitals, while communication disruptions can hinder emergency coordination. Water and wastewater systems are also at risk of service disruptions. Hail can cause significant damage to property, damaging roofs and vehicles and shattering windows. Further, the intense rainfall accompanying these storms can lead to various forms of flooding, especially due to overwhelmed drainage systems. For populations without adequate shelter, hail lightning, and high winds pose serious risks of injury or fatality. Lightning and hail can directly strike or hit residents, while strong winds can turn unsecured objects into projectiles that endanger the population.

2.7.3 Tornado

2.7.3.1 Hazard Description

A tornado is a violently rotating column of air that extends from a thunderstorm to the ground, characterized by its funnel-shaped cloud. It is one of the most powerful and destructive weather phenomena, capable of producing extreme winds, with speeds that can exceed 300 miles per hour. Tornadoes form under specific conditions, typically during severe thunderstorms, when differences in wind speed and direction at different altitudes cause the air to spin horizontally. Updrafts within the storm can then tilt this spinning air into a vertical orientation. Conditions conducive to tornado formation often include a combination of warm, moist air near the surface and cooler, drier air above.

Since 2007, the United States uses the Enhanced Fujita (EF) Scale to categorize tornadoes. The scale correlates wind speed values per F level and with potential damage.

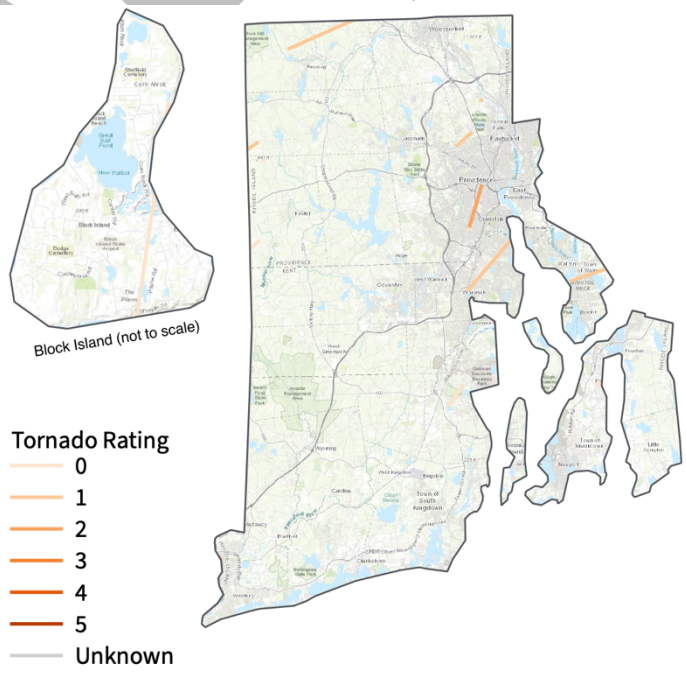
Table 2-26. Enhanced Fujita Scale (NOAA Storm Prediction Center)

Scale	Wind Speed (mph)	Relative Frequency	Potential Damage
EF0	65 to 85	53.5%	Light. Peels surface off some roofs; some damage to gutters or siding; branches broken off trees; shallow-rooted trees pushed over. Confirmed tornadoes with no reported damage.
EF1	86 to 110	31.6%	Moderate. Roofs severely stripped; mobile homes overturned or badly damaged; loss of exterior doors; windows and other glass broken.
EF2	111 to 135	10.7%	Considerable. Roofs torn off well-constructed houses; foundations of frame homes shifted; mobile homes complete destroyed; large trees snapped or uprooted; light object missiles generated; cars lifted off ground.
EF3	136 to 165	3.4%	Severe. Entire stores of well-constructed houses destroyed; severe damage to large buildings such as shopping malls; trains overturned; trees debarked; heavy cars lifted off the ground and thrown; structures with weak foundations blown away some distance.
EF4	166 to 200	0.7%	Devastating. Well-constructed houses and whole frame houses completely leveled; cars thrown, and small missiles generated.
EF5	> 200	< 0.1%	Explosive. Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 300 ft.; steel reinforced concrete structure badly damaged; high rise buildings have significant structural deformation.

2.7.3.2 Location and Extent

Tornadoes are a City-wide hazard. Tornadoes have very defined and narrow paths of impact compared to other natural hazards, like hurricanes or flooding, but the potential damage along its path can be significant. When tornadoes occur in the City of Providence, they usually range in severity between EF0 and EF2.

Figure 2-22. Tornado paths in Rhode Island (1950 to 2022) (NOAA)



2.7.3.3 Previous Occurrences

Table 2-27 includes the tornado events that have impacted the City of Providence from the NOAA NCEI database.

Table 2-27. Previous occurrences of tornadoes in the City of Providence (1950 to 2023) (NOAA)

Date	Magnitude	Narrative
August 18, 2023	EF2	A high amplitude, negatively tilted trough moving across the Great Lakes and into New England along with cold and warm front provided strong forcing which resulted in flooding, wind damage, and 5 tornadoes. In the warm sector dewpoints surged into the mid 70s with PWATs near 2 inches which led to torrential downpours. Tornadoes occurred in Scotland, Ct, Scituate, RI, North Attleboro, MA, Stoughton, MA, and Weymouth, MA. The tornadoes ranged in intensity from EF-0 to EF-2. A tornado caused significant damage along a discontinuous path in Scituate, Johnston, and North Providence, Rhode Island. This is the strongest tornado to have struck Rhode Island since the F-2 tornado in Cranston and Providence on August 7, 1986. The tornado first touched down near Byron Randall Road in Scituate which is where the most severe damage occurred. There were hundreds of large trees either uprooted or snapped at their bases. One home sustained damage to its roof, the top of its chimney was blown off, windows were blown in, and an exterior door was dislodged from its framing. Damage was consistent with winds of around 115 mph which is classified as EF-2 on the EF Scale. The tornado then tracked into Johnston where it crossed I-295 at Exit 10 and lifted a vehicle into the air before dropping it back onto the highway. The driver was transported to an area hospital with minor injuries. From there, the tornado moved across Bridle Way and Carriage Way where a number of trees were snapped or uprooted, some of which fell onto homes or vehicles. Some homes also lost some singles from their roofs. A metal Stop sign pole was bent in half and the sign was blown away. The tornado then caused damage in Highland Memorial Park Cemetery where a number of large trees were either snapped or uprooted. The damage observed in Johnston was consistent with winds of 90 to 100 mph which is classified as EF-1. Finally, the tornado crossed into North Providence. Similar to Johnston, a number of trees were either snapped or uprooted, some falling onto homes or vehicles. Most of the damage observed was to the north of Mineral Spring Avenue. One of the harder hit areas included Lydia Avenue, Armand Drive, and Bennett Street where two homes were made uninhabitable from fallen trees. The damage observed in North Providence was consistent with winds of 90 to 100 mph which is classified as EF-1 on the Enhanced Fujita Scale.
August 7, 1986	F2	The second tornado to occur within an hour in the county touched down in a portion of Cranston and moved in an east-northeasterly direction. The tornado skipped over a section of town neat the intersection of Cranston and Bridgham streets before touching down again on Broad Street in South Providence. A van was tipped over in Cranston and a house moved off its foundation. This tornado cause considerable damage to structures including homes in Cranston and buildings in South Providence. A very rare event in Rhode Island, the twister resulted in millions of dollars of property damage, twenty injuries, and very fortunately, no deaths. The injuries were caused mostly by flying debris. In South Providence a building completely lost its fourth flood. Parts of that area resembled a “war zone” after the storm. Plate glass windows were blown out of many buildings including a fast food restaurant. This tornado was easily confirmed by eyewitness accounts and by live media coverage. Up to 6,000 electric customers lost power.

2.7.3.4 Probability

Tornadoes in the City of Providence are somewhat likely (occurring every 20 to 50 years). Given that tornadoes typically spawn from severe storms, the climate change influences detailed above for severe storms are also relevant for tornadoes; climate change may increase the frequency and severity of tornadoes and alter the timing and seasonality of the hazard. Further, the 2024 Rhode Island State Hazard Mitigation Plan cites research conducted by the National Severe Storms Lab that looked at Significant Tornado Parameters to help determine future tornado probability; the findings corroborate that Rhode Island may see an increasing number of tornadoes.

2.7.3.5 Impacts

Tornadoes, though a less frequent hazard in the City of Providence, can still pose a significant risk to the City when they occur. The impact of a tornado in the City would likely be substantial, given the City's dense urban environment and historical infrastructure. Buildings, especially older ones not designed to withstand such extreme wind forces, could suffer severe damage or total destruction. Residential areas might see roofs torn off, windows shattered, and trees uprooted, leading to widespread property damage. The City's critical infrastructure, including power lines, roads, and communication networks, could also be disrupted, causing power outages, impeding emergency and rescue services, and isolating communities. In response to a tornado, emergency measures such as evacuating residents, providing shelters, clearing debris, distributing essential supplies like food, conducting search and rescue operations, and deploying fire and medical emergency services are crucial components of the disaster management effort.

Like most hazards, tornadoes also the potential to lead to injuries and fatalities, especially from windborne debris in the case of tornadoes. Beyond physical harm, the trauma of experiencing such a catastrophic event, along with the loss of homes, possessions, and potentially loved ones, can have long-lasting mental health consequences for residents of the City.

2.8 Winter-Related Hazards

2.8.1 Extreme Cold

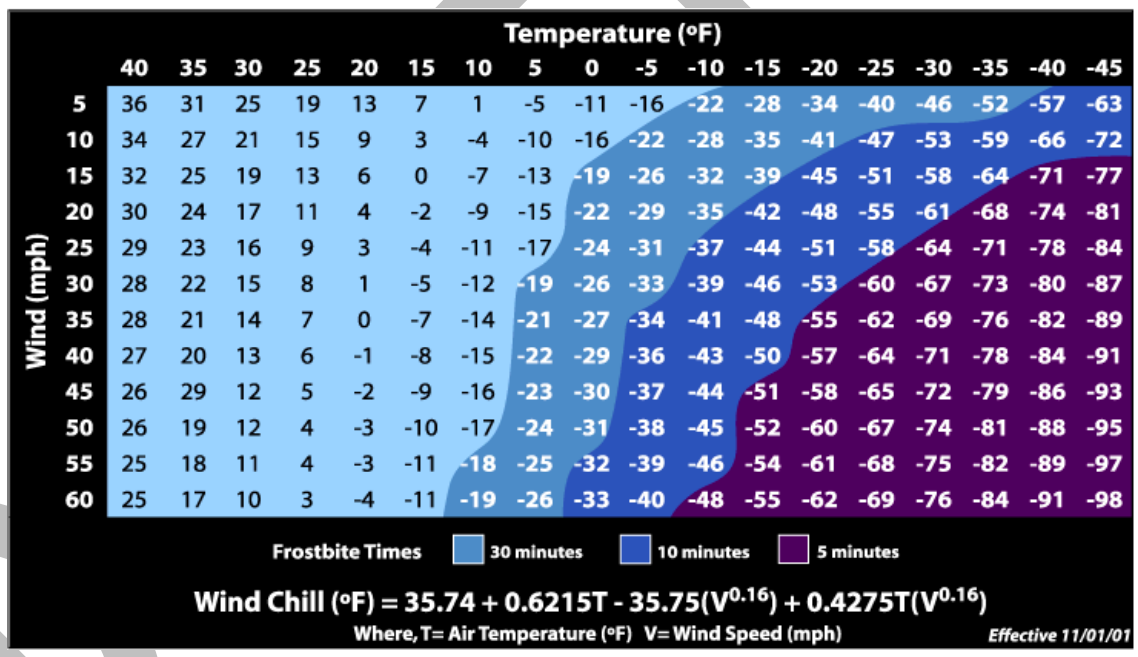
2.8.1.1 Hazard Description

Extreme cold refers to periods of unusually low temperatures that can pose significant health risks and impact various aspects of society and the environment. While definitions may vary based on geographic location and climate norms, extreme cold events are generally characterized by temperatures that are substantially lower than normal for a particular region and time of year. Extreme cold events often accompany or are left in the wake of winter storms, but can also occur without any associated storm activity. The National Weather Service (NWS)'s local weather forecast office that covers the City of Providence issues the following watches, warnings, and advisories related to extreme cold events:

- Wind Chill Advisory: Wind chill index between -15°F and -24°F for at least 3 hours using only the sustained wind.
- Wind Chill Warning: Wind chill index ≤ -25°F for at least 3 hours using only sustained wind.

The wind chill index used as a criteria above is a measure of what the air temperature feels like to the human skin due to the combination of cold temperatures and winds blowing on exposed skin. Figure 2-23 below shows the relationship between the temperature, wind, and wind chill index.

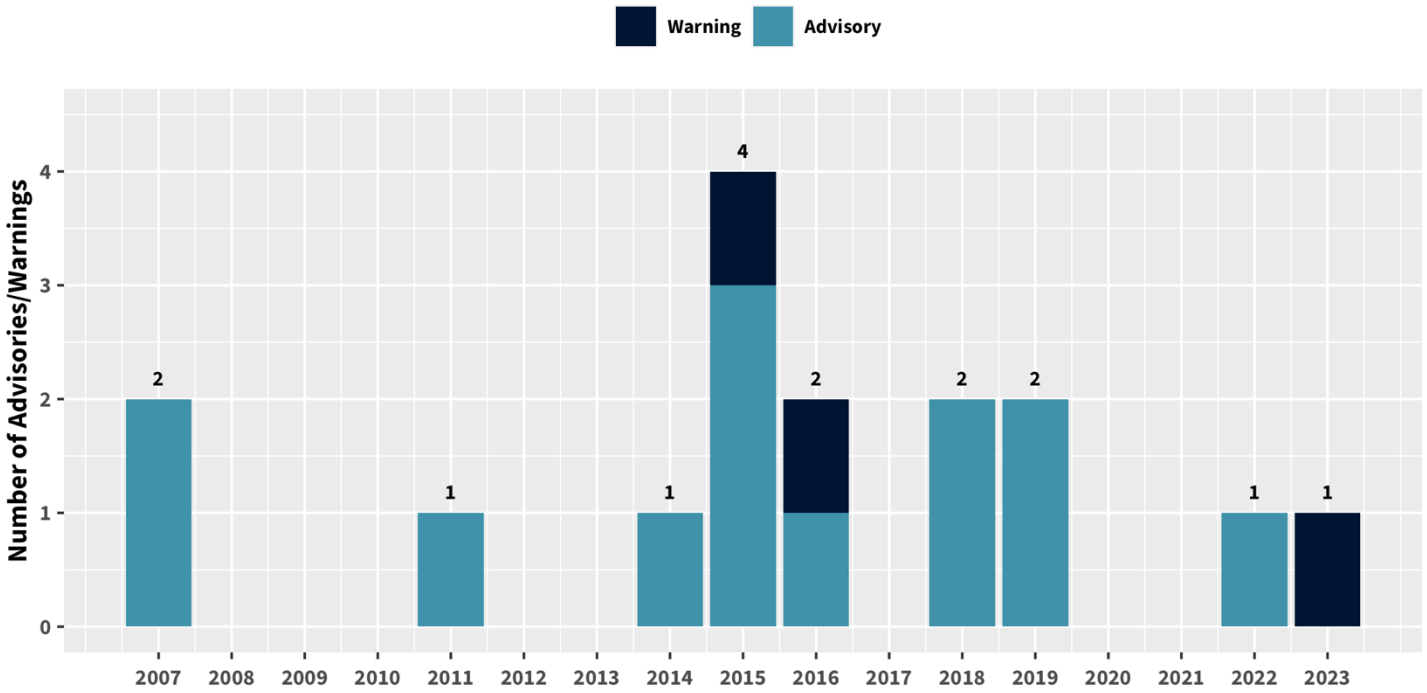
Figure 2-23. Wind chill index chart (National Oceanic and Atmospheric Administration (NOAA))



2.8.1.2 Location and Extent

Extreme cold events are a City-wide hazard. Based on historical data, the City of Providence could experience extreme cold events with a wind chill less than or equal to -25°F for at least 3 hours. Figure 2-24 below shows the annual number of wind chill advisories and warnings that were issued to the City of Providence's weather forecast zone (Southeast Providence) between 2007 and 2023.

Figure 2-24. Wind chill advisories and warnings issued to forecast zone, Southeast Providence, between 2007 and 2023 (Iowa State University Iowa Environmental Mesonet)



2.8.1.3 Previous Occurrences

NOAA's NCEI database of storm events includes 2 records of extreme cold/wind chill reported for the City's forecast zone (Southeast Providence) (Table 2-28).

Table 2-28. Previous occurrences of extreme cold/wind chill in forecast zone, Southeast Providence, (1950 to 2023) (NOAA)

Date	Zone	Narrative
February 14, 2016	Southeast Providence	Arctic high pressure brought strong northwest winds and extremely cold wind chills to southern New England. Many locations reported wind chills between 25 and 35 degrees below zero. Wind chills as low as 32 below zero were reported at TF Green Airport in Warwick, which is representative of greater Providence.
February 16, 2015	Southeast Providence	Low pressure off the Delmarva peninsula intensified rapidly as it moved northeastward. Its path just southeast of Nantucket brought heavy snow to all of southern New England and blizzard conditions and coastal flooding to coastal areas. A 56 year old female custodian was injured when she fell through a skylight while clearing the snow from the roof of Smithfield High School on February 18th. The Automated Surface Observation Station at T.F. Green Airport in Warwick, RI (KPVD) recorded wind chills as low as 26 below zero.

2.8.1.4 Probability

The probability of having an extreme cold event in the City is likely (occurring every 5 to 20 years). The probability and severity will likely decrease though due to warming temperatures from climate change.

2.8.1.5 Impacts

Extreme cold weather presents significant challenges for urban areas, affecting the population and emergency services alike. The most vulnerable groups, such as the homeless, the elderly, and those with disabilities, are at heightened risk of cold-related health issues, including frostbite and hypothermia. For the general population, the drop in temperature can make even short travel treacherous, and the increase in energy consumption for heating homes heightens the risk of frozen and burst pipes, disrupting water services. Power outages not only lead to a surge in the use of alternative heating sources, which can cause carbon monoxide poisoning and fires but also result in critical loss of heating, turning indoor conditions dangerous and potentially life-threatening.

Transportation is particularly impacted during extreme cold events. Cold snaps can cause hazardous road conditions that lead to increased accidents and obstructed travel routes, severely hindering the mobility of residents and the timely response of emergency services. First responders face these added risks, potentially leading to delayed arrival times at critical incidents. Furthermore, the cold can damage the infrastructure, such as roads and railways, and impair the functioning of vehicles and emergency equipment.

2.8.2 Winter Weather

2.8.2.1 Hazard Description

Winter weather consists of winter storm events in which the main types of precipitation are snow, sleet, or freezing rain:

- Snow: Snowflakes are collections of ice crystals that cling to each other as they fall toward the ground. Precipitation continues to fall as snow when the temperature remains at or below 32°F from the cloud base to the ground.
- Sleet: Sleet occurs when snowflakes only partially melt when they fall through a shallow layer of warm air. These slushy drops refreeze as they next fall through a deep layer of freezing air above the surface, and eventually reach the ground as frozen rain drops that bounce on impact.
- Freezing Rain: Freezing rain occurs when snowflakes descend into a warmer layer of air and melt completely. When these liquid water drops fall through another thin layer of freezing air just above the surface, they don't have enough time to refreeze before reaching the ground. Because they are “supercooled,” they instantly refreeze upon contact with anything that that is at or below 32°F, creating a glaze of ice on the ground, trees, power lines, or other objects.

Severe winter weather can include ice storms, heavy snow, and blizzards.

- Ice Storm: An ice storm is a freezing rain situation with significant ice accumulations. In addition to typical white ice, ice storms can cause black ice and ice jams.

    - Black ice is a deadly driving hazard defined as patchy ice on roadways or other transportation surfaces that cannot easily be seen. It is often clear (not white) with the black road surface visible underneath. It is most prevalent during the early morning hours, especially after snow melt on the roadways has a chance to refreeze over night when the temperature drops below freezing. Black ice can also form when roadways are slick from rain and temperatures drop below freezing overnight.
    - Long cold spells can cause rivers and lakes to freeze. A rise in the water level or a thaw breaks the ice into large chunks which become jammed at manmade and natural obstructions. Ice jams can act as a dam, resulting in severe flooding.
- Heavy Snow: Heavy snow is snowfall accumulating to 4" or more in 12 hours or less or snowfall accumulating to 6" or more in 24 hours or less.
- Blizzard: A blizzard is a dangerous winter storm that is a combination of blowing snow and wind resulting in very low visibilities

The National Weather Service (NWS)'s local weather forecast office that covers the City of Providence issues the following watches, warnings, and advisories related to ice storm events:

- Winter Weather Advisory: When any of the following is expected within the next 12 to 24 hours:
    - More than one predominant hazard: Winter weather event having more than one predominant hazard (i.e. snow and ice, snow and sleet, or snow, ice and sleet) meeting or exceeding advisory criteria for at least one of the precipitation elements, but remaining below warning criteria.
        - Snow, Ocean Effect Snow, and/or Sleet: 3 inches averaged over a forecast zone in 12 hours.
        - Snow and Blowing Snow: Sustained or frequent gusts of 25 to 34 mph accompanied by falling and blowing snow occasionally reducing visibility to less than or equal to 0.25 miles for less than 3 hours.
        - Blowing Snow: Widespread or localized blowing snow reducing visibility to less than or equal to 0.25 miles with winds less than 35 mph.
        - Freezing Rain: Any accretion of freezing rain or freezing drizzle on road surfaces.
        - Black Ice: A Special Weather Statement will usually be issued when sufficient moisture is expected to cause a thin layer of ice on road surfaces, typically on cloudless nights ("black ice"). At forecaster discretion a formal Winter Weather Advisory may be issued instead.
- Winter Storm Warning: When any of the following is expected within the next 12 to 36 hours:
    - More than one predominant hazard: Winter weather event having more than one predominant hazard (i.e. heavy snow and blowing snow (below blizzard conditions), snow and ice, snow and sleet, sleet and ice, or snow, sleet and ice) meeting or exceeding warning criteria for at least one of the precipitation elements.
        - Snow, Ocean Effect Snow, or Sleet: 6 inches averaged over a forecast zone.
- Ice Storm Warning: 0.5 inch or greater accretion of freezing rain in any zone.

- Blizzard Warning: Sustained winds or frequent gusts greater than or equal to 35 mph and considerable falling and/or blowing snow frequently reducing visibility to less than 0.25 miles for greater than or equal to 3 hours. Blizzard conditions need to be the predominant condition over a 3 hour period.

The Winter Storm Severity Index is a classification system used to communicate impacts from winter storms using NWS forecast data.

Table 2-29. Winter Storm Severity Index scale (NOAA)

Rating	Potential Impacts
No Impacts	Impacts not expected.
Limited Impacts	Rarely a direct threat to life and property. Typically results in little inconveniences.
Minor Impacts	Rarely a direct threat to life and property. Typically results in an inconvenience to daily life.
Moderate Impacts	Often threatening to life and property, some damage unavoidable. Typically results in disruptions to daily life.
Major Impacts	Extensive property damage likely, life saving actions needed. Will likely result in major disruptions to daily life.
Extreme Impacts	Extensive and widespread severe property damage, life saving actions will be needed. Results in extreme disruptions to daily life.

2.8.2.2 Location and Extent

Winter weather, including heavy snow, ice storms, and blizzards, are a City-wide hazard and can reach extreme levels.

Figure 2-25 below shows the annual number of winter weather-related advisories and warnings that were issued to the City of Providence's weather forecast zone (Southeast Providence) between 2005 and 2023.

The USACE Cold Regions Research and Engineering Laboratory maintains a database of damaging ice storms, which include the footprint polygons representing area where ice-sensitive structures (e.g. overhead power, communication towers, trees, etc.) were damaged by ice storms between 1940 and Spring 2014). While the raw data is not available due to data restrictions, FEMA provides the annualized frequency of this data on the census tract level through its National Risk Index (NRI) (Figure 2-26).

Figure 2-25. Winter weather-related advisories and warnings issued to forecast zone, Southeast Providence, between 2005 and 2023 (Iowa State University Iowa Environmental Mesonet)

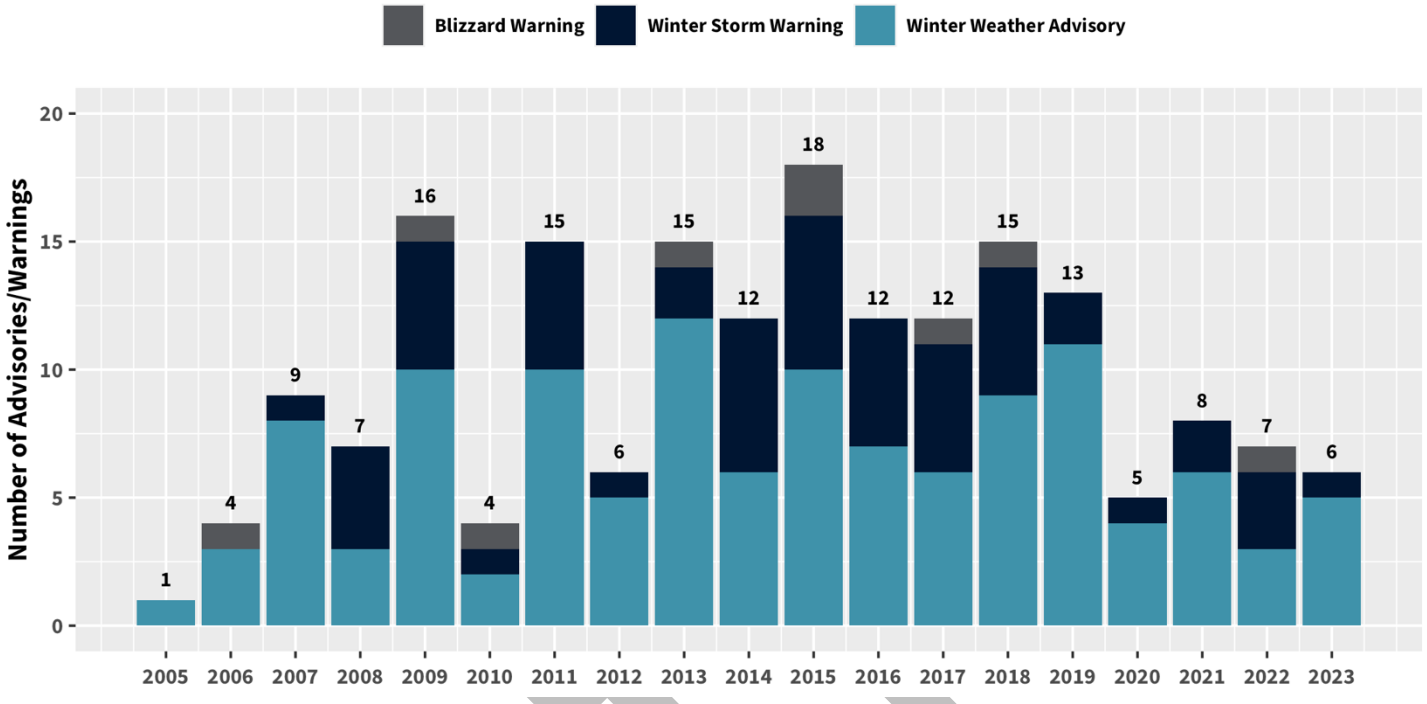
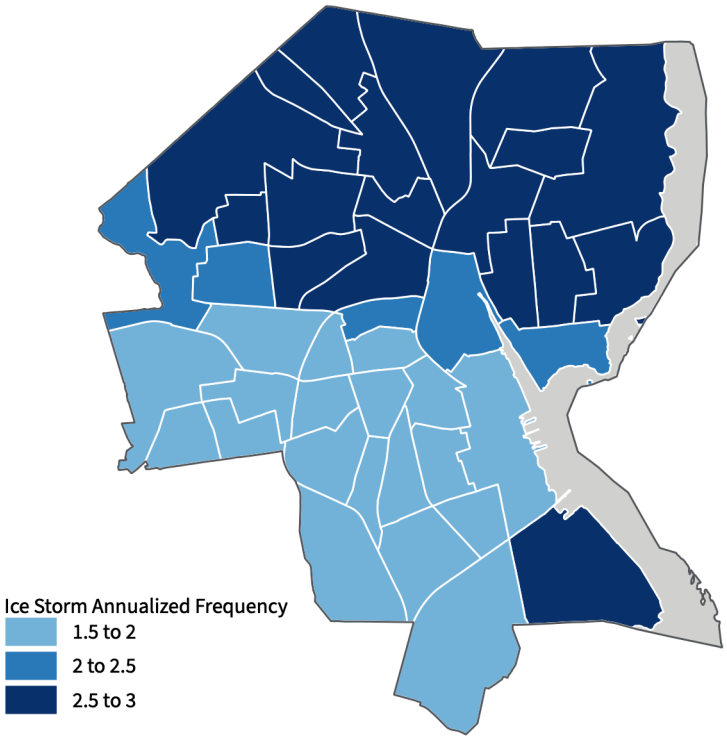


Figure 2-26. Annualized frequency of damaging ice storms in the City (FEMA)



2.8.2.3 Previous Occurrences

Providence County has received 5 major disaster declarations and 4 emergency disaster declarations from FEMA for winter weather.

Table 2-30. Historical winter weather-related FEMA disaster declarations for Providence County (FEMA)

Disaster Number	Declaration Type	Declaration Date	Declaration Title
4653	DR	May 12, 2022	Severe Winter Storm and Snowstorm
4212	DR	April 3, 2015	Severe Winter Storm and Snowstorm
4107	DR	March 22, 2013	Severe Winter Storm and Snowstorm
3203	EM	February 17, 2005	Record Snow
3182	EM	March 27, 2003	Snow
3102	EM	March 16, 1993	Blizzards, High Winds and Record Snowfall
3058	EM	February 7, 1978	Blizzard and Snowstorms
1091	DR	January 24, 1996	Blizzard of 96 (Severe Snow Storm)
548	DR	February 16, 1978	Snow and Ice

Table 2-31 includes the winter weather events in the City's forecast zone (Southeast Providence) from the NOAA NCEI database. The table includes event types of "blizzard," "heavy snow," "ice storm," "sleet," "winter storm," and "winter weather." The table denotes the precipitation types included in the event narrative of each report. The table also includes the recorded snow (in inches) in the City of Providence if the value was included in the event narrative.

Table 2-31. Previous occurrences of ice storm-related events in the City of Providence's forecast zone (Southeast Providence) (1950 to 2023) (NOAA)

Date	Event Type	Precipitation Types in Narrative	Recorded Snow in the City of Providence
January 2, 1996	Heavy Snow	Snow	
January 7, 1996	Heavy Snow	Snow	33.2"
February 2, 1996	Heavy Snow	Snow	5.8"
February 16, 1996	Heavy Snow	Snow	5.5"
March 2, 1996	Heavy Snow	Snow	9"
March 3, 1996	Winter Weather	Snow	
March 7, 1996	Heavy Snow	Snow; Freezing Rain	
April 7, 1996	Heavy Snow	Snow	
April 9, 1996	Heavy Snow	Snow	12.9"
December 6, 1996	Heavy Snow	Snow	
January 11, 1997	Heavy Snow	Snow	6"
January 31, 1997	Winter Weather	Freezing Rain	

Date	Event Type	Precipitation Types in Narrative	Recorded Snow in the City of Providence
March 31, 1997	Heavy Snow	Snow; Rain	
April 1, 1997	Heavy Snow	Snow	19.5"
February 25, 1999	Heavy Snow	Snow	6 to 8"
March 15, 1999	Heavy Snow	Snow	10"
January 13, 2000	Heavy Snow	Snow	
February 18, 2000	Heavy Snow	Snow	6"
January 20, 2001	Heavy Snow	Snow	
February 5, 2001	Heavy Snow	Snow	
February 25, 2001	Winter Weather	Snow; Freezing Rain; Sleet	
March 5, 2001	Heavy Snow	Snow	
November 27, 2002	Heavy Snow	Snow	6"
December 5, 2002	Heavy Snow	Snow	6"
February 7, 2003	Winter Storm	Snow	11"
February 17, 2003	Winter Storm	Snow	17"
March 6, 2003	Winter Storm	Snow	7"
December 5, 2003	Winter Storm	Snow	18"
November 12, 2004	Heavy Snow	Snow	6"
December 26, 2004	Winter Storm	Snow	8"
January 5, 2005	Winter Storm	Snow	6"
January 22, 2005	Winter Storm	Snow	
February 24, 2005	Heavy Snow	Snow	
March 1, 2005	Winter Storm	Snow	6"
February 12, 2006	Winter Storm	Snow	
March 16, 2007	Winter Storm	Snow	
December 13, 2007	Heavy Snow	Snow	
December 16, 2007	Heavy Snow	Not Specified	
December 19, 2008	Heavy Snow	Snow	9 to 10"
December 31, 2008	Heavy Snow	Snow	
January 18, 2009	Heavy Snow	Snow	
March 2, 2009	Heavy Snow	Snow	
December 19, 2009	Heavy Snow	Snow	
December 26, 2010	Winter Storm	Snow	11"
January 12, 2011	Heavy Snow	Snow	
January 26, 2011	Heavy Snow	Snow	
February 1, 2011	Winter Storm	Snow; Freezing Rain; Sleet	
January 19, 2012	Winter Weather	Snow	
January 21, 2012	Winter Weather	Snow	
February 29, 2012	Winter Weather	Snow	
November 7, 2012	Winter Weather	Snow; Rain	
December 29, 2012	Heavy Snow	Snow	
February 8, 2013	Heavy Snow	Snow	
February 8, 2013	Blizzard	Snow	

Date	Event Type	Precipitation Types in Narrative	Recorded Snow in the City of Providence
February 17, 2013	Winter Weather	Snow	
March 7, 2013	Winter Weather	Snow	
January 2, 2014	Heavy Snow	Snow	
January 21, 2014	Heavy Snow	Snow	
February 5, 2014	Heavy Snow	Snow	
January 26, 2015	Blizzard	Snow	16"
February 2, 2015	Heavy Snow	Snow	
February 8, 2015	Heavy Snow	Snow	
February 14, 2015	Heavy Snow	Snow	
February 25, 2015	Winter Weather	Snow	
March 1, 2015	Winter Weather	Snow	
March 5, 2015	Winter Weather	Snow	
January 23, 2016	Heavy Snow	Snow	
February 5, 2016	Heavy Snow	Snow	
February 8, 2016	Heavy Snow	Snow	
March 21, 2016	Winter Weather	Snow	
April 4, 2016	Heavy Snow	Snow	
December 17, 2016	Winter Weather	Snow	
January 7, 2017	Winter Storm	Snow	
February 9, 2017	Winter Storm	Snow	
March 14, 2017	Heavy Snow	Snow; Rain; Sleet	
December 9, 2017	Winter Weather	Snow	
January 4, 2018	Winter Storm	Snow	
January 30, 2018	Winter Weather	Snow	
March 13, 2018	Winter Storm	Snow	
November 15, 2018	Heavy Snow	Snow	
March 3, 2019	Winter Storm	Snow	
December 16, 2020	Heavy Snow	Snow	8.3"
February 7, 2021	Heavy Snow	Snow	5"
January 7, 2022	Heavy Snow	Snow	
January 28, 2022	Heavy Snow	Snow	

2.8.2.4 Probability

Winter weather in the City of Providence is extremely likely (occurring every 1 year or more). Current climate change projection models are inconclusive of how the frequency of ice storms is expected to change in the future. While not conclusive, as global temperatures rise, the overall frequency of ice storms, may decrease; however, the intensity and severity of these events when they do occur could increase because warmer air holds more moisture, which can lead to heavier precipitation. Further, the changing climate may lead to more instances of volatile weather patterns, where sudden drops in temperature follow warm periods. This can cause precipitation to fall as rain and then freeze upon contact with the still-cold ground, creating ice

accumulations. Additionally, as the climate warms, areas that traditionally experienced snowfall may begin to see more freezing rain if temperatures rise just above the freezing mark.

2.8.2.5 Impacts

The most immediate and visible impact of ice storms on the City is the accumulation of ice on surfaces, which can weigh down and break tree limbs, damage power lines, causing widespread power outages, and cause unsafe travel conditions. The City's infrastructure is at risk, with roads becoming slick and treacherous, leading to increased accidents and travel disruptions, which is especially impactful for emergency responders. Bridges and overpasses are particularly dangerous because they freeze before other surfaces. Public transportation may face delays or shutdowns, while even small accumulations of ice can be extremely dangerous to motorists and pedestrians. Ice can also accumulate on communication lines and antennas, disrupting both cellular and internet services, which are crucial during emergency situations.

Economically, businesses may be forced to close due to power outages, unsafe conditions for employees, or damage to premises and stock. The costs associated with cleanup and repair can be substantial for both the public sector and private residents. For instance, the City may need to deploy additional resources for salting and sanding roads, clearing debris, and repairing infrastructure. Residents may face expensive repairs or replacement costs, while the interruption to commerce during and after an ice storm can lead to a downturn in economic activity. On a social level, extended power outages during cold weather can lead to health and safety concerns, particularly for the elderly, young children, and those with medical conditions. Ice storms may also lead to school closures, disrupting student learning and working parents and guardians because of child care needs.

2.9 Human-Caused Hazards

2.9.1 Civil Disturbance/Unrest

2.9.1.1 Hazard Description

A civil disturbance is an activity such as a demonstration, riot, or strike that disrupts a community and requires intervention to maintain public safety. Civil disturbances and unrest can occur for various reasons, including social, political, economic, or racial tensions, and may be triggered by specific events or grievances. Civil disturbances and unrest are used by populations to assert their demands and push for change. Civil disturbances do not encompass all types of protest or public demonstrations, such as peaceful protests, and instead, are characterized by the involvement of illegal activities and a significant risk to public safety.

The severity of a civil disturbance incident varies and depends on the nature of the disturbance as well as the size of the crowd gathered. A low severity disturbance often results when police are dispatched to control traffic. A moderate severity disturbance is considered when businesses are disrupted or the result of property damage, requiring police intervention to restore order. Severe disturbance incidents typically involve some form of rioting, arson, assault, and potential death, warranting aggressive police intervention.

2.9.1.2 Location and Extent

Historically civil disorder has been most associated with urban areas and college campuses, making civil disturbance and unrest a City-wide hazard. The City of Providence has 8 college and university campuses located in its jurisdiction, including Brown University, Johnson & Wales University, Rhode Island College, Rhode Island School of Design, and University of Rhode Island Feinstein Providence Campus. Further, as civil disturbances and unrest can be politically motivated, Providence City Hall may be a focal point for such activities, serving as a symbolic and central location where participants may gather to express their grievances or demand action from the local government.

2.9.1.3 Previous Occurrences

As seen in many cities nationwide, demonstrations as part of the Occupy Wall Street (2011) and Black Lives Matter (2020) movements occurred in the City and impacted local response efforts. The following events led to more significant disruptions to the City:

- 2014: In November of 2014 in the City, a protest that began peacefully escalated into a standoff with police after demonstrators obstructed I-95 by entering the roadway. The incident, which involved the burning of an American flag and approximately 150 protesters breaching a fence near the Providence Public Safety Complex, resulted in a traffic shutdown for around half an hour. Authorities, including state troopers and local police, responded to the scene and detained five individuals who did not comply with dispersal commands. This group was part of a larger assembly of over 300 individuals who initially convened at Central High School to express their outrage with the grand jury's choice not to charge a white police officer in the fatal shooting of a black teenager, Michael Brown, in Ferguson, Missouri.
- 2020: In June of 2020 protests involving approximately 150 people over the death of George Floyd in the City turned violent and spread throughout downtown. Approximately 60 Providence and Rhode

Island State Police vehicles were deployed. Protestors broke into a nearby mall and vandalized and looted other stores throughout the downtown area. During the event, a Providence Police vehicle was burned. As a result, a curfew was declared in the City for the following few nights.

2.9.1.4 Probability

The probability of a civil disturbance or unrest is very difficult to predict due to its dependence on a multitude of fluctuating social and political factors, including economic disparities, political decisions, incidents of injustice, and societal shifts. Based on the previous occurrence data, the probability for a civil disturbance in the City is highly likely (occurring every 1 to 5 years), but as the social and political climate evolves, so does the potential for the hazard (both positively and negatively). A population's response can be stirred by sudden events or the culmination of long-standing grievances. The proliferation of information and ease of communication through digital media can also rapidly mobilize communities into action, increasing the probability of a civil disturbance. While climate change does not directly instigate civil disturbances, it can serve as a catalyst for protest activity. As the effects of climate change become more tangible and widespread, they can exacerbate existing social and economic pressures, leading to heightened public advocacy and demonstrations demanding action from policymakers and industry leaders.

2.9.1.5 Impacts

Civil disturbances and unrest can have significant repercussions for the City of Providence, affecting its residents, infrastructure, and the overall social fabric. When protests escalate into disturbances and unrest, there can be immediate public safety concerns. Traffic disruptions are common, as major thoroughfares may be blocked by protestors, which not only hampers the daily commute but can also delay emergency response services. Dynamics between protestors, police, and bystanders can lead to injuries, and even fatalities. Businesses, particularly those in the downtown area, may experience vandalism or looting, leading to economic losses and a temporary decline in commercial activity. The cost of policing, repairs, and clean-up efforts can strain businesses as well as the City's budget.

Long-term social impacts can be profound as well. Repeated instances of civil disturbance can deepen divides within the community, making reconciliation and positive dialogue more challenging. Such events often reflect underlying issues that need addressing, such as racial inequality, economic disparity, or political grievances. The aftermath of unrest provides an opportunity for community leaders and policymakers to engage in meaningful discussions to address these root causes. However, if not managed effectively, the long-term social consequences can perpetuate a cycle of mistrust and further unrest.

2.9.2 Chemical, Biological, Radiological, Nuclear, and Explosives/Hazardous Materials Release

2.9.2.1 Hazard Description

A chemical, biological, radiological, nuclear, and explosives (CBRNE)/hazardous materials release refers to an incident or event where substances that pose a risk to health, safety, or the environment are unintentionally or intentionally released. These incidents can occur in a variety of settings, from industrial sites to transportation accidents or as a result of terrorist activities.

- Chemical: A chemical incident is characterized as an unexpected, uncontrolled release of a chemical from its containment, and typically occurs at fixed-site facilities that manufacture, store, process, or otherwise handle hazardous materials or along major roadways, railways, waterways, and pipelines. Common routes of exposure include inhalation, ingestion, and physical contact, which may lead to respiratory distress, organ failure, burns, or death. Absorption rates vary and depend on the concentration of the chemical, the duration of the exposure, air temperature, humidity levels and the age of the person affected. The severity of a chemical incident depends on the type and amount of the material released, proximity to populations or sensitive areas such as waterways, and environmental factors such as wind velocity and direction, and sunlight exposure.
- Biological: A biological incident is characterized by the accidental or intentional release of naturally occurring biological diseases (both communicable and non-communicable). A biological agent can be organisms or toxins, and include the following:
    - Bacteria: Single-cell organisms that are the causative agents of anthrax, brucellosis, tularemia, plague, and numerous other diseases. They vary considerably in infectivity and lethality.
    - Rickettsia: Microorganisms that resemble bacteria in form and structure but differ in that they are intracellular parasites that can reproduce inside animal cells, such as typhus, rocky mountain spotted fever, and Q fever.
    - Viruses: Intracellular parasites that are about 100 times smaller than bacteria. A virus's strength can be altered to increase its efficiency. A particularly powerful strain of an endemic pathogen could be caused by a chance, natural mutation.
    - Fungi: Kingdom of spore-producing organisms that feed on organic matter, such as rice blast, cereal rust, and potato blight, that can cause severe disease in humans, such as coccidioidomycosis (valley fever) and histoplasmosis.
    - Toxins: Poisonous substance made by a living system, or a synthetic analogue of a naturally occurring poison, such as botulinum, ricin, and staphylococcal enterotoxin B.

  Biological incidents can be delivered in various ways, including:
    - Inhalation: Requires that a biological agent be aerosolized in a particle size that could be inhaled by an individual. Scenarios include airborne dissemination, for instance, via crop dusting aircraft, or dispersal through a building air handling system.
    - Injection: Involves the introduction of an agent into an individual by penetrating the skin barrier. Scenarios include targeted attacks with an injection device such as a syringe.
    - Ingestion: Involves an individual swallowing the agent or toxin. Scenarios include the introduction of an agent into a food or water source.
- Radiological and Nuclear: A radiological or nuclear incident can be defined as the uncontrolled release of radioactive or nuclear material. Radiological incidents typically involve nuclear assemblies, research, production, or power reactors and chemical operators. Radiological incidents may also include the use of Radiological Dispersal Devices, such as "dirty bombs," which cause the purposeful dissemination of radioactive material without a nuclear detonation. Other radioactive materials, such as radioactive medical devices, or radioactive recyclable metals, may also become a hazard.

The Nuclear Regulatory Commission (NRC) has developed an emergency classification system which indicates the risk of radiological incident to the public, and includes four types of alerts:

- Notification of Unusual Event: Events are in process or have occurred which indicate potential degradation in the level of safety of the plant. No release of radioactive material requiring off-site response or monitoring is expected unless further degradation of the safety systems occur.
- Alert: Events are in process or have occurred which involve an actual or potential substantial degradation in the level of safety of the plant. Any releases of radioactive material from the plant are expected to be limited to a small fraction of the Environmental Protection Agency (EPA) Protective Action Guidelines (PAG) exposure levels.
- Site Area Emergency: Events are in process or have occurred that result in actual or likely major failures of plant functions needed for protection of the public. Any releases of radioactive material not expected to exceed the EPA PAG exposure levels except near the site boundary.
- General Emergency: Events are in process or have occurred which involve actual or imminent substantial core degradation or melting with potential loss of containment integrity. Releases can reasonably be expected to exceed the EPA PAG exposure levels off-site for more than the immediate site area.

- Explosive: A high-yield explosive incident involves materials that rapidly release large amounts of energy and produce a pressure shock wave during detonation.
- Hazardous Material: A hazardous material incident is characterized by the release or improper handling of any of the above or other dangerous substances, like flammable liquids or gases. The United States Emergency Planning and Community Right-to-Know Act (EPCRA) categorizes hazardous materials severity:
  - Extremely Hazardous Substances: Materials that have acutely toxic chemical or physical properties and may cause irreversible damage or death to people or harm the environment if released or used outside their intended use.
  - Hazardous Substances: Materials posing a threat to human health and/or the environment, or any substance designated by the EPA to be reported if a designated quantity of the substance is spilled into waterways, aquifers, or water supplies or is otherwise released into the environment.

2.9.2.2 Location and Extent

The entire City of Providence is at risk of CBRNE and hazardous material release incidents. Areas of heightened concern include:

- Port of Providence: The Port of Providence (Prov Port) is one of America's most strategically located port facilities. Currently operated by Waterson Terminal Services, the Port is located at the convergence of Narragansett Bay and the Providence River. The Port's campus is more than 105 acres, and the facility offers in excess of 1 mile of linear berthing, capable of working 6 vessels at any one time. As one of New England's only deep water operations, Prov Port has an on-dock rail with 3 rail spurs, 20 acres of open lay down area, 300,000+ square feet of enclosed warehouse facilities, is

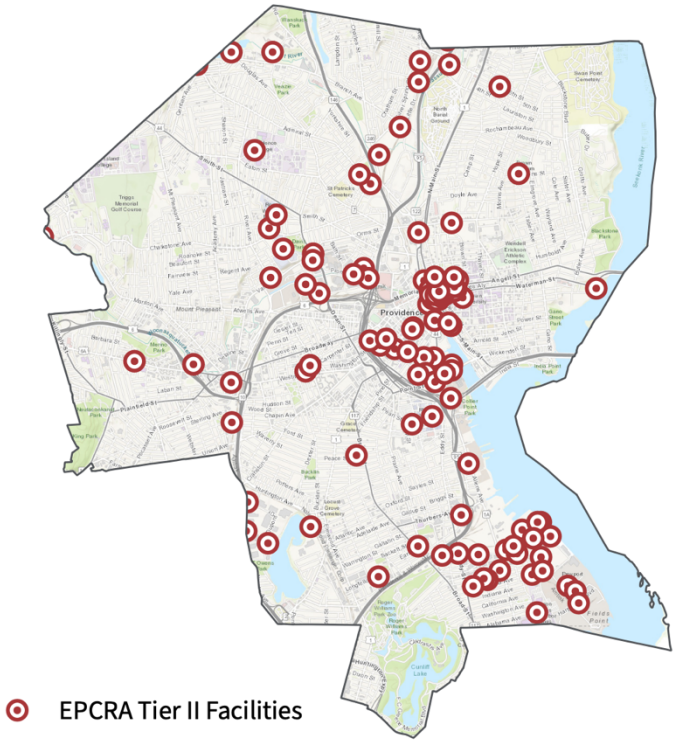
adjacent to pier face and on-dock rail lines, and has fixed and mobile cranes available. Prov Port provides both domestic and international bulk, break bulk, and project cargo clients. Tankers arriving at the Port provide fuel for Rhode Island, as well as Southeastern Massachusetts, Cape Cod, and northern Connecticut. The Port is also the main entry for the bulk of home heating fuel and motor fuels for the New England region, and has a major Liquified Natural Gas (LNG) storage and transfer facility; 8.5 million gallons of liquid ethanol is transported through the Blackstone Valley via cargo trains each year and blended at the port terminals for distribution. Prov Port is a critical economic engine for New England, with an estimated $200 million total economic impact on the region. The port is host to more than a dozen companies. Combined, the activities at Prov Port provide more than $60 million in direct business revenues and $16 million in revenue to local and state government.

- Tier I and Tier II Facilities: Several facilities in the City of Providence store, use, dispose, or handle hazardous materials on a regular basis. These facilities are classified as "Tier I" or "Tier II" facilities regulated by Title III of the EPCRA.
- Liquified Natural Gas (LNG) and Liquefied Petroleum Gas (LPG) Storage Facilities:
    - The LNG facility stores 600,000 barrels of LNG - a cryogenic gas that is cooled to -260°F for storage. It is primarily methane with a flammable range between 5 and 15 percent in air. When used, the temperature is elevated, and the liquefied gas expands 600 times and is transported to homes and businesses via the gas main system for commercial use. The tank is filled during the summer months for winter use by trucks coming from the LNG facility in Everett, Massachusetts. The tank is diked to contain a liquid leak equal to one and a half times the capacity of the tank. The facility is hazardous as in the case of a leak, the liquid would eventually heat up and migrate from the diked area until it contacted an ignition source where it would ignite and flash back to the diked area, igniting the rest of the pool and causing an extremely intense fire beyond the capabilities of any municipal fire department.
    - The LPG facility is located approximately 1 mile away from the LNG facility. The LPG facility contains 400,000 barrels of LPG. LPG is a gas cooled to -44°F, with an expansion ratio of 270 to 1 and is mainly propane. The flammable range is between 2 to 9 percent in air. The LPG facility is also approximately 500 feet from the largest chemical storage company in the city. LPG is used commercially for heating and is distributed under pressure via truck. LPG is brought to the city via ship. The facility receives approximately 12 deliveries annually. The main hazard of propane is that it is heavier than air, and should a leak occur, the gas will seek an ignition source and flash back to the container.

In addition to the facilities located within the City, areas of heightened concern outside of the City include:

- Millstone Nuclear Power Station: Located in Waterford, Connecticut, the Millstone Nuclear Power Station is the only multi-unit nuclear plant in New England. The City of Providence falls within the 50-mile Ingestion Exposure Pathway for the plant. Millstone Power Station has had periodic shutdown of its Unit 2 and Unit 3 reactors, with its Unit 1 reactor permanently shut down in 1998.

Figure 2-27. EPCRA tier II facilities located in the City of Providence (RIDEM)



2.9.2.3 Previous Occurrences

The RIDEM Office of Emergency Response operates an all-hazard response program. City-level data is unavailable, but in fiscal year 2022, there were 546 emergency response cases handled statewide (37 being hazardous material incidents).

RIDEM details major emergency response incidents in recent years - the incidents that occurred within the City of Providence include:

- Oil Tanker Rollover on Allens Avenue (2018): On October 3, 2018, a tanker truck rolled over on the I-95 north bound ramp off of Allens Avenue in the City. The truck was carrying 11,500 gallons of gasoline, and all but approximately 400 gallons were released into the surrounding area. Contaminated areas included a stream connected to the Providence River, grass bordering the east side of the street and the storm drain system discharging directly into the Providence River. Remediation efforts lasted several days, and extremely high levels of gasoline vapors were present in the storm drain system following the spill. These hazardous levels reached higher than 99% of the lower explosive limit, meaning the air was capable of combustion. Over 6,000 gallons of firefighting foam, water and gasoline were pumped out of the underground line beneath Allens Avenue, and a total of 17,900 gallons was collected throughout the entire cleanup process.
- Alarming Residential Mercury Release (2019): On February 9, 2019, a RIDEM emergency responder was notified by Rhode Island Hospital of a potential mercury exposure. It was discovered that, 12 days prior, the patient melted down old silver and gold dental fillings resulting in a release of toxic

mercury levels. Consequently, the patient suffered respiratory failure and pets at the residence were exhibiting signs of dying, some of which eventually passed. Sparking a public concern, a Lumex meter was used to detect mercury levels on the household residents' clothing, as well as the room where the patient was located. Levels of concern range from 50,000 parts per trillion (ppt), but anything above 1,000 ppt can prove alarming. Readings of the household residence reached the upper hundreds. However, the patient's clothing reached a high of an incredible 4,000 ppt. The contaminated clothing was disposed of properly to assure the surrounding environment was not affected any further.

The Providence Fire Department's (PFD) 2023 Annual Report details operation counts related to CBRNE and hazardous material incidents that the Department responded to, as shown in Table 2-32.

Table 2-32. Providence Fire Department 2023 operations related to CBRNE and hazardous materials (PFD)

Operation	Count
Gas leak (natural gas or LPG)	203
Carbon monoxide incident	131
Gasoline or other flammable liquid	12
Oil or combustible liquid	6
Chemical hazard (no spill or leak)	4
Chemical spill or leak	4
Refrigeration leak	3
Toxic condition, other	2
Combustible or flammable gas or liquid	1

2.9.2.4 Probability

CBRNE and hazardous materials incidents typically occur multiple times a year in the City of Providence, but based on qualitative analyses, majority of incidents are usually small in scale with no significant consequences. The probability of any CBRNE and hazardous materials incidents is extremely likely (occurring every 1 year or more), while the probability of a major incident is likely (occurring every 5 to 20 years). The probability is not expected to change due to direct impacts of climate change, but increases in natural hazards, like flooding, can indirectly increase the probability of the hazard due to cascading effects.

2.9.2.5 Impacts

CBRNE and hazardous material incidents can have the greatest impacts of human and environmental health in the City of Providence. As outlined above, these incidents can lead to immediate health hazards, causing acute medical conditions and fatalities in the population, necessitating quarantine measures, and straining the healthcare system. The necessity for large-scale evacuations to protect residents from exposure can result in significant disruptions to daily life. A chemical spill might contaminate water sources, soil, and air quality, leading to long-term ecological damage and affecting the food chain. Radiological incidents can render large areas uninhabitable for extended periods. Decontamination efforts can be extensive and costly, requiring specialized personnel and equipment.

2.9.3 Conflagration

2.9.3.1 Hazard Description

A conflagration refers to a large and destructive fire that causes extensive damage, typically consuming buildings and land over a significant area. These events are particularly prone to rapid spread in areas where residential and commercial buildings are densely clustered together. Conflagrations are often the result of one of the following:

- Criminal acts (arson, explosive devices, acts of terrorism)
- Residential accidents (improper use of electrical appliances, faulty connections, grease fires)
- Industrial accidents (hazardous material incidents, explosions, transportation accidents)
- Acts of nature (lightning strikes, earthquake byproduct)

While this type of fire is not usually considered a natural hazard, urban conflagrations can be ignited by a natural hazard event like an earthquake, tornado, or lightning strike.

2.9.3.2 Location and Extent

Conflagration is a City-wide hazard with the highest potential for spreading in the high-density development areas in the City of Providence (Figure 2-19). In addition to density levels, construction types and years can play a significant role in the extent of conflagrations. The City of Providence housing stock consists of approximately 35,000 wood frame buildings constructed between 1865 and 1940. These structures are mostly three-story structures of balloon construction, which enables fire to rapidly spread between floors due to the absence of any "stops" in the walls.

2.9.3.3 Previous Occurrences

The Providence Fire Department's 2023 Annual Report details operation counts related to fire and overpressure incidents (as reported to the National Fire Incident Reporting System) that the Department responded to, as shown in Table 2-33.

Table 2-33. Providence Fire Department 2023 operations related to fires and overpressures (PFD)

Operation	Count	Operation	Count
Building fire	83	Road freight or transport vehicle	6
Cooking fire, confined, no extension	79	Fires in structure other	5
Special outside fire, other	76	Chimney or flue fire, confined	3
Passenger vehicle fire	65	Natural vegetation fire, other	2
Brush or brush-and-grass mixture	51	Outside equipment fire	2
Outside rubbish, trash or waste	47	Water vehicle fire	1
Dumpster or other outside trash	37	Self propelled motor home or RV	1
Fire, other	36	Forest, woods or wildland fire	1
Trash or rubbish fire, contained	20	Garbage dump or sanitary landfill fire	1
Outside rubbish fire, other	16	Overpressure rupture	1
Fuel burner/boiler malfunction,	13	Explosion (no fire), other	1
Grass fire	13	Munition or Bomb Explosion	1
Mobile property (vehicle) fire	9	Excessive heat, scorch burns	4

While no previous conflagrations have occurred in the City of Providence in recent years, the following multi-building conflagration was reported nearby:

- Pawtucket – Central Falls Mill Fire (2020): An 8-alarm fire broke out on March 14, 2020 in multiple mill buildings on the border of Pawtucket and Central Falls. While the mills were vacant, about 200 residents in nearby homes and apartments were displaced during the fire. The fire response included roughly 300 firefighters on 44 engines and 24 ladders with mutual aid from Providence, Kent, Bristol and Washington counties.

2.9.3.4 Probability

The Providence Fire Department responds to multiple fires, annually. Due to fire response and prevention though, incidents rarely reach a severity level to be considered a conflagration. The probability of conflagration for the City of Providence is somewhat likely (occurring every 20 to 50 years). Climate change has the potential to impact the frequency of conflagrations caused by acts of nature (e.g. as climate change increases severe storm frequency, conflagration frequency can also increase). In addition, the frequency and severity may be impacted as other hazards, like drought and extreme heat, can cause conditions more conducive to fire starting and spread.

2.9.3.5 Impacts

For a densely populated urban center like the City of Providence, a conflagration could have devastating consequences. The immediate threat to life is paramount, with residents in affected areas at risk of injury or death. Entire neighborhoods, historical buildings, and critical infrastructure have the possibility of burning entirely or facing severe structural and smoke damage. The dense arrangement of older structures in parts of Providence, which may not meet modern fire safety standards, exacerbates the risk of fire spreading.

2.9.4 Cyber Attack

2.9.4.1 Hazard Description

A cyber attack is an offensive action that targets computer information systems, infrastructures, computer networks, or personal computer devices, using various methods to steal, alter, or destroy data or information systems. These attacks can be launched by individuals or groups with malicious intent to exploit vulnerabilities for various reasons, such as financial gain, espionage, personal grudges, or to disrupt services. Cyber attacks can take many forms, including viruses, worms, trojan horses, ransomware, phishing, Denial of Service (DoS) attacks, and Advanced Persistent Threats (APTs). Although cybersecurity incidents occur almost daily, the efficacy of the “threat actors” or type of attacks, can vary significantly and be classified into three categories:

- Hacktivists and Petty Criminals: Constitute most cyber-attacks on the internet, typically conducted by single individuals or small unaffiliated groups. These unstructured attacks exploit unprotected targets with known vulnerabilities and can be completely automated, using little technical skill and sophistication.
- Organized Crime and Cyberterrorists: Target a specific person or entity for financial gain, intellectual property, or blackmail. These structured attacks, for instance a Distributed Denial-of-Service (DDoS)

or intellectual property theft, tend to be more organized and planned, and often rely on insider knowledge.

- Sophisticated Nation States: Although fewest in number, these adversaries conduct reconnaissance over long periods of time, with extreme preparation and organization. These highly structured attackers use multiple methods of reconnaissance and multiple attack techniques to achieve their goal that may combine a physical attack with a cyber incident.

2.9.4.2 Location and Extent

The entire City of Providence is vulnerable to cyber attacks, especially given the pervasive use of the internet and connected devices in individual, business, and city capacities. The severity of cyber attacks can range widely with some attacks affecting an individual to other attacks spanning the entire City or broader region.

2.9.4.3 Previous Occurrences

The 2024 Rhode Island State Hazard Mitigation Plan provides a subset of cyber attacks that occurred in the State. The incidents from the list that impacted the City of Providence include:

- 2023: CharterCARE Hospital System (ransomware)
- 2023: Roger Williams Medical Center and Our Lady of Fatima (ransomware)
- 2022: Providence (hacking, data breach)
- 2022: Narragansett Bay Commission, Providence County (ransomware)
- 2022: Rhode Island Public Transit Authority (hacking, data breach)
- 2020: Care New England, Providence County (malware)
- 2018: Department of Children, Youth, and Families, Department of Human Services, and Department of Behavioral Healthcare, Developmental Disabilities and Hospitals (phishing)
- 2018: State Treasurer's Office (phishing)
- 2018: Thundermist Health Center, Providence County (ransomware)
- 2016: Rhode Island State Police (ransomware)
- 2016: City of Providence (hack)
- 2016: University Gastroenterology (ransomware)

2.9.4.4 Probability

Cyber attacks are extremely likely (occurring every 1 year or more). While cyber security is advancing, cyber attacks are still expected to persist at the same or an increased rate because of the combination of (1) the continued evolution of cyber criminals and advancement in sophisticated techniques and (2) the increased reliance on computers, devices, email, the internet, and other technologies. Climate change is not expected to have a direct impact on cyber attacks, but bad actors may exploit natural disasters to launch cyber attacks.

2.9.4.5 Impacts

Cyber attacks can have significant operational and financial impacts. At any level, a breach in cybersecurity could lead to the exposure of sensitive data, affecting not only operations but also privacy and security – this is especially concerning for governmental, medical, and financial institutions. For instance, a successful

attack on municipal databases could reveal personal information, financial records, or confidential communications, jeopardizing the integrity of the City's data systems and eroding public trust in the City's ability to safeguard information. Additionally, a cyber attack could disrupt the delivery of critical services such as emergency response, public transportation, and utility management.

The economic impact of a cyber attack on Providence's economy could be substantial, particularly if it affects the city's robust service sector, which includes education, healthcare, and financial services. Businesses may suffer due to compromised data, theft of intellectual property, or operational downtime. The costs associated with responding to a cyber attack, including mitigation, increased cybersecurity measures, and reputational damage control, can be significant. For small businesses, which may lack the resources for sophisticated cybersecurity defenses, the impact can be devastating, potentially leading to closure and job losses.

2.9.5 Terrorism/Active Threat

2.9.5.1 Hazard Description

According to the Code of Federal Regulations, terrorism is “the unlawful use of force and violence against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof, in furtherance of political or social objectives.” This term typically applies to acts intended to create fear or coerce a government or society in order to achieve an agenda that might otherwise be unattainable through nonviolent means. Terrorism can take many forms, including the following:

- Bombings and Explosive Attacks: The most common terrorist tactics, these involve the detonation of explosive devices intended to cause widespread destruction, casualties, and panic.
- Armed Assaults: Attacks where firearms are used to inflict mass casualties. Active shooter events fall under this category.
- Hijackings: Taking control of a vehicle, such as a plane or bus, often to fulfill a political demand or to use the passengers as hostages.
- Hostage Situations: Seizing and detaining hostages as leverage to negotiate demands or to garner media attention for a cause.
- Cyberterrorism: Attacks on information systems to disrupt critical infrastructure, steal sensitive data, or spread propaganda.
- Chemical and Biological Attacks: Involving the release of toxic chemicals or disease-causing biological agents to cause illness, death, and fear.
- Radiological and Nuclear Attacks: Using radioactive materials to cause contamination, radiation sickness, or in the case of a nuclear blast, massive destruction and long-term environmental damage.
- Vehicle Ramming Attacks: Using a vehicle to run over people in public spaces, causing injury and fatalities.
- Stabbings: Using bladed weapons to attack individuals, often with the intent to cause fear and chaos.
- Suicide Attacks: Perpetrators carry explosives on themselves or use a vehicle loaded with explosives to commit an attack, intending to kill others and themselves in the process.
- Kidnapping and Abductions: Taking someone against their will, often to demand a ransom, make a political statement, or influence government policies.

- Insider Threats: Attacks perpetrated by someone within an organization or community, exploiting their access and knowledge to conduct an attack.
- Ecoterrorism: The destruction of the natural environment or agricultural facilities, often intended to halt development or to draw attention to environmental issues.

An active threat, often referred to as an active shooter situation, is a specific type of terrorist act where an individual or group is actively engaged in killing or attempting to kill people, usually in a confined and populated area. This situation is dynamic and evolves rapidly, demanding immediate deployment of law enforcement and emergency response to stop the threat and mitigate harm to civilians. School shootings and mass shootings fall within active shooter situations.

- School Shooting: A school shooting is an incident in which an individual or group opens fire at an educational institution, such as a primary school, secondary school, or university. School shootings are often carried out by current or former students and can stem from a variety of complex motives, including mental health issues, bullying, retaliation, or ideological beliefs.
- Mass Shooting: A mass shooting is an event where a gunman shoots multiple people (typically defined as 4 or more victims, not including the shooter), usually in a single location, over a short period. The motives behind mass shootings vary and can include mental health issues, ideological extremism, or personal grievances.

2.9.5.2 Location and Extent

Terrorism and active threats are a City-wide hazard. While counterterrorism efforts can help, predicting the exact location of terrorist attacks is not possible. Generally, terrorists target densely populated or high-profile areas, making high profile infrastructure, like government buildings, sports and entertainment venues, schools, ports, and airports more probable, but any location has the potential to become a target of terrorism.

The severity of terrorist threats can differ widely based on various factors, such as the methods used, the capabilities of the terrorists, and the success of preventive security measures. These methods may range from bombings and shootings to kidnappings, assassinations, and cyberattacks, often in diverse combinations. The scale of terrorism is further influenced by target selection, which can include the general public, government entities, places of worship, or vital infrastructure. he extent of terrorism may also be influenced by public support or sympathy for extremist ideologies, as well as the recruitment and radicalization of individuals into terrorist organizations. Underlying social and economic issues like poverty, joblessness, and social disparities can also create environments that facilitate the spread of terrorist ideologies and activities.

2.9.5.3 Previous Occurrences

As stated in the 2024 Rhode Island State Hazard Mitigation Plan, there have been no previous occurrences of terrorism or active threats in the State, including in the City of Providence.

2.9.5.4 Probability

While no previous occurrences of terrorism or active threats have occurred in the City, the City is not precluded from future events; the probably of a terrorist or attack threat event in the City is unlikely (occurring every 50 years or less). The probability of terrorism and active threats is not directly impacted by climate change, but climate change can indirectly influence terrorism by exacerbating certain conditions that may contribute to the emergence and persistence of terrorist threats.

2.9.5.5 Impacts

The occurrence of a terrorism or active threat event within the City of Providence would pose severe implications for the physical safety of its residents, leading to potential deaths and injuries. Terrorism and active threats not only threaten the lives of residents, but also place emergency responders, including police, firefighters, and medical personnel, at significant risk as they are on the front lines entering volatile situations, which can expose them to direct threats from perpetrators and secondary dangers from unstable environments. The complexity and unpredictability of responding to terrorist acts demand a high level of coordination and can strain local emergency services.

Beyond the immediate physical dangers, the ripple effects of terrorism or an active threat on the City's social fabric can be profound and lasting. The psychological toll on the community, characterized by increased anxiety, fear, and a sense of vulnerability, can undermine the City's sense of security and normalcy. Mental health challenges, including PTSD, depression, and anxiety disorders, may see a significant uptick, necessitating a robust and sustained mental health response to support affected individuals. The incident could also lead to social polarization, mistrust among community members, or stigmatization of certain groups, which could erode the cohesive and inclusive nature of the City of Providence's social environment, impacting community relations and social interactions.

Further, the impact of terrorism or an active threat event on physical infrastructure can be extensive, disrupting the daily life and economy of the City. Key infrastructure elements such as transportation networks, utilities, and public buildings could be damaged or rendered inoperative, affecting mobility, access to services, and the continuity of business operations. The destruction or impairment of such infrastructure requires significant financial resources and time to repair or rebuild, leading to prolonged disruptions.

2.10 Technological Hazards

2.10.1 Electrification

2.10.1.1 Hazard Description

Electrification refers to the process of powering by electricity systems, processes, or devices that were previously powered by other forms of energy, such as fossil fuels. Electrification is a key strategy in reducing carbon emissions and combating climate change by transitioning towards cleaner energy sources like wind, solar, and hydroelectric power. Electrification is applied in various sectors including transportation (electric vehicles), heating and cooling systems in buildings, and industrial processes, aiming to improve energy efficiency, reduce pollution, and enhance sustainability.

While it can enhance efficiency and reduce reliance on fossil fuels, electrification also presents as a hazard due to:

- Electrical Fires: Overloading circuits or faulty wiring can cause electrical fires, posing risks to buildings and occupants, especially in densely populated areas where such fires can spread quickly.
- Battery Fires: Lithium-ion batteries in electric bikes and scooters can overheat and catch fire.
- Electrocution Risks: Improperly installed or maintained electrical systems can lead to electrocution hazards for residents and workers, especially in wet conditions or during maintenance work.
- System Overloads: As demand on electrical grids increases, there's a risk of system overloads, leading to widespread power outages that can affect critical services and daily life.
- Dependency on Electrical Grid: Heavy reliance on the electrical grid makes societies vulnerable to disruptions from natural disasters, cyberattacks, or infrastructure failures, highlighting the need for robust backup systems.

2.10.1.2 Location and Extent

The City of Providence as well as the State of Rhode Island are at the forefront of renewable energy initiatives in the United States. Executive Order 20-01: Advancing a 100% Renewable Energy Future for Rhode Island by 2030, set by the State in 2020, marks a pioneering goal to fulfill 100% of the State's electricity demand with renewable energy by 2030. The City of Providence has also established the following clean energy targets:

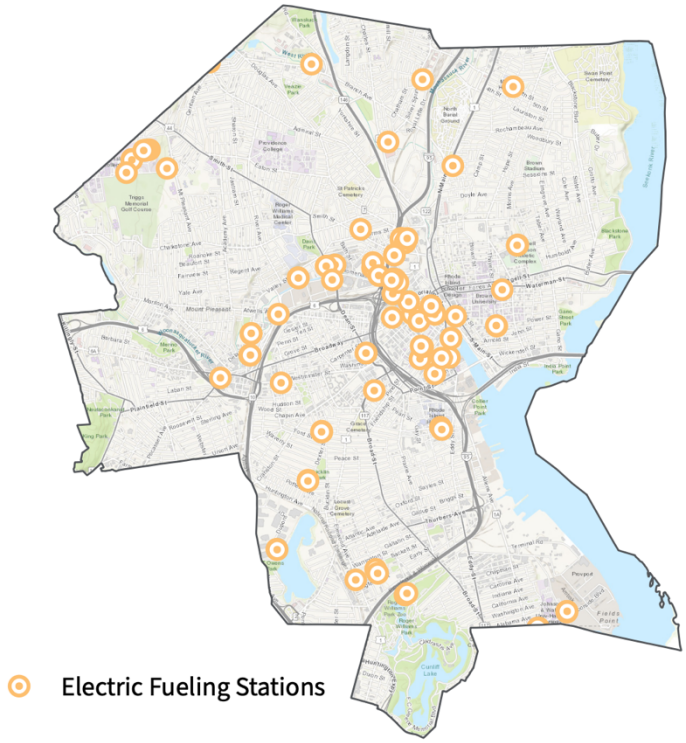
- By 2035, 50% of citywide electricity is carbon-free.
- By 2050, 100% of citywide electricity is carbon-free.
- Local generation accounts for 30% of supply.
- 100% of municipal buildings' electricity will be renewable by 2030.
- 100% of municipal buildings' heating will be renewable by 2040.

The Rhode Island Public Transit Authority (RIPTA), the operator of the public transportation in the City, has already taken steps toward decarbonizing its fleet, including full electrification of the R-Line. The agency is continuing towards decarbonization and has completed an Action Plan for Electrification and Service Growth, which envisions how RIPTA can achieve a fully zero emission transit fleet across several scenarios through the lens of full implementation of the service improvements and expansions. The scenarios include a mix of fleet conversion methods, including hybrid vehicles, a mix of hydrogen fuel cell buses, battery electric buses, depot charging, and on-route charging.

Beyond public targets, the City and State are also encouraging private electrification. The Rhode Island Office of Energy Resources (RIOER), for example, administers electric vehicle and bicycle rebate programs to support adoption of electric vehicles and bicycles by Rhode Island residents, small businesses, non-profits, and public sector entities, such as DRIVE EV, DRIVE+, DRIVE FLEET, and the Erika Niedowski Memorial Electric Bicycle Rebate Program. Since its inception in 2022, DRIVE EV has had the greatest number of applicants (151) from the City of Providence. To support electric vehicles, the City has 206 public chargers (Figure 2-28).

Electrification is a City-wide hazard for the City of Providence.

Figure 2-28. Alternative fueling stations (electric) within the City of Providence (DOE)



2.10.1.3 Previous Occurrences

As detailed in the Conflagration hazard profile, Providence Fire Department responds to multiple fires, annually, but fires due to electrification are not specifically parsed out. Based on a qualitative search, the following occurrence related to electrification occurred in recent years:

- University Heights Apartments Fire (2022): In November, a heavy fire started in a first-floor apartment at University Heights. PFD reported that the probable cause of the fire was a malfunction of a lithium-ion battery contained in one of the 3 micro-mobility devices (e.g. electric bicycles) that were stored in the living room. The fire resulted in a total loss of 2 apartments that displaced 7 adults and 3 children.

2.10.1.4 Probability

Due to the novelty of electrification and lack of significant historical data or records, the probability of hazard events related to electrification is difficult to accurately determine. Given the proliferation of batteries though and increasing use of electric vehicles, scooters, and bicycles, the probability of electrification hazard events is highly likely (occurring every 1 to 5 years). As detailed in the hazard description, the emergence of electrification is primarily motivated by climate change concerns. Consequently, the probability of hazards from electrification will increase as the City of Providence continues further in its electrification initiatives. The increase may be attributed to the more extensive

electric network (e.g. more electric buses, chagrining stations, etc.) as well as greater demands put on the network by the changing climate (e.g. extreme heat can lead to overheating of batteries, which causes fires).

2.10.1.5 Impacts

As detailed above, electrification poses a hazard to the City of Providence due to possible electrical fires, battery fires, electrocution risks, system overloads, and electrical grid dependency. These hazards can impact the City's residents, emergency responders, operations, and infrastructure. Fires and electrocution put the population at direct risk of injuries and fatalities; fires can cause a range of health conditions, including respiratory issues from inhaling smoke, such as bronchitis or asthma exacerbation, while exposure to high heat can lead to burns and heatstroke.

Electrification introduces new challenges for firefighters and emergency responders, including dealing with high-voltage electrical systems and lithium-ion battery fires, which require specific extinguishing methods. These incidents demand updated training and equipment, and pose higher risks of electrocution and explosion compared to traditional fires. Responding to electric vehicle fires, for example, requires knowledge of how to safely disconnect power and manage thermal runaway in batteries.

Further, the strain of electrification on the power grid can lead to widespread power outages, affecting residential, commercial, and critical infrastructure operations. Such outages disrupt daily life, impede business activities, and compromise essential services like emergency response and healthcare. Additionally, the reliability of power for heating or cooling systems can be crucial for public safety and comfort. As electrification pushes the City to be more reliant on the electrical grid, power outages also become increasingly more consequential.

2.10.2 Infrastructure/Utility Failure

2.10.2.1 Hazard Description

Infrastructure and utility failure refers to the breakdown or malfunctioning of essential systems and services that support daily life, including electricity, water supply, sewage treatment, natural gas, telecommunications, and transportation networks. These failures can result from various causes such as:

- Natural Disasters: Events like hurricanes, floods, earthquakes, and wildfires can severely damage infrastructure and utilities, disrupting services due to physical destruction or power outages.
- Aging Infrastructure: Over time, infrastructure elements such as bridges, roads, and water pipes deteriorate, leading to increased risk of failure without adequate maintenance and upgrades.
- Cyber Attacks: Targeted attacks on digital systems that control utilities and infrastructure can lead to shutdowns or malfunctions in essential services like electricity and water supply.
- Technical Failures: Equipment malfunctions or failures within power plants, water treatment facilities, or telecommunications networks can disrupt services due to inherent mechanical or electrical issues.
- Human Error: Mistakes made during the operation, maintenance, or construction of infrastructure can lead to utility failures, such as cutting a major power line or improperly managing a dam.

- Terrorist Attacks: Deliberate attacks aimed at infrastructure targets can cause significant damage, intended to disrupt services and create chaos.
- Overload and Demand Surges: Infrastructure and utilities can fail when demand exceeds the capacity, such as power grids during heatwaves or water systems in drought conditions.
- Poor Planning and Management: Lack of foresight in infrastructure development and inadequate risk management can lead to vulnerabilities, exposing systems to a higher risk of failure.
- Economic Constraints: Financial limitations can lead to deferred maintenance and underinvestment in infrastructure, increasing the likelihood of failures due to outdated or worn-out equipment.

2.10.2.2 Location and Extent

Energy

Rhode Island uses natural gas, fuel oil, and renewable energy as its major sources of energy. Power plants in Rhode Island produce a combined capacity of just over 2 gigawatts (GW), barely exceeding consumers' peak demand of 1.9GW during the summer months – 93% of the power is produced from natural gas and 7% from renewables. One of the four top producing power plants, Manchester Street, is located within the City of Providence. Rhode Island's transmission and distribution network is comprised of 16 miles of high voltage and 403 miles of low voltage transmission line, primarily distributed through National Grid. Electric service in Rhode Island is ranked second in the United States for reliability with most outages occurring due to major natural hazard events, such as hurricanes and severe storms.

Water

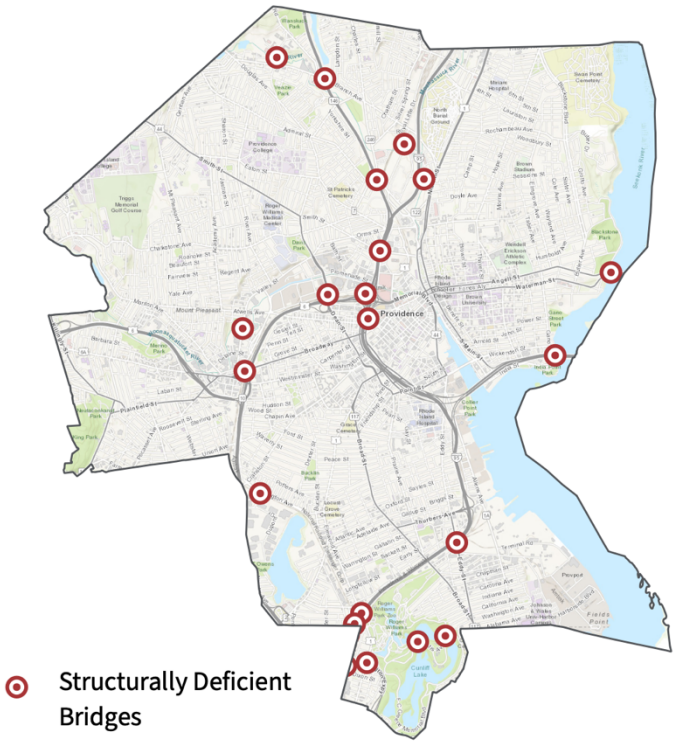
Water in the City of Providence is supplied by Providence Water, a department of the City of Providence, from the Scituate Reservoir. Providence Water serves approximately 600,000 people, who consume an average of 60 million gallons of water each day. The water system includes about 1,000 miles of mains and pipes in its distribution system and the Providence Water Purification Plant for treatment.

The Narragansett Bay Commission owns and operates Rhode Island's two largest wastewater treatment facilities, including the Field's Point Wastewater Treatment Facility in the City of Providence. The Commission is responsible for 110 miles of interceptors, 7 pump stations, 32 tidegates, and 62 combined sewer overflows.

Transportation Networks

The City of Providence has a network of public roads and highways maintained by local, state, and federal entities as well as bridges, primarily owned and managed by the Rhode Island Department of Transportation (RIDOT). Within the State, almost 20% of non-interstate roads are in poor condition, while 17.5% of bridges are structurally deficient (highest percentage in the United States); the structurally deficient bridges within the City of Providence are mapped in Figure 2-29.

Figure 2-29. Structurally deficient bridges in the City (Bureau of Transportation Statistics)



Infrastructure and utility failure is a City-wide hazard, not only because critical infrastructure is located throughout the entire City, but also because the effects of a failure can extend far beyond the immediate vicinity of the incident (e.g. power line failure would disrupt the entire coverage area). The severity of an infrastructure or utility failure is impacted by the nature of the failure itself, such as whether it is a complete collapse or a partial disruption, and the scope of the system's service area, with larger coverage areas potentially facing more widespread impacts. Factors such as the criticality of the affected service and the availability of alternative solutions or backup systems also play significant roles in determining the overall severity of the event.

2.10.2.3 Previous Occurrences

The Department of Energy (DOE) publishes annual summaries of electric disturbance events nationwide. below lists the events from 2019 to 2023 that affected Rhode Island - these events may not have specifically impacted the City of Providence (data restrictions prevent filtering beyond the state-level).

Table 2-34. Electric disturbance events that impacted Rhode Island (2019 to 2023) (DOE)

Begin Date	Begin Time	End Date	End Time	Alert Criteria	Event Type
January 23, 2023	7:05 AM	January 24, 2023	5:17 PM	Loss of electric service to more than 50,000 customers for 1 hour or more	Severe Weather

Begin Date	Begin Time	End Date	End Time	Alert Criteria	Event Type
March 14, 2023	8:00 AM	March 16, 2023	8:20 AM	Loss of electric service to more than 50,000 customers for 1 hour or more	Severe Weather
May 1, 2023	5:16 AM	May 1, 2023	9:31 AM	Loss of electric service to more than 50,000 customers for 1 hour or more	Severe Weather
September 28, 2023	1:06 PM	September 28, 2023	4:30 PM	Complete loss of monitoring or control capability at its staffed Bulk Electric System control center for 30 continuous minutes or more.	Other
September 28, 2023	1:06 PM	September 28, 2023	4:30 PM	Complete loss of monitoring or control capability at its staffed Bulk Electric System control center for 30 continuous minutes or more.	Other
September 16, 2023	10:35 AM	September 17, 2023	1:00 AM	Loss of electric service to more than 50,000 customers for 1 hour or more	Weather or Natural Disaster
September 8, 2023	3:15 PM	September 9, 2023	10:05 PM	Loss of electric service to more than 50,000 customers for 1 hour or more	Weather or Natural Disaster
November 27, 2023	6:00 AM	November 27, 2023	1:00 PM	Loss of electric service to more than 50,000 customers for 1 hour or more	Weather or Natural Disaster
December 18, 2023	5:45 AM	N/A	N/A	Unexpected Transmission loss within its area, contrary to design, of three or more Bulk Electric System Facilities caused by a common disturbance (excluding successful automatic reclosing).	Other
December 18, 2023	5:45 AM	N/A	N/A	Firm load shedding of 100 Megawatts or more implemented under emergency operational policy	Vandalism; Suspicious Activity
January 29, 2022	8:45 AM	January 30, 2022	1:00 AM	Loss of electric service to more than 50,000 customers for 1 hour or more	Severe Weather
February 17, 2022	10:30 AM	February 17, 2022	10:31 AM	Physical threat to its Facility excluding weather or natural disaster related threats, which has the potential to degrade the normal operation of the Facility. Or suspicious device or activity at its Facility.	Suspicious Activity
February 18, 2022	7:10 AM	February 18, 2022	4:25 PM	Loss of electric service to more than 50,000 customers for 1 hour or more	Severe Weather
April 19, 2022	8:41 AM	April 19, 2022	12:10 PM	Loss of electric service to more than 50,000 customers for 1 hour or more	Severe Weather
October 14, 2022	1:15 PM	October 14, 2022	5:45 PM	Loss of electric service to more than 50,000 customers for 1 hour or more	Sever Weather
November 30, 2022	6:45 PM	December 2, 2022	4:00 AM	Loss of electric service to more than 50,000 customers for 1 hour or more	Severe Weather
December 23, 2022	5:20 AM	Unknown	-	Loss of electric service to more than 50,000 customers for 1 hour or more.	Severe Weather
March 1, 2021	10:45 PM	March 2, 2021	6:35 PM	Loss of electric service to more than 50,000 customers for 1 hour or more.	Severe Weather

Begin Date	Begin Time	End Date	End Time	Alert Criteria	Event Type
March 29, 2021	11:06 AM	Unknown	-	Loss of electric service to more than 50,000 customers for 1 hour or more.	Severe Weather
June 30, 2021	6:50 PM	Unknown	-	Loss of electric service to more than 50,000 customers for 1 hour or more.	Severe Weather
August 22, 2021	12:11 PM	August 23, 2021	4:30 PM	Loss of electric service to more than 50,000 customers for 1 hour or more	Severe Weather
October 27, 2021	2:25 AM	October 29, 2021	8:37 AM	Loss of electric service to more than 50,000 customers for 1 hour or more	Severe Weather
February 7, 2020	4:25 PM	February 8, 2020	12:00 PM	Loss of electric service to more than 50,000 customers for 1 hour or more.	Severe Weather
March 20, 2020	10:20 PM	March 20, 2020	11:30 PM	Complete loss of monitoring or control capability at its staffed Bulk Electric System control center for 30 continuous minutes or more.	System Operations
March 24, 2020	2:55 AM	March 24, 2020	6:50 AM	Loss of electric service to more than 50,000 customers for 1 hour or more.	Severe Weather
April 13, 2020	1:05 PM	April 14, 2020	4:00 PM	Loss of electric service to more than 50,000 customers for 1 hour or more.	Severe Weather
August 4, 2020	3:15 PM	August 7, 2020	10:27 AM	Loss of electric service to more than 50,000 customers for 1 hour or more.	Severe Weather
August 27, 2020	5:11 PM	August 28, 2020	10:00 AM	Loss of electric service to more than 50,000 customers for 1 hour or more.	Severe Weather
September 30, 2020	5:55 AM	September 30, 2020	11:30 PM	Loss of electric service to more than 50,000 customers for 1 hour or more.	Severe Weather
October 7, 2020	6:50 PM	October 9, 2020	3:00 PM	Loss of electric service to more than 50,000 customers for 1 hour or more.	Severe Weather
November 15, 2020	11:05 PM	November 16, 2020	5:00 AM	Loss of electric service to more than 50,000 customers for 1 hour or more.	Severe Weather
November 30, 2020	4:24 PM	December 1, 2020	2:25 PM	Loss of electric service to more than 50,000 customers for 1 hour or more.	Severe Weather
December 5, 2020	4:40 PM	Unknown	Unknown	Loss of electric service to more than 50,000 customers for 1 hour or more.	Severe Weather
December 25, 2020	7:55 AM	December 25, 2020	4:45 PM	Loss of electric service to more than 50,000 customers for 1 hour or more.	Severe Weather
February 25, 2019	1:35 PM	February 26, 2019	2:50 AM	Loss of electric service to more than 50,000 customers for 1 hour or more.	Severe Weather
October 17, 2019	12:45 AM	October 19, 2019	9:30 AM	Loss of electric service to more than 50,000 customers for 1 hour or more.	Severe Weather
November 1, 2019	1:15 AM	November 2, 2019	9:30 PM	Loss of electric service to more than 50,000 customers for 1 hour or more.	Severe Weather

Most notably in recent years, the City of Providence experienced a bridge failure. On December 11, 2023, RIDOT closed the west bound side of the Washington Bridge due to the finding of a critical failure of some bridge components, anchor rods, which were part of the original bridge structure built in 1968 and provide counterbalance for a cantilevered bridge structure. The failure was discovered during work on a pre-existing

$78 million project to rehabilitate the west bound side of the Washington Bridge. In the initial week of the bridge closure, RIDOT moved quickly to install bypass lanes on I-195 to allow two lanes in each direction on the east bound side of the Washington Bridge, which is an entirely different structure from the west bound bridge, but the failure still resulted in considerable delay for motorists, especially during rush hour periods.

2.10.2.4 Probability

The probability of an infrastructure or utility failure of the City of Providence is extremely likely (occurring every 1 year or more) – this probability is primarily because of power outages though, which are typically short in duration with insignificant consequences. High consequence failure events are much less probable in the City. The frequency and severity of infrastructure and utility failures are expected to rise due to climate change though, with increasing extreme weather events putting stress on existing systems. Higher temperatures, more frequent storms, and rising sea levels can exacerbate the wear and vulnerability of critical infrastructure, leading to more frequent breakdowns. Additionally, the changing climate patterns challenge the design and resilience of utilities.

2.10.2.5 Impacts

Infrastructure and utility failures in the City of Providence could significantly disrupt daily life, public safety, and the local economy. The immediate impacts could include loss of power, water, transportation routes, or communication services, disrupting lifelines and causing potential safety and health hazards. For example, utility failure in electrical or gas systems can cause fires or gas leaks or failure of medical equipment, while lack of access to clean water can impact hygiene and health. Infrastructure and utility failures can also challenge emergency response capabilities due to delayed response times in the case of transportation infrastructure failures or disruptions in patient care in healthcare facilities because of electricity failures. The economic repercussions are also profound, with businesses facing operational disruptions and potential losses, while the cost of repairs and upgrades strains City resources.

2.11 Vulnerability Assessment

The goal of profiling the location, extent, previous occurrences, probability, and impacts of each of the above hazards is to be able to summarize the vulnerabilities of the City of Providence, so the planning team can develop a strategy to increase the City's resiliency. The below tables rank the natural hazards relevant to the City of Providence with higher ranks denoting higher vulnerability. The summary tables are broken into two categories: threats to property and threats to people. The City's vulnerability to each hazard is determined by the probability, severity, and climate change trend.

- Probability: The probability component gauges the recurrence rate of each hazard, providing insights into its likelihood of occurrence per year – these values are determined based on the "Probability" sections for each hazard included above.
    - **1** Unlikely: Occurring every 50 years or less
    - **2** Somewhat Likely: Occurring every 20 to 50 years
    - **3** Likely: Occurring every 5 to 20 years
    - **4** Highly Likely: Occurring every 1 to 5 years
    - **5** Extremely Likely: Occurring every 1 year or more
- Severity: The severity for natural hazards is determined using the historic loss ratio, which quantifies the magnitude of past damages inflicted by each hazard (on people and property); these values are provided by FEMA through its National Risk Index database (unless otherwise noted below).

  Historic Loss Ratio Scale (Property)
    - **1** 0%
    - **2** 0% to 0.01%
    - **3** 0.01% to 0.1%
    - **4** 0.1% to 1%
    - **5** Greater than 1%

  Historic Loss Ratio Scale (People)
    - **1** 0%
    - **2** 0% to 0.00001%
    - **3** 0.00001% to 0.0001%
    - **4** 0.0001% to 0.001%
    - **5** Greater than 0.001%
- Climate Change Trend: Each hazard was also marked to indicate how the vulnerability is expected to change based on climate change (based on the "Probability" sections above).
    - **1** Decrease, No Change, or Inconclusive
    - **2** Increase (Indirect)
    - **3** Increase (Direct)

Table 2-35. Ranking of natural hazards by probability with sources identified

Hazard	Probability	Probability Score	Source
Coastal Flooding/ Sea Level Rise	Extremely Likely (1 year or more)	5	RICMRC STORMTOOLS, NOAA
Extreme Heat	Extremely Likely (1 year or more)	5	CDC National Environmental Public Health Tracker
Infectious Disease	Extremely Likely (1 year or more)	5	RIDOH
Riverine Flooding	Extremely Likely (1 year or more)	5	NOAA NCEI Storm Database
Severe Storm	Extremely Likely (1 year or more)	5	NOAA NCEI Storm Database
Urban Flooding	Extremely Likely (1 year or more)	5	NOAA NCEI Storm Database
Winter Weather	Extremely Likely (1 year or more)	5	NOAA NCEI Storm Database
Drought	Highly Likely (1 to 5 years)	4	US Drought Monitor
Infestation and Invasive Species	Highly Likely (1 to 5 years)	4	Rhode Island Forest Health
Extreme Cold	Likely (5 to 20 years)	3	NOAA NCEI Storm Database
Hurricane	Likely (5 to 20 years)	3	NOAA National Hurricane Center
Earthquake	Somewhat Likely (20 to 50 years)	2	USGS Seismic Hazard Model
Tornado	Somewhat Likely (20 to 50 years)	2	NOAA NCEI Storm Database
Dam Inundation	Unlikely (50 years or less)	1	Stanford University Dams Program

Table 2-36. Ranking of natural hazards by severity (against property) with sources identified

Hazard	Historic Loss Ratio (Property)	Severity Score	Source
Tornado	8.366958488%	5	FEMA National Risk Index
Earthquake	1.862535558%	5	FEMA National Risk Index
Coastal Flooding/ Sea Level Rise	0.225541112%	4	FEMA National Risk Index
Urban Flooding	-	4	* Assumed to be on same scale of coastal flooding
Hurricane	0.134677500%	4	FEMA National Risk Index
Riverine Flooding	0.033589476%	3	FEMA National Risk Index
Dam Inundation	-	3	* Assumed to be on same scale of riverine flooding
Severe Storm	0.000047619%	2	FEMA National Risk Index
Winter Weather	0.000046256%	2	FEMA National Risk Index
Extreme Cold	0.000010351%	2	FEMA National Risk Index
Extreme Heat	0.000000014%	2	FEMA National Risk Index
Drought	0%	1	FEMA National Risk Index
Infectious Disease	0%	1	RIDOH
Infestation and Invasive Species	0%	1	* Human estimate

Table 2-37. Ranking of natural hazards by severity (against people) with sources identified

Hazard	Historic Loss Ratio (Property)	Severity Score	Source
Infectious Disease	0.08403%	5	RIDOH
Tornado	0.0287580%	5	FEMA National Risk Index
Earthquake	0.0140610%	5	FEMA National Risk Index
Coastal Flooding/ Sea Level Rise	0.0018665%	5	FEMA National Risk Index
Riverine Flooding	0.0007154%	4	FEMA National Risk Index
Dam Inundation	-	4	* Assumed to be on same scale of riverine flooding
Urban Flooding	-	4	* Assumed to be on same scale of riverine flooding
Extreme Heat	0.0000521%	3	FEMA National Risk Index
Hurricane	0.0000194%	3	FEMA National Risk Index
Extreme Cold	0.0000116%	3	FEMA National Risk Index
Severe Storm	0.0000017%	2	FEMA National Risk Index
Winter Weather	0.0000013%	2	FEMA National Risk Index
Drought	0%	1	FEMA National Risk Index
Infestation and Invasive Species	0%	1	* Human estimate

Table 2-38. Ranking of natural hazards by climate change trends with sources identified

Hazard	Climate Change	Climate Change Score	Source
Coastal Flooding/ Sea Level Rise	Increase (Direct)	3	RICMRC STORMTOOLS, NOAA
Drought	Increase (Direct)	3	Climate Mapping for Resilience and Adaptation
Extreme Heat	Increase (Direct)	3	CDC National Environmental Public Health Tracker
Hurricane	Increase (Direct)	3	NOAA National Hurricane Center
Riverine Flooding	Increase (Direct)	3	Climate Mapping for Resilience and Adaptation
Severe Storm	Increase (Direct)	3	NASA
Tornado	Increase (Direct)	3	National Severe Storms Lab
Urban Flooding	Increase (Direct)	3	Climate Mapping for Resilience and Adaptation
Dam Inundation	Increase (Indirect)	2	-
Infectious Disease	Increase (Indirect)	2	-
Infestation and Invasive Species	Increase (Indirect)	2	-
Earthquake	No Change	1	USGS
Extreme Cold	Decrease	1	CDC National Environmental Public Health Tracker
Winter Weather	Inconclusive	1	NASA, Climate Mapping for Resilience and Adaptation

Table 2-39. Composite ranking of natural hazards (against property and people) (probability x severity x climate change trend)

Hazard	Composite Index (Property)
Coastal Flooding/ Sea Level Rise	60
Urban Flooding	60
Riverine Flooding	45
Hurricane	36
Extreme Heat	30
Severe Storm	30
Tornado	30
Drought	12
Infectious Disease	10
Earthquake	10
Winter Weather	10
Infestation and Invasive Species	8
Dam Inundation	6
Extreme Cold	6

Hazard	Composite Index (People)
Coastal Flooding/ Sea Level Rise	75
Riverine Flooding	60
Urban Flooding	60
Infectious Disease	50
Extreme Heat	45
Severe Storm	30
Tornado	30
Hurricane	27
Drought	12
Earthquake	10
Winter Weather	10
Extreme Cold	9
Infestation and Invasive Species	8
Dam Inundation	8

3 Capability Assessment

3.1 Introduction

This section has been structured to better document local, state, and federal department, agency, and program capabilities in terms of pre-disaster and post-disaster activities. It has been organized into 3 main sections: Planning and Regulatory Capabilities, Administrative and Technical Capabilities, and Financial Capabilities to better define the programs, policies, and funding opportunities each department or agency is implementing to reduce risk and work towards implementing hazard mitigation programs targeted at increased resiliency.

The City of Providence implements several hazard mitigation policies and procedures, state laws, executive orders, and regulations to promote the safety of its residents and minimize risk to community assets. This section presents a brief description of each of the primary mitigation programs currently in place as a tool to help decision makers direct and coordinate mitigation activities, resources, and policies.

3.2 Planning and Regulatory Capabilities

3.2.1 Comprehensive and Master Plans

3.2.1.1 Providence Tomorrow: The Comprehensive Plan

The Comprehensive Plan is an urban planning policy document that guides growth and development in the City of Providence. The Comprehensive Plan is both a vision for the City's future and an impactful policy document that outlines how the City can use land to meet goals around housing, economic development, environmental sustainability, and transportation. The Comprehensive Plan is updated every decade with the next release planned for January of 2025. While the upcoming release has not been finalized, the City shared a draft of the Comprehensive Plan, which includes many of the mitigation actions included in the 2019 Hazard Mitigation Plan and shares common goals with this Plan update. The below text outlines the goals and objectives that are shared or complementary to the mitigation goals and objectives of this Plan.

<u>Sustainability, Resilience, and the Environment</u>

Goal – Protect, preserve, and restore the natural environment; improve resilience to climate and environmental hazards; ensure equity in environmental policy; and mitigate the impacts of greenhouse gas emissions, air and water pollution, and contamination on residents' health, safety, and quality of life.

- Objective SRE1 – Climate Protection, Stormwater and Flooding. Ensure the protection and resilience of the people, natural environment, built environment, and infrastructure of Providence to the effects of climate change and extreme weather.
- Objective SRE2 – Climate Protection, Air Quality and Heat Mitigation. Ensure resilience and the protection of public health to the effects of extreme heat and air pollution.
- Objective SRE3 – Nature and the City. Protect and restore environmentally significant and sensitive areas and habitat including wetlands and wetland buffers, rivers and riverbanks, and the urban forest.

- Objective SRE4 – Resource Conservation. Conserve energy, reduce consumption of fossil fuels in alignment with local targets and state mandates, and develop and implement renewable energy sources.
- Objective SRE5 – Sustainability and the Built Environment. Ensure that buildings and infrastructure are environmentally sustainable and resilient to the effects of climate change.
- Objective SRE6 – Brownfields. Prioritize the remediation of brownfields (land contaminated by hazardous substances and/or petroleum) to revitalize neighborhoods, remove health hazards, address community needs including open space, and improve the environment.
- Objective SRE7 – Public Awareness and Involvement. Encourage and foster environmentally sustainable and climate-resilient practices.
- Objective SRE8 – Frontline Neighborhoods and Environmental Justice. Mitigate the disproportionate environmental and health impacts of pollution, climate impacts, and the degradation of natural systems on environmental justice neighborhoods.
- Objective SRE9 – The Environment and the Region. Ensure coordination with other municipalities and the state to ensure mutually beneficial environmental outcomes.

<u>The Built Environment</u>
Goal – Protect, preserve and promote a high-quality built environment.

- Objective BE5 – Design Leadership. Ensure that the City of Providence takes the lead in design excellence and historic preservation.
- Objective BE6 – Public Awareness. Promote public awareness of urban design and historic preservation principles through education and collaboration with partners and schools.
- Objective BE8 – The Built Environment and Natural Hazards. Protect the built realm from natural hazards.

<u>Housing</u>
Goal – Grow, improve, and preserve Providence's housing stock to expand affordable, accessible, healthy, and sustainable housing options for all residents.

- Objective H1 – Improve and Preserve Existing Housing. Revitalize, modernize, and preserve Providence's housing stock.
- Objective H4 – Housing Design. Promote high quality residential design throughout the City.

<u>People and Public Spaces</u>
Goal – Create a sustainable, high-quality, and innovative parks system that reflects the unique identity of Providence.

- Objective PS2 – Sustain our Park and Recreation Assets. Provide the necessary resources to build and maintain a park system that offers a diversity of recreational opportunities for all residents.
- Objective PS5 – Stewardship of Resources. Protect natural and cultural resources by incorporating them into the fabric of an overall system of public open space and enhance their climate resilience.
- Objective PS7 – Community Gardens. Continue to identify, establish, maintain and expand city park sites for community gardens.

Community Services and Facilities

Goal – Sustain a high quality of life by providing efficient, responsive, and cost-effective city services, and maintaining quality community facilities.

- Objective CS2 – Police, Fire and Public Safety. Ensure the safety and well-being of residents by providing fire and police protection and adequate resources, technology, and training to perform these vital services.
- Objective CS3 – Emergency Management. Enhance the City's capacity to mitigate, prevent, protect against, respond to, and recover from major emergencies and disasters.
- Objective CS4 – Water. Provide a safe, sustainable, and adequate water supply for residential, commercial and industrial users.
- Objective CS5 – Wastewater. In conjunction with the Narragansett Bay Commission (NBC), provide an efficient and sanitary wastewater treatment system that adequately serves the entire city, operates in full compliance with all state and federal standards, and improves water quality in Narragansett Bay.
- Objective CS7 – Energy. Provide for the energy needs of City residents and the State, while phasing out the use of fossil fuels and lessening impacts on the environment.

Land Use

Goal – Promote and manage growth through land development while sustaining Providence's high quality of life and preserving its unique attributes.

- Objective LU6 – Maintain and Enhance Open Spaces and Public Facilities. In areas designated as public/open space on the future land use map, preserve and protect Providence's open spaces and public facilities to enhance the overall quality of life for city residents.
- Objective LU8 – Sustainability and the Environment. Promote sustainability and environmental quality through appropriate land use controls.

3.2.2 Housing Plans

3.2.2.1 Anti-Displacement and Comprehensive Housing Strategy

The City of Providence published the Anti-Displacement and Comprehensive Housing Strategy in 2021, which provides an actionable 10-year housing plan with clear strategies and housing production goals to ensure the City offers housing that is affordable, safe, and equitable to residents of all income, age, and ability levels to improve quality of life and stability in the City of Providence neighborhoods. Key goals from the report include:

- Providing rental and ownership housing choice opportunities for residents of all incomes throughout all City neighborhoods,
- Encouraging price diversity in all new housing development,
- Promoting mixed income development,
- Promoting more affordable housing development in high opportunity neighborhoods throughout the City,
- Investing in the City of Providence's existing housing stock to preserve and enhance its affordability and quality, and
- Increasing funding sources available for production and rehabilitation of housing in the City.

The goals and recommendations from the Strategy encourage greater resilience by increasing the stability and equity of housing within the City and by investing in housing stock preservation and rehabilitation, while expanding code compliance and enforcement. The Strategy does not address development in high hazard areas though and does not highlight the importance of educating the City's residents on being knowledgeable about risks and protections, like flood insurance options.

3.2.3 Capital Improvement Plans

3.2.3.1 Fiscal Year 2024 Capital Improvement Plan

The City of Providence approved the Fiscal Year 2024 Capital Improvement Plan, which outlines planned improvements to the City's public infrastructure over the course of 5 years (FY 2024 to FY 2028). Mayor Smiley's comprehensive Capital Improvement Plan identifies and prioritizes city projects to address the City's long-term infrastructure needs. The investments, which total $336.55 million over the 5 years with $132 million in the first 2 fiscal years, include investments in public works, public property, parks, and planning. The planned improvements will increase the City's resilience through:

- $61.3 million for road maintenance, street repair, and street resurfacing
- $35 million for sewers and storm water management
- $7.3 million for the Fox Point Hurricane Barrier System
- $750 thousand for hazard mitigation of public property
- $2 million for flood and climate mitigation for public property
- $15.38 million for public parks
- $14.96 million for matches for federal funding initiatives like the Safe Streets for All Grant and Woonasquatucket River Greenway enhancement

The above list provides a representative, subset of the investment targets and is not comprehensive.

3.2.4 Transportation Plans

3.2.4.1 Rhode Island Public Transit Authority Climate Action Plan 2022

In 2021, the Federal Transit Administration issued a Sustainable Transit for a Healthy Planet Challenge to encourage transit agencies to adopt strategies for reducing greenhouse gas emissions; The Rhode Island Public Transit Authority (RIPTA) accepted the challenge and prepared the Climate Action Plan to guide its efforts toward greater sustainability in collaboration with federal, state, and local partners. The Climate Action Plan lists the following goals:

- Use 100% renewable electricity for operations by 2030
- Decrease total energy use by 10% for all facilities by 2030
- Decrease total greenhouse gas emissions from the transit fleet by 25% by 2030
- Achieve net-zero emissions by 2050

The goals on the Climate Action Plan, if accomplished, will increase resiliency within the State and City through the reduction of greenhouse gas emissions, but introduce new hazards that can threaten the City's resiliency due to the greater reliance on electricity and renewable energy; electrification as a hazard was profiled above in Chapter 2 of this Plan.

3.2.5 Emergency Operations and Response Plans

3.2.5.1 Providence Emergency Management Agency Emergency Operations Plan

The Providence Emergency Management Agency (PEMA) maintains an Emergency Operations Plan (EOP) that addresses mitigation, preparedness, response, and recovery from a variety of natural, human, and technologic hazards. The City of Providence EOP is current as of September 2020.

3.2.5.2 Fox Point Hurricane Barrier Coordination Guide

The Fox Point Hurricane Barrier (FPHB) Coordination Guide outlines activating and operating the FPHB located in the City of Providence and serves as the focal point for ensuring coordination of the FPHB during a major hurricane or coastal storm between multiple federal, state and local partners. The Coordination Guide has 6 main objectives:

- Minimize injury and loss of life
- Minimize property damage and adverse economic impact
- Minimize adverse environmental impact
- Engage multiple federal, state, and local partners in order to coordinate the operation of the FPHB during severe weather scenarios, abnormal tides and surge and special events
- Provide awareness for federal, state, and local partners about critical areas that are essential and indispensable to the operation of the FPHB
- Provide a deliberative coordination tool that facilitates the operation of the FPHB in order to improve operational speed and effectiveness

3.2.5.3 Providence Water Supply Board Water System Supply Management Plan

Providence Water is the largest water utility provider in Rhode Island, and primary supplier for the City of Providence. The Rhode Island Water Resources Board (WRB) administers the water supply planning process for water suppliers that produce over 50 million gallons of water per year in the State. WRB has adopted Rules and Procedures for Water Supply System Management Planning for guiding the content and approval process pursuant to the Rhode Island General Laws, Chapter 46-15.3 Public Drinking Water Supply System Protection. By law, the plans are confidential.

The Water System Supply Management Plan for the Providence Water Supply Board was updated in 2018 and includes an Emergency Response Plan that identifies vulnerability, criticality, and response. All operations are on Supervisory Control and Data Acquisition, a system of software and hardware elements that allows industrial organizations to control industrial processes locally or at remote locations, and monitor, gather, and process real-time data. Security and cyber threat plans are currently in development. Additional capabilities include the following:

- 800 Mhz radio exercises with Rhode Island National Guard
- Table Top Exercises with State Cyber Team
- 120 million gallons of storage (2 days of supply)
- CodeRed: customer notification system
- Hurricanes: employ proactive response and pull flashboards out to handle flows and transfer to generator power prior to a storm

- Blizzards: plow their own facilities to ensure fuel supply to specific sites

3.2.5.4 All-Hazards Debris Management Plan

The All-Hazards Debris Management Plan (The Debris Plan) is designed to provide policies, guidance, and lists of resources to the City of Providence for the removal and disposition of debris caused by a major disaster in order to facilitate and coordinate the management of debris to:

- Mitigate against any potential threat to the lives, health, safety, and welfare of the impacted community members in the City of Providence
- Expedite the recovery efforts in the impacted area and to maximize cost recovery for the City of Providence under a Stafford Act Declaration
- Address any threat of significant damage to improved public or private property

3.2.6 Resilience and Climate Adaptation Plans

3.2.6.1 The City of Providence's Climate Justice Plan

In 2016, Mayor Jorge O. Elorza set a goal for the City of Providence to become carbon neutral by 2050. Recognizing that the climate crisis is not only the result of carbon emissions, but also the result of race and power inequities that support an extractive economy that disproportionately burdens low-income communities, the Mayor's Office of Sustainability and the City's communities co-created the Climate Justice Plan in 2019. The climate action plan aims to create an equitable, low-carbon, and climate-resilient City by setting forth concrete carbon reduction targets in buildings and transportation sectors while promoting clean energy sources and also addressing the system-level changes that are needed in the City's governance structures, economic system, and the overall health of communities in order to ensure a just and equitable transition away from fossil fuels. The Plan provides near-term policy and program recommendations to meet the targets.

The City of Providence's Climate Justice Plan is strong in its focus on creating an equitable transition to a low-carbon, climate-resilient future, ensuring that policy reforms benefit all community members, especially those on the frontlines of climate impact. However, the Plan's effectiveness is somewhat hindered by the absence of sufficient data to track progress across all its targets. Multiple Plan targets depend on data that the City does not currently have (the City does intend to collect the data). This lack of comprehensive data underscores the challenge in fully realizing the ambitious goals set forth in the Plan, making it difficult to gauge true progress and enforce accountability.

3.2.6.2 Towards a Resilient Providence

Towards a Resilient Providence is a comprehensive report detailing the flooding threats of climate change to the City along with the climate challenges, efforts underway, and a host of recommendations that have been put forward to enhance resilience policy and practice to increase the City's resilience. The report examines overarching themes like the economy and society, infrastructure and environment, and health and well-being as well as key infrastructure systems, such as the Fox Point Hurricane Barrier, the wastewater treatment facilities, and the stormwater system. The report also looks at specific areas within the City like

the Providence Port Area, Downtown, and the Woonasquatucket River Corridor, providing tailored recommendations for each.

Overall, the document underscores the urgency of addressing climate change in the City of Providence through integrated planning, community engagement, and strategic investment in resilient infrastructure. The report includes the following key findings:

- The effects of climate change are not uniform throughout the City. Effective resilience planning requires that the City understands that increasing risk and vulnerability of changing climate affects different places and people throughout the City.
- On the agency level, the City of Providence has already begun developing and working towards resilience initiatives, but the City needs to work towards an integrated vision, framework, and strategy for resilience in the City, much of which must be coordinated with the state and other public, private, and non-profit entities.
- Partnerships with public, private, and non-profit organizations, together with community stakeholders have implemented substantial initiatives with multiple benefits that support building resilience to natural hazards. However, this work does not cumulatively or consistently address larger scale infrastructure, or economic or social systems at risk from changing climate conditions.
- With the understanding that projects addressing significant vulnerabilities can takes years from design to completion, accelerating climate change requires establishing policies and actions for more frequent assessment, planning, investment for all major infrastructure that sustains community well-being, including the City's wastewater, stormwater, and transportation systems.
- Multiple models and tools are used in Rhode Island to assess vulnerability, define risk, and drive regulatory actions. The lack of a single predictive flooding model that incorporates future climate conditions (e.g. increased precipitation, coastal and riverine flooding, sea-level rise) together with the hurricane barrier dynamics is an impediment to data-driven investment and decisions.

3.2.6.3 Resilient Rhody

Resilient Rhody is a State-wide climate resilience action strategy that responds to the changing weather and environmental conditions in Rhode Island caused by climate change. The goal of the Strategy is to identify actions, including projects, policies and legislation, and funding and financing opportunities, that the State can take to better prepare for a changing climate. The Strategy serves as a roadmap for making Rhode Island more resilient to climate change, aligning state-level actions with local and regional efforts. Resilient Rhody highlights several themes for building resilience in Rhode Island, such as:

- Protecting Critical Infrastructure: Ensuring the State's infrastructure is resilient to climate impacts, including sea level rise, flooding, and extreme weather.
- Preserving Natural Systems: Maintaining and enhancing the State's natural systems to provide ecosystem services and buffer against climate impacts.
- Enhancing Community Preparedness: Strengthening community resilience through emergency preparedness, public health measures, and social services.
- Fostering Economic Resilience: Promoting economic resilience by supporting climate-resilient businesses and industries.

3.2.6.4 Narragansett Bay Commission Resiliency Plan

As the primary wastewater manager in the City and situated along the waterfront, the NBC's Resiliency Plan was approved by the Rhode Island Department of Environmental Management (RIDEM) in April of 2020. In addition, the Implications of Climate Change for Rhode Island Wastewater Collection and Treatment Infrastructure study included several alternatives to ensure the facility's resilience such as hardening of the shoreline, protection of power supply, and reducing recovery time. No future expansion plans exist, as the facility is built out.

3.2.7 Natural Resource Plans

3.2.7.1 PVD Tree Plan

The PVD Tree Plan is a strategic initiative aimed at enhancing the urban forest in the City of Providence through a comprehensive and community-driven approach. Developed through extensive collaboration among local stakeholders, including individual, community, non-profit, and City stakeholders with guidance from a Steering Committee of climate justice frontline community representatives and urban forestry experts, the Plan seeks to create a healthier, more resilient, and equitable urban canopy. It addresses the uneven distribution of tree coverage, which historically has favored wealthier and predominantly White neighborhoods, by promoting large-scale investments in tree planting, maintenance, and protection against development pressures and climate change. Central to the plan is the concept of tree equity, which strives to ensure that all communities, particularly low-income and communities of color, gain equal access to the numerous benefits of urban trees—ranging from improved air quality and reduced urban heat to enhanced communal well-being and economic opportunities.

The PVD Tree Plan stands out as a robust strategy primarily due to its community-driven approach, engaging a broad and diverse array of participants in its development. This inclusion ensures that the Plan not only reflects a wide range of perspectives but also fosters strong community buy-in and support for its implementation. By focusing on mitigating urban hazards, such as extreme heat and flooding, the Plan directly addresses some of the most pressing environmental challenges faced by the City today. Furthermore, the PVD Tree Plan places a significant emphasis on equity, aiming to correct historical imbalances in tree distribution across the City of Providence. This focus ensures that the benefits of the urban forest, including improved air quality, enhanced stormwater management, and cooling effects, are accessible to all neighborhoods, particularly those historically underserved and vulnerable to climate impacts.

3.2.7.2 City of Providence Harbor Management Plan

The Harbor Management Plan is a document which presents the City's goals, objectives, and recommendations for guiding public and private use of the land and water of its tidal waters, which extend inland on the Woonasquatucket River and establishes an implementation program to achieve the desired outcomes. The plan is designed to be useful to the City in determining its priorities for management of the harbor. As a policy document, the plan focuses on the following topics: water quality, public access, mooring management, and shipping, navigation and multi-use of harbor waters, as well as storm preparedness.

Goals of the Harbor Hazard Mitigation Plan include:

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

The Harbor Management Plan presents a Risk Assessment (Table 3.1) that includes flood/surge and wind threats. It also includes details of a 3-level short-term preparedness, response, and recovery plan 72 hours prior to a storm event, or as necessary for unpredictable events. Several long-term mitigation projects were developed and incorporated into Section 4.0 Mitigation Strategy.

Table 3-1. Harbor Management Plan risk assessment (City of Providence Harbor Management Plan)

Marine Interest	Effect	Result: Level 1	Result: Level 2
Flood and Surge			
Main harbor	Wide fetch	Poor holding	
Moored boats	Decreased scope	Dragging	Threaten bridge
Marina facility	Flooded facility	Floating debris	Threaten bridge
		Spills of hazardous materials	Threaten surrounding wetlands
	Docks topping pilings	Freed docks and boats	
Private residences	Flooded property		
Wind			
Moored boats	Windage	Dragging or pennant breakage	
Marina facility	Windborne debris	Structural damage	

The following goals, objectives, and actions related to hazard mitigation are included in the Harbor Management Plan:

- Water Quality
    - Goal: Maintain and improve the water quality of Providence Harbor and rivers within and contributing to the harbor management area.
        - Objective 2: Support and enforce policies, designations, regulations, and initiatives that protect and improve water quality and critical habitat.
            - Action 8: Develop erosion mitigation strategies for shoreline areas including India Point, Richmond Square, and the Seekonk River along River Drive, and promote living shorelines along currently hardened shoreline where appropriate and feasible.

        - Objective 3: Promote water quality improvements through improved wastewater treatment, stormwater management, and investment in 'green' infrastructure projects.
            - Action 1: Support efforts to improve the stormwater system that drains into York Pond, just inland of the Seekonk River. Current conditions contribute to erosion of the riverbank, flooding, and water quality impacts.
            - Action 2: Support funding for citywide stormwater management programs, including the potential development and implementation of a stormwater enterprise fund.
        - Objective 4: Promote resiliency, protection of water quality, compatible mixed use, and economic vitality in the port area.
            - Action 2: Require all port area operators and businesses to comply with hazard mitigation and debris management regulations.
            - Action 3: Work with the Harbormaster and others to manage the cleanup of large debris after storms, including derelict vessels, damaged and derelict piers, and downed tree limbs.
- Shipping, Navigation and Multi-Use of Harbor Water Policies and Implementation
    - Goal: Provide for safe and efficient navigation by all commercial and recreational users of City waters.
        - Objective 2: Develop regulations, policies and initiatives to address compatible and safe use of harbor waters by a variety of users.
            - Action 6: Incorporate sea level projections into the construction of bridges and other structures in flood zones and vulnerable waterfront areas.

3.2.7.3 Special Area Management Plans

The Rhode Island Coastal Resources Management Council (RICRMC) is authorized under the federal Coastal Zone Management Act of 1972 to develop and implement Special Area Management Plans (SAMP) to address specific regional issues. These plans are ecosystem-based management strategies that are consistent with the RICRMC's legislative mandate to preserve and restore ecological systems. The RICRMC coordinates with local municipalities, as well as government agencies and community organizations, to prepare the SAMPs and implement the management strategies.

Metro Bay SAMP

The Metro Bay is Narragansett Bay's largest urban waterfront, which is roughly 24 miles of shoreline bordering the cities of Cranston, East Providence, Providence and Pawtucket. The Metro Bay SAMP aims to make the Bay a more appealing place to live and work by improving the economic, social and environmental resources of the working waterfront; attracting major developers with more predictable and efficient permitting; and providing recreation and access to the water. The Metro Bay SAMP also aims to provide a functional framework for future environmentally and economically sensitive redevelopment of the SAMP boundary encompassing most of the waterfront in the 4 cities. The RICRMC coordinated with the cities of Cranston, East Providence, Providence and Pawtucket, as well as government agencies and community organizations to prepare the SAMP.

The SAMP rules provide an alternative coastal vegetative buffer policy for the Metro Bay region that accommodates increased public access to the coast, improved water quality via on-site vegetative stormwater treatment, and the preservation and restoration of habitat corridors and the general aesthetic value of Rhode Island's urban shoreline. Additionally, the intent and purpose of the rules is to promote economic development along the urban shorelines with a predictable permitting process, ensure redevelopment proceeds in a coordinated fashion, and ensure that conflicts are resolved in favor of maintaining a balance among port, recreation, commercial, and residential uses consistent with the designated RICRMC water types.

The SAMP includes an Urban Coastal Greenway Policy (UCG) whose goal is to create a continuous greenway with public access along northern Narragansett Bay's urban shoreline. The UCG divides that shoreline into zones where different buffer regulations apply. The leading goals of the UCG policy are to prevent further degradation of coastal waters by treating stormwater (through vegetative means where possible), to protect and/or restore coastal habitats, and to ensure public access to the urban shoreline while preserving an aesthetically appealing view from both the water and the shore. In addition, the UCG policy offers a mechanism to encourage thoughtful economic development of the Metro Bay Region shoreline in a way that contributes to the RICRMC's goals of enhancing the natural, recreational, and industrial history of the region.

RICRMC encourages the use of effective, innovative techniques to achieve runoff reduction, pollutant abatement, and hazard mitigation. Accordingly, experimental technologies to achieve these goals may be implemented within the urban coastal greenway, at the discretion of RICRMC.

The UCG policy uses "managed landscape," defined as a vegetated area within a buffer zone or urban coastal greenway where limited landscaping practices are allowed. These practices may include the removal of non-native invasive plants, restorative plantings of native and sustainable plant species, and the pruning, trimming, and selective cutting of vegetation designed to manage habitat, maintain scenic view-sheds, and preserve shoreline access. Managed landscapes also provide for infiltration of stormwater and the minimization of erosion. The UCG policy encourages low impact development (LID) stormwater management techniques that improve water quality and enhance the developer's ability to maximally utilize an urban lot. Vegetated areas may include green roofs, bioretention areas, or other LID vegetation alternatives.

Recommendations for Management of the Woonasquatucket River and Promenade District
The Metro Bay SAMP includes a sub-element, Recommendations for Management of the Woonasquatucket River and Promenade District. The management plan serves as a visioning and guidance document for implementing the UCG policy specifically within the coastal area between the Providence Place Mall and Atwells Avenue, an area that is part of the SAMP-delineated Inner Harbor and Rivers Zone.

<u>Shoreline Change (Beach) SAMP</u>
Recognizing the need for comprehensive planning to address the impacts of storm surge, flooding, sea-level rise and erosion, the RICRMC initiated the development of the Rhode Island Shoreline Change SAMP. The

Shoreline Change SAMP builds off previous work completed through the Salt Ponds SAMP and the Metro Bay SAMP. The Shoreline Change SAMP provides guidance and tools for state and local decision makers to prepare and plan for, absorb, recover from, and successfully adapt to impacts of coastal storms, erosion, and sea-level rise. The SAMP presents an array of best management practices to improve state and local planning and decision making with respect to shoreline change and coastal hazards. In addition, physical adaptation techniques, retrofits and structural design considerations are also discussed.

The Shoreline Change SAMP includes a Coastal Hazard Application Process that will be implemented by regulatory amendments to the RICRMC's Red Book to address the coastal hazard issues detailed in the Shoreline Change SAMP chapters.

3.2.8 Regulations

3.2.8.1 Building Code

The City of Providence's Department of Inspection and Standards (DIS) enforces building codes implemented by the Rhode Island State Building Code Commission. The State adopts and enforces the International Building Code (IBC) as the primary model code for new construction, renovation, and alteration of buildings. The 2024 State of Rhode Island Hazard Mitigation Plan outlines the following key aspects of the State building code:

- Rhode Island follows the accessibility requirements outlined in the IBC and the Americans with Disabilities Act.
- Rhode Island has adopted energy efficiency codes from the International Energy Conservation Code to promote sustainable building practices and reduce energy consumption.
- Building codes include provisions for fire and life safety, including requirements for fire-rated construction materials, fire alarm systems, sprinkler systems, and emergency exits.

Building codes utilized for Rhode Island include:

- RISBC-1 Rhode Island Building Code (510-RICR-00-00-1) Incorporates the International Building Code, 2018 Edition, by reference
- RISBC-2 Rhode Island State One- and Two-Family Dwelling Code (510-RICR-00-00-2) Incorporates the International Residential Code, 2018 Edition, by reference
- RISBC-3 Rhode Island Plumbing Code (510-RICR-00-00-3) Incorporates the International Plumbing Code, 2018 Edition, by reference
- RISBC-4 Rhode Island Mechanical Code (510-RICR-00-00-4) Incorporates the International Mechanical Code, 2018 Edition, by reference
- RISBC-5 Rhode Island Electrical Code (510-RICR-00-00-5) Incorporates the National Electrical Code, 2020 Edition, by reference
- RISBC-6 Rhode Island Property Maintenance Code (510-RICR-00-00-6) Incorporates the International Property Maintenance Code, 2018 Edition, by reference
- RISBC-8 State of Rhode Island Energy Conservation Code (510-RICR-00-00-8) Incorporates the International Energy Conservation Code, 2018 Edition, by reference
- RISBC-9 Enforcement and Implementation Procedure (510-RICR-00-00-9)

- RISBC-10 Code Interpretations (510-RICR-00-00-10)
- RISBC-11 Rhode Island Certification of Building Officials, Building, Electrical, Plumbing and Mechanical (510-RICR-00-00-11)
- RISBC-12 New Materials, Devices or Methods of Construction (510-RICR-00-00-12)
- RISBC-13 Standards for Existing Schools (510-RICR-00-00-13)
- Rhode Island Swimming Pool and Spa Code (510-RICR-00-00-14) Incorporates the International Swimming Pool and Spa Code, 2018 Edition, by reference
- RISBC-17 Public Meetings Accessibility Standard (510-RICR-00-00-17) Incorporates the Uniform Federal Accessibility Standards, as published in the Federal Register, by reference
- RISBC-18 Use of Native Lumber (510-RICR-00-00-18)
- RISBC-19 State Fuel Gas Code (510-RICR-00-00-19) Incorporates the International Fuel Gas Code, 2018 Edition, by reference
- RISRC-1 State Rehabilitation Building and Fire Code for Existing Structures (510-RICR-00-00-20)

The Rhode Island Building Code Commission adopted the 2018 edition of International Building Code (which include hazard resistant provisions as described in the following paragraph), along with the International Residential Code, International Plumbing Code, International Mechanical Code, International Fuel Gas Code, International Energy Conservation Code, and the 2020 edition of National Electric Code as of February 1, 2022. The Rhode Island Fire Safety Code Board of Appeal and Review adopted the 2018 editions of NFPA 1 Fire Code and NFPA 101 Life Safety Code, 2019 edition of NFPA 72 Fire Alarm Code as of July 1, 2021.

Key hazard resistant building code provisions found in the 2018 International Building Code, which is utilized statewide, include:

- Structural Design Requirements: Provides requirements for the structural design of buildings to ensure their resistance to various hazards, including earthquakes, high winds, and snow loads. These requirements are aimed at enhancing the overall structural integrity and safety of buildings.
- Wind Design Requirements: Provides specific provisions for wind design, considering the geographical location of the structure. Wind loads are calculated based on factors such as wind speed, exposure, and building height.
- Seismic Design Requirements: Incorporates seismic design provisions to address earthquake hazards. The code includes seismic design categories and requirements for the design and construction of buildings in seismic-prone regions.
- Flood-Resistant Design Requirements: Includes provisions related to flood-resistant design, particularly in areas prone to flooding. It may specify elevation requirements, construction materials, and other considerations to reduce the risk of flood damage. The vast majority of the regulations required by the NFIP are included within the International Building Code and the International Residential Code.
- Fire-Resistant Construction Requirements: Requirements for fire-resistant construction are included to mitigate the risk of fire hazards. This includes specifications for fire-resistant materials, assemblies, and building features.

- Material and Construction Standard Requirements: Establishes standards for building materials and construction methods to ensure the durability and safety of structures, considering various hazards.

On November 9, 2009, the Green Buildings Act (RIGL §37-24) was signed into law and was further updated on June 27, 2022. The Act requires that all new construction and renovation projects over 10,000 gross square feet, constructed by a public agency, be designed and constructed to a Leadership in Energy and Environmental Design Certified or an equivalent high performance green building standard. A public agency includes all state departments, municipalities, public institutions of education, and any subdivisions of these agencies. The Rhode Island Green Buildings Advisory Committee was formed in 2010 to help implement the Green Buildings Act. The Committee, which consists of volunteers from State agencies and the public, works with the Department of Administration and the Rhode Island Building Code Commission to help ensure compliance with the law and to provide education on green building practices for Rhode Islanders.

3.2.8.2 Zoning Ordinance

The City of Providence Zoning Ordinance regulates the use of land in the City. The Division of Structures and Zoning within DIS is charged with issuing zoning certificates, building and demolition permits, review and approval of plans, building inspections, the issuance of certificate of occupancy, compliance with the building codes as mandated by the State of Rhode Island, and issuance of notice of violation when a building is not in compliance with the building codes or zoning ordinance.

Special approvals may be required when a project is in an overlay district such as the Capital Center District, Special Flood Hazard Area (SFHA) District, or if a project requires a subdivision of land. If a project is not consistent with the ordinance, a property owner may apply for a special use permit or variance from the Zoning Board of Review. The DIS administers zoning conformance and can guide property owners through this process. Even if a property owner does not require any special permits or board reviews, the DIS must still review building plans to confirm that they are compliant with the Zoning Ordinance. Once it is confirmed that a project is conformant with zoning, the permitting process moves into the plan review phase, where one applies for a building permit.

The City Plan Commission is responsible to ensure that subdivision, land development projects, and institutional master plans are consistent with the Comprehensive Plan. No public or private improvement, project or subdivision, or zoning ordinance can be initiated or adopted unless it conforms to the Comprehensive Plan.

<u>Special Flood Hazard Areas District</u>

The SFHA are established as a floodplain overlay district. The district includes all SFHA within the City of Providence designated as Zone A, AE, AH, AO, A99, V, or VE on the Providence County FIRM and Digital FIRM issued by FEMA for the administration of the NFIP. The exact boundaries of the special flood district may be defined by the 100-year base flood elevations shown on the FIRM and further defined by the Providence County FIS report dated July 19, 2023. The maps are on file in the City of Providence Department of Planning

and Development. The Floodplain Management Guidelines (43 FR 6030) establish specific requirements of compliance with Executive Order 11988 by all federal agencies. Before any development may commence, the significance of a floodplain must be determined.

Therefore, projects must conform with or significantly outweigh the following requirements of:

- Avoid direct or indirect support of floodplain development wherever a practicable alternative exists,
- Reduce the risk of flood loss,
- Minimize the impact of floods on human safety, health and welfare, and
- Restore and preserve the natural and beneficial floodplain values.

Local Historic District

In 1960, the City of Providence established a local historic district zoning ordinance to protect and preserve special areas of historic and architectural value. In a local historic district, a design review process guides development and change in a way that preserves important elements of the past for the benefit of future generations. Properties located within a locally designated districts cannot be altered without the review and approval of the Providence Historic District Commission.

To date, the City of Providence has designated 8 local historic districts:

- Armory Historic District (509 properties)
- Broadway Historic District (164 properties)
- College Hill Historic District (945 properties)
- Providence Landmarks District (339 properties)
    - The creation of the Providence Landmarks District used the template of the City's Industrial and Commercial Buildings District (ICBD). The City's ICBD is considered to be the region's first non-contiguous, thematic local historic district. The ICBD is comprised of middle 19th to 20th century industrial and commercial buildings throughout the City. The buildings in the ICBD are reviewed by the Historic District Commission for demolition and major alterations only. The landmark status provides various city, state, and federal incentives for rehabilitation and development of these landmark buildings. The Providence Landmarks District was created as an umbrella with two subcategories:
        - Residential District (55 properties)
        - Industrial and Commercial Buildings District (ICBD) (284 properties)
- Jewelry Historic District (25 properties)
- North and South Elmwood Historic District (271 properties)
- Power-Cooke Street Historic District (90 properties)
- Stimson Avenue Historic District (32 properties)

3.2.8.3 Floodplain Management

The City of Providence elects to comply with the requirements of the National Flood Insurance Act of 1968 (P.L. 90-488, as amended). It also references Use Regulations in Article IX of the City of Providence Code of Ordinances (Sections 5-121 through 5-125), which includes additional floodplain management measures to

ensure public safety, minimize hazards to persons and property from flooding, protect watercourses from encroachment, and maintain capability of floodplains to retain and carry off floodwaters.

The Department of Planning and Development by ordinance is responsible for floodplain management for the City, but DIS is actively working to assume this role. The designated floodplain management agency for the City oversees the adoption and maintenance of flood zone regulations and the Flood Insurance Rate Maps (FIRM) in collaboration with other departments according to National Flood Insurance Program (NFIP) and the Federal Emergency Management Agency (FEMA) regulations. The FIRM and Flood Insurance Study (FIS) reports and any revisions and amendments are on file with the City Clerk, Department of Planning and Development, Building Official, PEMA, and DIS.

3.2.8.4 Soil Erosion and Sediment Control Ordinance

Development for non-agricultural uses, such as housing developments, industrial areas, recreational facilities, and roads, can cause excessive quantities of soil erosion. The erosion can necessitate costly repairs to gullies, washed out fills, roads, and embankments. The resulting sediment can also clog stormwaters and road ditches, muddy streams, and deposit silt in ponds and reservoirs. Sediment is considered a major water pollutant.

The City of Providence's Soil Erosion and Sediment Control Ordinance aims to prevent soil erosion and sedimentation from occurring as a result of non-agricultural development within the City by requiring proper provisions for water disposal, construction waste disposal and the protection of soil surfaces during and after construction, in order to promote the safety, public health and general welfare of the City. These types of developments are required to submit a plan prepared by a professional engineer for approval and are subject to inspections during construction. No determination of applicability shall be required for the following:

- Construction, alternation or use of any additions to existing single family or duplex homes or related structures, provided the grounds coverage of such addition is less than ¼ acre, and such construction, alteration and use does not occur within 100 feet of any watercourse or coastal feature, and the slopes at the site of land disturbance do not exceed 10 percent.
- Use of a home or community garden.
- Excavations for improvements other than those described in subsection (1) above which exhibit all of the following characteristics:
    - Does not result in a total displacement of more than 50 cubic yards of material; and
    - Has no slopes steeper than 10 feet vertical in 100 feet horizontal or approximately 10 percent; and
    - Have all disturbed surface areas promptly and effectively protected to prevent soil erosion and sedimentation.
- Grading, as a maintenance measure, or for landscaping purposes on existing developed land parcels or lots, provided that all bare surfaces are immediately seeded, sodded or otherwise protected from erosive actions and all of the following conditions are met:
    - The aggregate of areas of such activity does not exceed 2,000 square feet; and

  - The change of elevation does not exceed 2 feet at any point; and
  - The grading does not involve a quantity of fill greater than 18 cubic yards; except where fill is excavated from another portion of the same parcel and the quantity does not exceed 50 cubic yards.
- Grading, filling, removal, or excavation activities and operations undertaken by the City under the direction and supervision of the director of public works for work on streets, roads, or right-of-way dedicated to public use, provided, however, that adequate and acceptable erosion and sediment controls are incorporated in engineering plans and specifications are employed. Appropriate controls shall apply during construction as well as after the completion of these activities. All such work shall be undertaken in accordance with the performance principles provided for in subsection 5-105(c) and such standards and definitions as may be adopted to implement said performance principles.

3.2.8.5 Stormwater Management

Municipal staff participated in review of the 2018 Rhode Island Stormwater Design and Installation Standards Manual (250-RICR-150-10-8) and related Low Impact Development (LID) Guidelines, emphasizing the urban perspective. Innovative approaches to managing a decaying and overburdened stormwater system are encouraged in the Comprehensive Plan and grant funding sources for implementation continue to be sought.

Stormwater Permitting

The City of Providence is one of 32 Rhode Island municipalities located completely or partially in an urbanized area automatically designated under the RIDEM Stormwater Program Phase II Stormwater Rules. In Rhode Island, operators of regulated small municipal separate sewer systems (MS4s) may be required to obtain authorization to discharge stormwater. Operators must meet the requirements of the General Permit for Small MS4s and Industrial Activity at Eligible Facilities Operated by Regulated Small MS4s. These communities will be required to reduce the discharge of pollutants from their storm sewer systems to the "maximum extent practicable" to protect water quality.

In the City of Providence, the Engineering Division is responsible for coordinating the City's Stormwater Management Plan in conformance with the requirements of Rhode Island Pollutant Discharge Elimination System (RIPDES). The City has the authority and discretion to invoke penalties or impose a lien whenever a stormwater management facility is not implemented, operated, or maintained in accordance with its approval and Article VI. Any penalty invoked shall be in accordance with this section.

All applicants are required to develop and submit a stormwater management plan. These plans must address stormwater management on a site-by-site basis and all requirements of this article. All stormwater management practices must be consistent with the Rhode Island Stormwater Design and Installation Standards Manual and the Rhode Island Soil Erosion and Sediment Control Handbook, as amended. This includes demonstrating that a proposed project provides for protection of life and property from flooding and flood flows. Water quantities must be controlled in accordance with the manual and handbook or a

municipally approved regional stormwater management plan for the watershed in which the project site is located. Project stormwater management plans must include the following standards:

- Control and maintenance of post-development peak discharge rates from the 2-year, 10-year, 25-year, and 100-year storm events and predevelopment levels.
- Downstream analysis of the 100-year storm event and control of the peak discharge rate for the 100-year storm to mitigate significant downstream impacts.
- Discharge from any stormwater facility must be conveyed through properly constructed conveyance system to provide for non-erosive flows during all storm events. The proposed stormwater conveyance system consisting of open channels, pipes, and other conveyance devices shall at a minimum accommodate the runoff from a 25-year storm event. The stormwater conveyance system must provide for non-erosive flows to receiving waters.

Combined Sewer Overflow Abatement Program

At the turn of the century, most urban areas across the nation built sewer systems to carry rain water and sewage in the same pipe, a combined sewer. During dry weather conditions, the sewer systems operate sufficiently, but, during heavy rain storms, these combined flows frequently exceed the capacity of the sewer system and overflow into local rivers and Narragansett Bay, causing combined sewer overflow (CSO). Since the 1990s, the Narragansett Bay Commission (NBC) has worked on multiple versions of a comprehensive Combined Sewer Overflow Abatement Program with Phase I construction beginning in 2001

Construction of Phase I was completed in October 2008. The Phase I facilities included a tunnel, tunnel pump station, and 7 drop shafts. Approximately 1.1 billion gallons of combined water and wastewater that would had gone straight into Narragansett Bay are now treated at the Field's Point Wastewater Treatment Facility each year.

CSO Phase II Facilities were completed in December 2014. These facilities consist of 2 interceptors, 2 sewer separation projects, and a constructed wetlands facility that will reduce the discharge from 17 combined sewer overflows. The interceptors are be located along the Seekonk and Woonasquatucket Rivers and convey flows to the Main Spine Tunnel constructed as part of Phase I. The Woonasquatucket Interceptor is 16,400 feet long with an 1,800-foot long tunnel adit, and the Seekonk Interceptor is 7,200 feet long.

NBC is currently constructing Phase IIIA facilities in the Cities of Pawtucket and Central Falls. Phase IIIA facilities include a 2.2 mile long deep rock CSO storage tunnel, accompanying pump station, and near-surface facilities to convey flow from CSO outfalls to the tunnel. Phase III also includes construction of green stormwater infrastructure to promote infiltration of stormwater runoff to the groundwater table. Phase IIIA facilities are currently scheduled to be operational by February 21, 2028.

3.3 Administrative and Technical Capabilities

3.3.1 Providence Emergency Management Agency and Office of Homeland Security

PEMA is charged with protecting the community by coordinating and integrating all activities necessary to build, sustain and improve the capability to mitigate against, prepare for, respond to, and recover from threatened or actual natural disasters, acts of terrorism, or other human-caused disasters. PEMA undertakes this mission with clear customer-focus and recognition that people are the most valuable asset. PEMA values the contributions and dedication of the personnel who staff the emergency response and management systems and employs and deploys the best available technologies in support of this mission.

PEMA maintains a wide variety of Memorandums of Understanding (MOU) and Memorandums of Agreement (MOA) that cover everything from first response to non-profits for every emergency management function. PEMA conducts shelter exercises with various groups, coordinates with the Health Equity Zones looking at health issues in vulnerable neighborhoods, and conducts public education and outreach programs in the schools. PEMA has an expanded emergency operations center (EOC) with increasing capacity to host and share with a variety of partner organizations.

PEMA maintains both primary and secondary EOCs:

- Primary EOC: Providence Emergency Management Agency
- Alternate EOC: Providence Public Safety Complex

The EOC provides a central location where the Mayor, Emergency Support Function (ESF) lead agency representatives, and senior decision makers will gather to provide a coordinated response.

PEMA maintains several Emergency Support Function Annexes that provide the structure for coordinating federal interagency support for a local response to an incident. They are mechanisms for grouping functions most frequently used to provide local support during times of disaster or emergency and are in-line with state and federal support. The Incident Command System (ICS) provides for the flexibility to assign ESF and other stakeholder resources according to their capabilities, taskings, and requirements to augment and support the other sections of the City of Providence EOC in order to respond to incidents in a more collaborative and cross-cutting manner. While ESFs are typically assigned to a specific section at the EOC for management purposes, resources may be assigned anywhere within the Unified Command structure. Regardless of the section in which an ESF may reside, that entity works in conjunction with other sections to ensure that appropriate planning and execution of missions occur.

- ESF 1 – Transportation: Maintains and re-establishes multi-modal transportation within the City of Providence. It will also coordinate all available and attainable resources needed to address transportation infrastructure concerns. The City of Providence utilizes the principles of the ICS.
- ESF 2 – Communications: Provides the City of Providence with provisions for communications support before, during, and after an emergency/disaster situation. ESF 2 coordinates communications assets (both equipment and services) that may be available from a variety of sources (i.e., City of Providence agencies, volunteer groups, the telecommunications industry, state government agencies, and the National Guard), and communications systems procedures.

- ESF 3 - Public Works and Engineering: Provides in a coordinated manner, the resources of ESF 3 agencies to support emergency public works and engineering needs during an emergency or a disaster in the City of Providence.
- ESF 4 – Firefighting and Emergency Medical Services: Coordinates all firefighting and emergency medical resources to prepare for, respond to, recover from, and mitigate emergency situations. The City of Providence has compiled, identified, and typed all resources available to emergency operations in an appendix to the City of Providence Resource Management Plan.
- ESF 5 - Emergency Management: Ensures that there is a coordinated response to emergency events within the City of Providence. ESF 5 will work with the various City departments to ensure that field operations have the necessary resources to complete their mission. Also, ESF 5 will coordinate the acquisition of state and federal resources, as required, through the state EOC.
- ESF 6 - Mass Care, Emergency Assistance, Housing, and Human Services: Coordinates local and state assistance in support of local efforts to meet mass care needs of victims and disaster workers involved in a disaster in the City of Providence. This ESF does not command resources, but rather works in cooperation with the governmental and non-governmental organizations that provide mass care to disaster victims and disaster workers.
- ESF 7 – Logistics Management and Resource Support: Provides direct and active support to emergency response and recovery efforts during and following a disaster. ESF 7 support includes the locating, procuring, and issuing of resources, including but not limited to, supplies, office space, staging areas, media areas, office equipment, fuels, contracting services, personnel, heavy equipment, generators, and transportation. ESF 7 provides equipment, materials, supplies, emergency relief supplies, space, office equipment, office supplies, telecommunications, contracting services, transportation services, and personnel to the City of Providence entities for emergency operations. It sets the stage for the City of Providence to continue operations even in the event of an emergency, while being self-sufficient from the local stocks, private sector, and other Providence County jurisdictions for up to 72 hours.
- ESF 8 – Public Health and Medical Services: Addresses the activities associated with mobilizing and managing public health services in the City of Providence under emergency or disaster conditions. Responsibility for health and medical services is shared between the Rhode Island Department of Health, licensed doctors, health care workers, and local Emergency Medical Technicians throughout the City of Providence.
- ESF 9 – Urban Search and Rescue: Coordinates the use of municipal search and rescue resources in response to actual or potential emergency or disaster events. Because of limited capabilities of the City of Providence in search and rescue, the primary responsibility of ESF 9 is to act as a liaison with cooperating state agencies including Rhode Island Urban Search and Rescue, Rhode Island State Police, and the RIEMA.
- ESF 10 – Oil and Hazardous Materials: Responsible for safety measures and precautions that protect the public until a hazardous situation has been corrected by returning the hazardous material to a controlled environment. The City of Providence is responsible for hazardous materials response until resources are unavailable, exhausted, or not within the capabilities of local government. Resources

available in response to an oil and hazardous materials incident are referenced in an annex to the City of Providence Resource Management Plan.

- ESF 11 – Agriculture and Natural Resources: Prioritizes and coordinates the response to protect natural resources and agriculture in the City of Providence, including but not limited to, the water supply, parks, and cultural and historic property resources. The City of Providence will support the coordination of agencies pertaining to service animals, household pets, other animals, pests, and food supply management. Specialized resources, especially those from state and federal government will be coordinated through the RIEMA in a large-scale emergency event.
- ESF 12 – Energy: Involves close coordination with the utilities operating in the City of Providence to ensure that the integrity of the power supply systems is maintained during emergency situations and that any damages that may be incurred are repaired and services restored in an efficient and expedient manner afterward. ESF 12 is also responsible for notifying state ESF 12 of any power outages or downed wires within the City.
- ESF 13 – Public Safety and Security: Establishes actions and responsibilities for command, control, and coordination of all law enforcement personnel and equipment in response to an emergency or disaster. ESF 13 coordinates with state ESF 13 to procure additional resources as needed. ESF 13 assists in the development, maintenance, and planning of security force responses to disasters and emergencies including terrorist incidents or incidents involving weapons of mass destruction.
- ESF 14 – Long-Term Community Recovery: Responsible for planning and coordinating all issues regarding long-term recovery from a disaster, including but not limited to federal assistance programs and post-disaster mitigation. This ESF will work closely with state and federal counterparts to ensure the City of Providence maximizes the assistance it will receive and allows for a quick and complete recovery from an emergency event.
- ESF 15 – External Affairs: Coordinates the dissemination of emergency public information and warning notifications (across multiple systems and media) to control the spread of misinformation. ESF 15 will not be activated in all disasters but only in response to a verifiable need in conjunction with the operation of a Joint Information Center, if necessary. Furthermore, ESF 15 also coordinates the local public-private sector partnership ensuring that private sectors assets are brought to bear in the best possible matter.
- ESF 16 – Volunteer and Donation Management: Provides guidance for the engagement and coordination of volunteers, volunteer services, and donations management in an emergency and establishes a consistent framework for coordinating with volunteer organizations supporting a response. This plan does not conflict with the established procedures of voluntary agencies regarding their respective procedures for soliciting goods and services or mobilizing their trained volunteers. This plan outlines logistical and resource support following an emergency and establishes lines of communication between the primary and supporting ESF 16 agencies and other ESF agencies for an emergency or disaster that impacts the City of Providence. However, in a City of Providence emergency, voluntary agencies are expected to abide by this document.

3.3.2 City of Providence Department of Sustainability and Sustainability Commission

The City of Providence Department of Sustainability works to provide a better quality of life for all residents while maintaining nature's ability to function over time by minimizing waste, preventing pollution, promoting efficiency, and developing local resources to revitalize the local economy. The Department is also tasked with reducing energy consumption in City-owned facilities to cost-effectively lower utility operating costs and ensure occupant comfort and safety in City facilities.

The Department of Sustainability has conducted several charrettes over the years to talk about the City's issues of resiliency and to bring community members together to discuss issues and offer recommendations to emerging trends. A Racial and Environmental Justice Committee (REJC), comprised of frontline community members, was created to focus on equity in environmental issues such as climate change and sea-level rise. The REJC is working together to integrate voices and concerns of low-income communities into City decision-making through the Department of Sustainability. This initiative comes from the desire to shift the structures that have contributed to inequities based on race in the City.

The City of Providence has also assembled the Sustainability Commission with responsibilities defined by City ordinance as follows:

- Work with the Department of Sustainability, the Mayor, the City Council and other City departments to coordinate the City's environmental agenda and provide a level of accountability for the environmental initiatives the City is currently implementing or planning to implement.
- Communicate with the public important developments in the City's environmental agenda. This will bring an extra level of transparency and accessibility to the City's progress on important environmental goals.
- Include experts from the City and from the community to discuss and propose innovative, yet achievable, environmental initiatives which the City could adopt to further green the City of Providence.

3.3.3 Providence Resilience Partnership

The Providence Resilience Partnership (PRP) was formed with the goal of supporting a City-wide mobilization effort to address the City of Providence's vulnerabilities. The PRP is a collective of public, private sector, academic, and community leaders committed to leveraging economic, environmental, and social knowledge and dialogue so urban neighborhoods in the City can address and adapt to climate change impacts. The partnership accentuates social justice as a critical interweaving element of resilience building and works at the neighborhood level to build the capacity of community members to engage in science-informed practical measures to counter impacts. In addition, the partnership also secures expertise from local and state governments, businesses, colleges, and other stakeholder spheres to support its endeavors. The PRP's work includes:

- Research: The PRP works to review, organize, and synthesize decades of data & studies to analyze the impacts and risks of climate change.

- Community Engagement: PRP is working to create ways for neighborhoods across the City to understand the impending risks from climate change, learn best practices for resilience, and collaborate on finding the best solutions for the City.
- Climate Ready Providence: PRP is working to plan comprehensively, while aligning different communities and interest groups around an integrated City-wide resilience plan.

3.3.4 City of Providence Department of Public Works

The City of Providence Department of Public Works (DPW) provides efficient, cost-effective, high-quality services relative to the operations, maintenance, planning, construction and engineering of public works infrastructure, and waste management for the City of Providence. The Department is comprised of 7 divisions that include Administration, Engineering, Traffic, Parking, Highway, Sewer, and Environmental.

3.3.5 City of Providence Department of Public Safety

The City of Providence Department of Public Safety is committed to informing the residents of the City of Providence about key public safety initiatives and encourages the public to work with PEMA to ensure the safety and welfare of all who visit, work, and live in the City.

3.3.6 City of Providence Police Department

The City of Providence Police Department united with all community members, is committed to improving the quality of life in the City by aggressively resolving problems, preserving the peace, protecting human rights, and apprehending criminals consistent with the law.

3.3.7 City of Providence Fire Department

The City of Providence Fire Department provides for the protection of human life and property from fire and other disasters, either natural or man-made, through fire safety education, the development, and enforcement of fire codes, provision of emergency medical services and suppression of fire.

3.3.8 City of Providence Department of Information Technology

The mission of the City of Providence Department of Information Technology is to support the network, applications and electronic hardware throughout the City, which employees and the public use to conduct daily business. Using cost-effective and proven technology, these systems support municipal finance, operations, property management and public outreach for the City, and advance the Administration's goals of ensuring City government is efficient, transparent, and accessible for staff, residents, and visitors.

3.3.9 City of Providence Stormwater Innovation Center

The City of Providence Stormwater Innovation Center was created in 2020 initially as a collaboration between the Audubon Society of Rhode Island, the City of Providence Department of Parks, and the Nature Conservancy of Rhode Island. The Center is now hosted in Roger Williams Park and has grown into a collaboration between the City of Providence Department of Public Works, the University of Rhode Island's Coastal Institute, Restore America's Estuaries, Rhode Island Department of Transportation, the Southeast New England Program Network, the Narragansett Bay Estuary Program, the University of New Hampshire

Stormwater Center, Rhode Island School of Design, the Roger Williams Park Conservancy, Save the Bay, and the Green Infrastructure Coalition.

The Stormwater Innovation Center conducts research, develops trainings and outreach on stormwater best practices focusing especially on green infrastructure. The Center shares effective strategies and valuable insights about stormwater management and green infrastructure with municipalities, non-profits, and stormwater professionals throughout Rhode Island and Southeast New England. To build regional expertise in stormwater management, the Center organizes place-based professional trainings and workshops for planners, engineers, landscape architects, contractors, and maintenance staff, fostering a community of knowledge sharing and networking. Through public outreach events, tours, community science programs, innovative signage and materials, and school programming, the Center aims to raise awareness and appreciation for sustainable stormwater practices, creating a positive environmental impact.
The Stormwater Innovation Center includes an Advisory Committee of 50 members that meets weekly to provide practical input and ideas that drive the Center's mission and objectives. The team actively contributes to ongoing and future projects, spanning research, training, community outreach and stormwater management implementation. The team collaborates on grant applications and pursues funding opportunities, ensuring an efficient and effective approach to securing financial support. Through this collaborative effort, the Advisory Committee significantly influences the Center's direction and success.

3.3.10 Rhode Island Coastal Resources Management Council

The RICRMC plans for and manages the coastal resources of the State. The Coastal Resources Management Program contains numerous policies and programs for the protection of coastal resources, including coastal wetlands and other shoreline features (e.g., beaches, and dunes). RICRMC has statutory authority to restrict the alteration of coastal wetlands for preservation purposes, and to implement regulations requiring erosion setbacks, coastal buffer zones and to prohibit construction on beaches, in dunes, and on barrier spits that are identified as undeveloped or moderately-developed.

RICRMC currently employs coastal policy analysts to analyze climate change and sea-level rise issues, shoreline change, beneficial re-use of sediment, and wetlands restoration. In addition, the RICRMC employs engineers and environmental scientists for permitting review and enforcement. The RICMRC spends a significant amount of time in the development of coastal hazard analysis tools and engagement with stakeholders. Technical support is provided to other State agencies and municipalities related to RICRMC programs, including SAMPs, stormwater design and installation, and coastal and estuarine land conservation. Additionally, RICRMC provides technical assistance through membership of EC4, including the EC4 Science and Technical Advisory Board and Resiliency subcommittees.

RICRMC has several ongoing partnerships to reduce risks from coastal hazards and for public education and outreach. Some specific projects include:

- Partnering with statewide and local planners, the University of Rhode Island, GIS coordinators, and Rhode Island Sea Grant to develop tools for determining vulnerability to present and future coastal

flooding scenarios from storm surge and sea-level ride. For example, STORMTOOLS, Coastal Environmental Risk Index and Substantial Damage Estimation maps
- Coordinating the Coastal and Estuarine Habitat Restoration Program and Trust Fund, which includes funding for projects that seek to restore or enhance ecological conditions that have been. Degraded by human impacts in coastal or estuarine habitats
- Giving numerous presentations to professional groups and the public on coastal hazards, climate change adaptation, coastal habitat restoration, and other topics

3.3.11 Rhode Island Executive Climate Change Coordinating Council

The Rhode Island Executive Climate Change Coordinating Council (EC4) is a state-level body established to address climate change issues in Rhode Island. The EC4 plays a pivotal role in the State's efforts to mitigate and adapt to climate change, bringing together various stakeholders and agencies to coordinate responses to climate-related challenges. The EC4 serves as a central coordinating body to address and manage the multifaceted impacts of climate change on Rhode Island's communities, economy, and environment. The EC4 includes 2 advisory boards:

- EC4 Advisory Board: The EC4 Advisory Board has 13 full members, appointed by the Governor, House and Senate. Members include municipal representatives as well as those with expertise in economic policy, workforce development, protection of natural/cultural resources, energy planning, education, public health, and housing. The Board is charged with advising the EC4 on all matters pertaining to the duties and powers of the Council, including evaluating and making recommendations regarding plans, programs, and strategies relating to climate change mitigation and adaptation. The Board also assists the EC4 in communication and outreach and improving public access to resources and information about climate change to build public support for making the State's communities more resilient.
- EC4 Science and Technical Advisory Board (STAB): The EC4 STAB has 9 members, appointed by the Governor with the advice and consent of the Senate, from institutions of higher education in the State, research laboratories located in the State, and State agencies with expertise in, and responsibility for, addressing issues pertaining to climate change. The EC4 STAB is charged with keeping the EC4 abreast of important developments in scientific and technical information relating to climate change and resiliency. The Board also advises the EC4 regarding opportunities to provide timely support for key policy and management decisions, inventories key climate scientific and technical work being done by public and private sector entities, and assists the EC4 in communicating scientific and technical information to key user groups and the general public.

3.3.12 Citizens Emergency Response Team

The Citizens Emergency Response Team (CERT) include community members that completed a 20-hour course that includes education about disaster preparedness for hazards that may affect the City of Providence and training in basic disaster response skills such as fire safety, light search and rescue, team organization and disaster medical operations. Using the training learned in the classroom and during exercises, CERT members can assist others following an event when professional responders are not

immediately available to help, or by taking a more active role in emergency preparedness projects in the community.

3.3.13 Warning and Notification Systems

3.3.13.1 Emergency Alert System

The Emergency Alert System (EAS) is a national public warning system that requires broadcasters, cable television systems, wireless cable systems, Satellite Digital Audio Radio Service providers, and Direct Broadcast Satellite providers to provide the communications capability to the President to address the American public during a national emergency. The System can also be used by state and local authorities to deliver important emergency information, such as AMBER Alerts and weather alerts. When appropriate, the City of Providence can send a short 30 second message directed to the residents of the City. From the EOC in the City, the emergency management staff can send Civil Emergency Messages to the NWS and the State Warning Point via the State Warning System.

3.3.13.2 CodeRED Emergency Notification System

The City of Providence utilizes the CodeRED Emergency Notification System to alert residents, commuters, and businesses in emergency situations. CodeRED allows emergency officials to notify residents and businesses by telephone, cell phone, text message, email, and social media regarding time-sensitive emergency information. CodeRED emergency message types include AMBER Alerts, hazardous incident notifications, boil water advisories, evacuation notices, parking bans, and severe weather alerts. The service is free and easy to sign up for. To sign up, visit the City of Providence website: https://www.providenceri.gov/pema/codered/

3.3.13.3 Rhode Island Red Cross Emergency Notification System

The Rhode Island American Red Cross (ARC-RI) ENS enables immediate information dissemination of updates, reminders, and emergencies to ARC-RI volunteers via various contact methods. The system enables appointed personnel to quickly and easily contact one, several or all individuals via web or telephone interface and distributes notifications via multiple media, including telephone, cell phone, email, pager, and text messaging. The System is capable of recorded voice and text-to-speech notifications, multilingual text-to- speech conversion, pre-defined messages, and recipient acknowledgement.

3.3.13.4 Emergency Management State Radio System

The Rhode Island Emergency Management State Radio System (EMSTARS) is a Simplex (non-repeated) radio system that links local EOCs to the Rhode Island State EOC. This is an encrypted radio system that is located and kept secure in each EOC. It has been designed to afford communities a redundant mode of secure communications to the state EOC. EMSTARS is designed to be a base-to-base system only. There are no other talk groups on the VHF system. The City of Providence EMSTARS site is located at the EOC.

3.3.13.5 National Warning System

The National Warning System (NAWAS) is used to convey warnings to United States federal, state, and local governments, as well as the military and civilian populations in areas endangered by disasters. NAWAS can

be used for emergencies related to peacetime nuclear accidents, railroad disasters, downed aircraft, and warning of potential natural disasters, such as hurricanes, floods, tsunamis, and tornadoes. As part of an overall and effective warning method, NAWAS was envisioned as being suited for disseminating peacetime civil emergency warnings to state and local governments, who are responsible for further dissemination of warnings to other communities and the general public. The City of Providence NAWAS site is located at the Department of Telecommunications located on West Exchange Street in the City.

3.3.13.6 Port of Providence Emergency Siren Warning System

The Port of Providence Emergency Siren Warning System is intended to alert workers and residents who are outside their residence or place of work that may not be able to receive a traditional notification. Examples of emergencies where the sirens would likely be activated include a chemical spill, hostile intruder, or severe weather emergency. Each of the 4 strategically placed sirens emits a tone of 125 decibels, loud enough to cover a diameter of 5,400 feet. The activation will consist of an alert tone followed by a specific voice message regarding the nature of the emergency. This system operates on the City's legacy VHF Radio system.

3.3.13.7 National Oceanic and Atmospheric Administration Weather Radio

The National Oceanic and Atmospheric Administration (NOAA) Weather Radio is a network of radio stations broadcasting continuous weather information directly from a nearby National Weather Service (NWS) office. It is operated by the NWS, an agency of NOAA within the United States Department of Commerce. NOAA Weather Radio broadcasts NWS warnings, watches, forecasts, and other hazard information 24 hours a day. It also broadcasts alerts of non-weather emergencies such as national security, natural, environmental, and public through the Federal Communications Commission's (FCC) Emergency Alert System. The City of Providence's NOAA Weather Radio transmitter is on 162.4 MHz. Tone activated receivers are owned by individual community members as well.

3.3.13.8 Rhode Island Broadcasters Association's Cancellation System

The Rhode Island Broadcasters Association (RIBA) has a unified cancellation and delay notification system that transmits weather-related class cancellations throughout Rhode Island and bordering communities. The City submits notices through RIBA's secure automated telephone or web-based system. The data is then available in real-time to all participating radio and television stations as well as on their websites. RIBA has modified its system to include more than just weather-related closings and they have initiated a program to send alert messages to cell phones, email addresses, or home phone numbers of individuals who subscribe on the websites of any of their member stations.

3.3.13.9 AMBER Alert System

The State of Rhode Island Department of Public Safety's AMBER Alert Program is a voluntary partnership between law enforcement agencies, broadcasters, transportation agencies, and the wireless industry, to activate an urgent bulletin in the most serious child-abduction cases. The goal of an AMBER Alert is to instantly galvanize the entire community to assist in the search for and the safe recovery of the child.

3.3.13.10 Greater Providence Chamber of Commerce E-Alert

The Greater Providence Chamber of Commerce uses a business-based email system, E-Alert. Based on prior coordination with the Chamber, approximately 2,600 business can be reached in the Providence metropolitan area.

3.4 Financial Capabilities

3.4.1 Federal and State Opportunities

The City, across all municipal departments, considers and pursues all applicable federal, state, and local grant opportunities to assist in implementing hazard mitigation programs.

3.4.1.1 Federal Emergency Management Agency

FEMA has several programs including the Hazard Mitigation Grant Program, Pre-Disaster Mitigation Program, Flood Mitigation Assistance Grant Program, Building Resilient Infrastructure and Communities Grant Program, and Public Assistance Mitigation (406 Mitigation) Program.

3.4.1.2 United States Housing and Urban Development

The United States Housing and Urban Development provides funding through the Community Development Block Grant Program. The Program provides communities with resources to address a wide range of unique community development needs, particularly through the Disaster Recovery Assistance Program, which provides grants to help cities, counties, and states recover from presidentially declared disasters, especially in low-income areas, subject to availability of supplemental appropriations.

3.4.1.3 United States Department of Agriculture

The United States Department of Agriculture Natural Resources Conservation Service makes funding available through the Conservation Innovation Grant Program and the Emergency Watershed Protection Program.

3.4.1.4 United States Economic Development Administration

The United States Economic Development Administration empowers distressed communities to revitalize, expand, and upgrade their physical infrastructure to attract new industry, encourage business expansion, diversify local economies, and generate or retain long-term, private sector jobs and investment.

3.4.1.5 Rhode Island Department of Environmental Management

RIDEM provides funding opportunities through its Green Space Grant Programs, which fund land conservation, recreational land acquisition and development, and recreational trail development and improvements.

- Local Open Space Grant: Provides up to 50% matching funds to municipalities, land trusts and non-profit conservation land organizations to preserve valuable open space throughout the State.
- Outdoor Recreation Grant: Provides matching funds to cities and towns and recognized Native American tribes for the acquisition, development and renovation of outdoor recreational lands and facilities. The program is funded through State bonds. Funding categories include Large Recreation

Development grants (up to 80% matching funds to a maximum of $400,000), Small Recreation Development Grants (up to 80% matching funds to a maximum of $100,000), and Recreation Acquisition grants (up to 50% matching funds to a maximum of $400,000).

- Recreational Trail Grant: Provides financial assistance to municipalities and non-profit 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.

3.4.2 Local Opportunities

3.4.2.1 Capital Improvement Plan

The City regularly plans and budgets for both short and long-term capital improvement projects through its Capital Improvement Plan. The City of Providence approved the Fiscal Year 2024 Capital Improvement Plan, which was detailed above.

3.5 Education and Outreach

3.5.1.1 Municipal Website

PEMA maintains a webpage hosted on the City's website that includes a variety of local, state, and regional emergency program information for residents, business owners, and tourists with the following site map:

- Stay Connected: Provides information on how to stay connected through CodeRED enrollment, volunteer opportunities, training opportunities, and access PVD 311.
- Plan for Emergencies and Disasters: Provides information on how to make effective plans for emergencies and disasters with hazard-specific information on winter weather and cold, earthquakes, flooding, hurricanes, infectious disease, power outages, thunderstorms and lightning, and tornadoes. The page also provides link to preparedness information for pet owners, business owners, seniors and people with medical needs, and high-rise building residents.
- Gather Supplies: Provides an inventory of supplies residents can gather to create home kits for disaster preparedness and evacuations.
- Hazard Mitigation Plan: Provides public access to the City's Hazard Mitigation Plan.
- Warming Centers: Provides tips for preparing and responding to cold weather as well as warming center locations throughout the City.

3.5.1.2 Drills and Exercises

PEMA regularly develops and executes drills and exercises internally and for the public.

- Drill: A drill is a type of operations-based exercise that is a coordinated, supervised activity usually employed to test a single specific operation or function in a single agency. Drills are commonly used to provide training on new equipment, develop or test new policies or procedures, or practice and maintain current skills.
- Exercise: An exercise is an instrument to train for, assess, practice, and improve performance in prevention, protection, response, and recovery capabilities in a risk-free environment. Exercises can be used for testing and validating policies, plans, procedures, training, equipment, and interagency agreements, clarifying and training personnel in roles and responsibilities, improving interagency

coordination and communications, identifying gaps in resources, improving individual performance, and identifying opportunities for improvement.

Table 3-2 lists the drills and exercises that have been conducted by PEMA from 2019 through 2023.

Table 3-2. Exercises and drills conducted by PEMA from 2019 through 2023

Date	Activity
April 2019	City Hall Active Shooter Drill
April 2019	Operation Fallout Shelter
July 2019	Hurricane TTX
September 2019	Port Evacuation Drill
July 2020	Hurricane TTX
June 2021	EAB Hurricane TTX
Date	**Activity**
July 2021	Port Siren Test
July 2021	ERT Hurricane TTX
November 2021	EAB Winter Storm TTX
November 2021	ERT Winter Storm TTX
November 2021	Port Evacuation Exercise
May 2022	NWS SNE Hurricane TTX
June 2022	ERT Hurricane Exercise
June 2022	EAB Hurricane TTX

Date	Activity
June 2022	ERT Hurricane TTX
September 2022	EAB Hurricane TTX
November 2022	CERT Operational Exercise
November 2022	ERT Winter Storm TTX
January 2023	EAB Winter Storm TTX
June 2023	Port Siren Test
Date	**Activity**
August 2023	Active Threat (School) TTX
September 2023	City Hall Evacuation Drill
September 2023	Port Evacuation Drill
October 2023	Port Evacuation Drill
November 2023	Active Threat (School) FSE
November 2023	EAB Winter Storm TTX
November 2023	ERT Winter Storm TTX

3.5.1.3 Training Opportunities

PEMA offers a variety of training opportunities for the City's community and volunteers. Courses offered include Until Help Arrives, CPR, and the Community Emergency Response Team (CERT) class, as well as trainings on a variety of topics held at the monthly volunteer meetings.

- Until Help Arrives: Until Help Arrives is a 3 to 4 hour class that offers students the opportunity to learn bleeding control, tourniquet use, proper interaction with 911, initial incident response, mass casualty response, and comforting the injured.
- CPR: Performing CPR promptly may save a life. The CPR training teaches how to perform CPR and be prepared to act in the event of a cardiac emergency.
- CERT: The CERT class is a free 20-hour course that teaches basic disaster preparedness and response skills including how to use a fire extinguisher, disaster medical operations, light search and rescue, extrication, cribbing, disaster psychology, and the Incident Command System.
- Other: PEMA also provides monthly volunteer meetings on a variety of different training topics. Previous volunteer training include:
    - Volunteer reception training
    - Medical Point of Distribution (MED POD) training
    - Crowd management
    - Shelter management training

- General radio operations
- Active shooter awareness
- Disaster assessment training
- Critical incident stress management
- Basic search and rescue training
- Narcan administration training

3.5.1.4 Outreach Activities

PEMA actively participates in outreach tables at public events to educate the community about disaster preparedness, response, recovery, mitigation, and resilience strategies. By engaging directly with residents, PEMA helps raise awareness about potential hazards and promotes the importance of emergency management.

PEMA's community outreach activities between 2021 and 2023 included:

- PEMA Open House: On June 19, 2021, PEMA hosted an open house at PEMA headquarters. The purpose of this event was to invite the new volunteers and community members to see the facility, learn about what PEMA does first hand, both during emergencies and day-to-day, and to receive some training preparedness.
- Providence Police Academy Vaccinations: On April 25, 2021, PEMA assisted the Providence Police Department by administering vaccinations at the Providence Career and Technical Academy for incoming recruits after their physical fitness testing. On May 6, 2021, PEMA held a second clinic at the Public Safety Complex in the auditorium to administer second doses to those vaccinated at the previous clinic.
- National Night Out: National Night Out was held on the evening of August 3, 2021 at George J. West Park. PEMA helped coordinate additional attendees, the mobile EOC (MEOC), and power for attendees, the DJ, and the popcorn machine.
- Flu Clinic at St. Martin de Porres Senior Center: On Wednesday, November 17, 2021, PEMA staff and 1 volunteer ran a flu clinic with Asthensis Pharmacy from 9 AM to 12:30 PM.
- RAILSAFE: On December 10, 2021, PEMA visited the Providence Amtrak station as part of the annual RAILSAFE initiatives.
- PEMA Visit by Providence College Emergency Management: On Wednesday, March 16, 2022, Michael Moricas, Director of Emergency Management for Providence College and one of his associates, Charlie, visited PEMA. The goal of the visit was to discuss emergency management efforts as well as tour the EOC and other facilities to help guide the team on improvements at Providence College.
- Grade 2 through 4 Emergency Preparedness at Blessed Sacrament School: On April 8, 2022, PEMA staff, Rachel and David, along with PEMA volunteers, Meredith and Teri, conducted an hour and a half training with 40 students in 2nd, 3rd, and 4th grade. The students were led in a discussion about emergency management and disasters, then shown 3 videos, followed by a hands-on discussion diving deeper into disasters as well as making a communications plan and emergency kit at home.

- Presentation to the Family Self Sufficiency Program Coordinating Committee: On June 2, 2022, PEMA staff presented to the Rhode Island Housing Family Self Sufficiency Program Coordinating Committee. The team covered family preparedness and the CodeRED system for 25 minutes.
- PVD Fest Outreach: On the weekend of June 10 to 12, 2022, PEMA supported the City's annual PVD Fest in both incident command, foot patrols, and community outreach. PEMA staff members, Rachel and Alexa, set up the misting tent and 2 outreach tables at East Approach near Kennedy Plaza. Throughout the event, Rachel and Alexa operated the misting tent and oversaw teams of volunteers conducting foot patrols as well as handing out test kits, masks, and other preparedness materials to event attendees. The team also used the opportunity to recruit for future PEMA trainings, CERT, and the volunteer program as well as registrations for RISNER and CodeRED. 14 volunteers assisted with this effort.
- PVD PRIDE Parade and Festival: On June 16, 2022, PEMA supported the City of Providence PRIDE event by establishing a presence near the festival footprint, as well as operating a community outreach table during the event. PEMA staff and volunteers handed out test kits, masks, and other preparedness materials to event attendees. The team also used the opportunity to recruit for future PEMA trainings, CERT, and the volunteer program as well as registrations for RISNER and CodeRED. 6 volunteers assisted with this effort.
- PVD 4th of July Fireworks: On July 3, 2022, PEMA supported the City of Providence 4th of July event by establishing a presence near the event footprint, as well as operating a community outreach table during the event. PEMA staff and volunteers handed out test kits, masks, and other preparedness materials to event attendees. The team also used the opportunity to recruit for future PEMA trainings, CERT, and the volunteer program as well as registrations for RISNER and CodeRED. 1 volunteer assisted with this effort.
- National Night Out: On August 4, 2022, PEMA supported the City's National Night Out celebration at George J. West Elementary on Roanoak Street. PEMA staff, Alexa, coordinated several requests for guests and equipment to support the event. On the evening on August 4, 2022, PEMA staff, Alexa and David, and PEMA volunteer, Forrest, worked the event providing power, misting tent, coordination, and community outreach.
- PEMA Presentation at New Voices Workshop: PEMA Director Decerbo attended the New Voices Workshop, held on September 7, 2022 at the Woonasquatucket River Watershed Council. Director Decerbo gave a presentation to the group about PEMA and how PEMA can support those within the City.
- OVFest at Riverside Park: On October 9, 2022, the Olneyville Neighborhood Association held OVFest at Riverside Park. PEMA Director Decerbo and 2 PEMA volunteers attended and established an outreach table at the event.
- Woman and Infants Hospital Safety Day at 101 Dudley Street: On October 14, 2022, PEMA staff, Rachel, and 2 PEMA volunteers setup an outreach table to discuss PEMA and general preparedness with Woman and Infants Hospital staff during their annual Safety Day.
- State Representative Sanchez Visits PEMA: On Friday, November 18, 2022, Rhode Island Representative Sanchez visited PEMA for a tour of the facility. Director Decerbo led Representative Sanchez on the tour.

- Planning for a Climate Resilient Providence: Community Meeting and Workshop: On Sunday, December 11, 2023, FEMA staff, David, attended the Planning for a Climate Resilient Providence community meeting and workshop, held at the Joslin Recreation Center in Olneyville. The City of Providence Planning, Sustainability, and PEMA teams were joined by community group Nuevas Voces and the Woonasquatucket River Watershed Council to discuss climate concerns and resilience strategies that can be implemented into the upcoming City of Providence Comprehensive Plan update. Local community members were in attendance, and following the presentations, a workshop was held to gather feedback and ideas from the public.
- Jewelry District Neighborhood Association Meeting: On Tuesday, January 10, 2023, PEMA Director Decerbo attended an hour and a half meeting with the Jewelry District Neighborhood Association. During this meeting, Director Decerbo facilitated a presentation about PEMA and emergency preparedness.
- Councilman Pichardo Meet and Greet: On Saturday, February 11, 2023, Councilman Pichardo held a meet and greet at the Recreation Center, located at 159 Sackett Street, from 10 AM to 12 PM. The goal of this event was to provide an opportunity for residents to meet officials from the various City departments, and be able to ask questions about those department operations. PEMA staff, Alexa and Meredith, attended the event.
- Continuity Meeting with Church of The Redeemer: On Friday, February 24, 2023, PEMA Deputy Radcliffe attended a Zoom meeting with members of the Episcopal Dioecies and The Church of The Redeemer, located on Rochambeau Avenue, to discuss their ongoing continuity planning. The meeting was attended by 5 participants, and lasted 1.5 hours. Deputy Radcliffe sent the team the Business Continuity templates as a guide for them to start their process, and answered various questions about starting this process, building teams, and establishing plans.
- RIPride Festival and Illuminated Light Parade at Innovation Park and Downtown: On Saturday, June 17, 2023, PEMA staff and PEMA volunteers, staffed the PEMA misting tent, outreach table, passed out water, and provided volunteer patrols on the footprint. There was also an evacuation during this event, in which the PEMA staff and volunteers assisted Providence Police and NES Security in clearing the footprint and maintaining safety in the parking garage during shelter-in-place.
- City of Providence 4th of July Celebration at India Point Park: On Tuesday, July 4, 2023, Director Decerbo and Preparedness Coordinator Griffin attended the City of Providence 4th of July celebration and provided the PEMA misting tent along with an outreach table.
- National Night Out at Roanoak Street: On Tuesday, August 1, 2023, Deputy Radcliffe, Preparedness Coordinator Pearson, and PEMA volunteer, Terri, attended the City of Providence National Night Out celebration and provided the PEMA misting tent along with an outreach table and generator power for the event.
- PVDFest at Innovation Park: On Saturday, September 9, 2023 through Sunday September 10, 2023, PEMA staff and volunteers, staffed the PEMA misting tent, outreach table, passed out water, and provided volunteer patrols on the footprint. There was also an evacuation during this event, in with PC Griffin, PC Pearson, and the PEMA volunteers assisted Providence Police and NES Security in clearing the footprint and maintaining safety in the parking garage during shelter in place.

- EPLO Presentation: On Friday, November 3, 2023, PEMA Director Decerbo and Deputy Radcliffe were asked to attend the RING EPLO presentation, held at Varnum Armory in East Greenwich. Director Decerbo presented to the group a brief on PEMA.

3.6 National Flood Insurance Program

Communities across the country enhance their flood management capabilities by participating in the NFIP, which supports flood risk reduction before and after disasters and helps mitigate the socioeconomic impact of floods. The NFIP allows property owners and renters in participating communities to purchase federal flood insurance policies. The NFIP encompasses all 4 types of capabilities: planning and regulatory (adoption of floodplain management regulations), administrative and technical (designation of a floodplain administrator and related functions), financial (speeding recovery and access to funding), and education and outreach (supporting flood risk communication and mitigation).

3.6.1 NFIP Participation

The City of Providence participates in the NFIP. The City joined the NFIP on December 11, 1970. In 2023, the City had 515 policies in force with a total coverage of $143,221,000.
The City of Providence has:

- Repetitive Loss Properties
  - Number: 24
  - Claims: 104
  - Building and Contents Payments: $8,466,811
- Severe Repetitive Loss Properties
  - Number: 7
  - Claims: 60
  - Building and Contents Payments: $7,030,289

3.6.2 Adoption of NFIP Standards and Maps

The City of Providence has adopted the minimum NFIP floodplain management criteria. The City has adopted the FIRM with the map date of October 2, 2015.

3.6.3 Staffing, Enforcement, and Continued Compliance in the NFIP

The City employs a floodplain manager through DIS. As of the Plan submittal, the Senior Plan Examiner, Yaniv Gal, is the City's floodplain manager (secondary role). The FIRM and FIS reports are accessible to the City through FEMA's website, which allows for public access. The City supports map change requests via FEMA. The City requires that large development projects in SFHA are first reviewed and approved through the Department of Planning and Development, while building permits are reviewed and issued through DIS. Further, floodplains are regulated in new subdivisions through the Stormwater Management Plan and FEMA construction requirements, while floodplain rules are enforced through floodplain review and complaint driven compliance.

3.6.4 Substantial Damage and Substantial Improvement

The NFIP looks to reduce flood risk after a flood event. It does this through substantial damage/substantial improvement rules. These rules apply when a structure is more than 50% damaged or improved (by cost). The owner must build in a way that complies with current building codes and ordinances. This applies even if the structure was exempt from those rules before the damage or improvement. It also applies to damage from non-flood events like fire or wind. Substantial damage/substantial improvement allows communities to require owners of structures built before they joined the NFIP to comply with current standards. Communities are responsible for making substantial damage/substantial improvement determinations and notifying property owners. The City's floodplain manager has the necessary training and makes substantial damage/substantial improvement determinations. The City communicates substantial damage/substantial improvement requirements before and after an event through PEMA.

4 Mitigation Strategy

4.1 Mitigation Goals

In completing the risk and vulnerability analyses, the Local Hazard Mitigation Committee (LHMC) considered projects and actions that would reduce the City of Providence's vulnerability to the identified hazards. As part of this planning process, the LHMC worked to identify gaps and deficiencies both in local capabilities and hazard assessment. Subsequently, the LHMC identified the following mitigation goals:

1. **Be Data-Driven:** Update hazard profiles to incorporate the latest data and scientific understanding with an emphasis on future projections to ensure readiness for evolving threats.
2. **Design Intelligently:** At a minimum, follow these steps before designing mitigation measures:
    a. Perform a root cause analysis
    b. Understand the design of legacy systems in the context of current and future capacity needs
    c. Leverage nationwide best practices
    d. Explore nature-based solutions
3. **Connect Systems and People:** Foster collaboration between different systems and agencies to create more cohesive and efficient mitigation opportunities.
4. **Be Forward Thinking:** Leverage emerging opportunities presented by new regulations (e.g. Executive Order 20-01: Advancing a 100% Renewable Energy Future for Rhode Island by 2030) and technological advancements, while concurrently mitigating the risks or challenges that they introduce. Tailor hazard mitigation strategies to align with the evolving landscape and its novel ramifications.
5. **Prioritize Our Community:** Increase public involvement in disaster preparedness through education and outreach programs. Lift up our community groups by encouraging community-driven ideas and solutions and providing resources to ensure success. Build up our community's financial resilience and provide aid after catastrophic losses.
6. **Adapt and Inform Policy and Investments:** Ensure that policy, building code, and investment decisions are proactive and adaptive, aligning with the current and future risk environment and mitigation best practices to safeguard communities.

4.2 Mitigation Actions

4.2.1 Mitigation Action Categories

The LHMC determined that the identified goals could be met by considering actions aligned to the following mitigation categories:

- Public Education and Awareness
- Property Protection
- Natural Resource Protection
- Structural Projects
- Emergency Services
- Planning and Prevention

4.2.2 Review of Previous Mitigation Actions

For this Plan update, the LHMC was provided with a complete list of previously identified mitigation actions and asked to review the status of the actions. Each action was assigned one of the following status values:

- Completed: The action has been fully completed.
- Not Completed: The action was not started or has been started and is not completed.
- Revised: Action has been revised to reflect current planning environment or identified changes.
- Cancelled: The action has been removed from consideration due to either a lack of resources or changing mitigation priorities.
- Ongoing: The action is completed and has become an ongoing activity or capability of PEMA or another agency.
- Consolidated: The action has been consolidated into another action because it is complimentary or duplicative.

Table 4-1 lists the mitigation actions from the 2019 Plan with their current statuses.

4.2.3 Mitigation Actions

An updated list of mitigation actions (Table 4-2) was developed by combining "Not Completed" and "Revised" (after applicable revisions) actions from the 2019 Plan with newly identified mitigation actions. The newly created actions were developed by the LHMC based on the following:

- Updated hazard list and risk assessment
- Goals and objectives
- Existing local actions
- Local capabilities
- Public input from the public meetings

Subsequent to Table 4-2, this section provides specific details concerning each identified mitigation action, including the expected time frame, cost, benefits, assigned lead agency, assigned support agency (if applicable), and potential funding sources. The time frame is defined as follows:

- Time Frame
    - Short Term: For example, the period for hazard mitigation planning, capital improvements, or jurisdictions budget cycles.
    - Medium Term: For example, the period for structural projects, regulation, education and outreach, natural systems protections, or comprehensive plans.
    - Long Term: For example, the period for comprehensive plans, economic development plans, transportation plans, climate action plans, or the lifetime of infrastructure assets.

Table 4-1. Mitigation actions included in the 2019 Plan with current statuses

Category	2019 Action Number	Title	Description	Status	Notes
Public Education and Awareness	2019 - 1	Stormwater Learning Center	Partner with academic institutions, government agencies, and nonprofits to create a living laboratory for green infrastructure. The primary functions are to (1) provide opportunities for learning best practices for project design, construction and maintenance, (2) scientific research and analysis to measure water quality impacts of stormwater management practices, and (3) training, outreach and education to build the community of practice and foster broad public engagement in sustainable environmental practices.	Completed	The Stormwater Innovation Center was launched in 2020 and is successfully delivering on all outlined tasks in the description.
Public Education and Awareness	2019 - 2	Mitigation Education/Incentive Program	The Inspection and Standards Department will provide information to contractors and homeowners on risks of building in hazard-prone areas and inform builders and homeowners of the benefits of building and renovating structures to current standards. The City will use FEMA's Home Builder's Guide to Coastal Construction (Publication #499), FEMA's Coastal Construction Manual, (Publication #55CD Third Edition), No Adverse Impact (NAI) Coastal Land Management Guidelines developed by the Association of State Floodplain Managers, Rhode Island Coastal Properties Guide, and other FEMA publications, as applicable. In addition, the City will promote and support enforcement of the latest policy revisions relative to climate change and SLR and distribute literature related to mitigation techniques including information from the Institute of Business and Home Safety, retrofit methodology (FEMA's library of technical bulletins), grant/loan sources, and insurance options. Consider developing public/private partnership incentives to implement mitigation measures in coordination with local, state, and federal funding opportunities. Incentives could include tax incentives, cost-sharing, and regulatory streamlining or	Revised	This action was revised into 3 separate actions to make the action more actionable and succinct.

Category	2019 Action Number	Title	Description	Status	Notes
			acceleration of the permit process for those who implement mitigation activities.		
Public Education and Awareness	2019 - 3	Municipal Certified Floodplain Manager	Personnel from the Inspection and Standards Department should become a Certified Floodplain Manager (CFM) through the Association of State Floodplain Managers and serve as the City's Floodplain Coordinator. In addition to providing floodplain coordination information to the public, a CFM can assist with floodplain mapping, certificates and floodplain mitigation alternatives.	Not Completed	The CFM is currently on-board, but the position has not been funded yet (pending 2025 budget approval).
Public Education and Awareness	2019 - 4	Outreach Campaign Evacuation Routes/Bridges/Roads	Steps should be taken to inform residents about which bridges, and roads are subject to flooding, as well as about indicators to begin evacuation. Principles of the Emergency Response Plan that are pertinent to given neighborhoods or the population in general should be summarized and distributed. Hazardous locations and warning signs, along with critical phone numbers and evacuation routes, could be conveyed on a calendar, a refrigerator magnet, or some other item commonly displayed in households. Outreach to residents could also be in the form of an annual mailing prior to hurricane season to give information on property protection and preparedness. Public service messages in the newspaper, on the radio, or during public forums may be alternatives. Incorporate education/awareness for out of town/state visitors/tourists. Visitors/tourists may not be familiar with local authorities, evacuation routes, or know what to expect if police-enforced evacuation becomes necessary. Distribute information on city evacuation routes and emergency services to hotels, bed and breakfasts, real estate agencies dealing with seasonal rentals, and other facilities and events hosting tourists. This action should include the annual update on the vulnerability of these critical infrastructure components in relation to climate change and SLR, with revisions made accordingly.	Revised	This action is being spearheaded by RIEMA and RIDOT, so is revised accordingly.

Category	2019 Action Number	Title	Description	Status	Notes
Public Education and Awareness	2019 - 5	Port Resilience Through Partnerships/Planning	Shipping lines will turn to ports that rapidly resume normal operations after hurricanes. The City of Providence should approach storm resilience and climate change as a business opportunity through inclusion of resilience planning such as, developing pre- contracts for debris removal after an event, or businesses could implement data backup mechanisms to help the port resume operations more quickly after an event. Encourage the establishment of a new collaborative partnership between the state and port community to better understand the economic implications of severe weather events and benefits of resiliency planning. Prior to the start of hurricane season (June 1st), PEMA will: • Develop and implement an annual Disaster Mitigation Workshop for businesses, industries, and shoreline users • Develop and implement an education/training program for harbor and shorefront users that includes the distribution of the Harbor Hazard Mitigation Plan and a storm readiness checklist for boaters • Update accurate lists of principal marine interests and pump out facilities including marinas, waterfront businesses, neighboring Harbormasters, Coast Guard, Towing and Salvage Companies, Environmental teams, Key vessel operators, and fishing cooperatives	Cancelled	This mitigation action will be cancelled as ProvPort is already spearheading port master planning, which will incorporate this Plan. The City Planning Department is also engaged in the ProvPort planning process.
Public Education and Awareness	2019 - 6	Outreach Program Floodplain Compliance	The Inspection and Standards Department enforce compliance of building permits with floodplain standards. A public outreach program would inform residents/contractors in the application process.	Not Completed	The City is in the process of getting a Certified Floodplain Manager in the Inspections and Standards Department (see Action 2019 – 3 above) - once the CFM is established, this action

Category	2019 Action Number	Title	Description	Status	Notes
					will all be reviewed within the existing documentation from Inspection and Standards Department.
Public Education and Awareness	2019 - 7	Periodic CRS Feasibility	CRS is a voluntary program that recognizes and encourages a community's efforts that exceed the NFIP minimum requirements for floodplain management. The CRS program emphasizes three goals: • The reduction of flood losses • Facilitating accurate insurance rating • Promoting the awareness of flood insurance By participating in the CRS program, communities can earn a 5 to 45 percent discount for flood insurance premiums based upon the activities that reduce the risk of flooding within the community. The City evaluated the feasibility of enrolling in the CRS program in 2013 and again in 2015. In both instances, it was determined as not cost-beneficial to pursue enrolling given the limited number of existing policies and limited capacity of staff to complete.	Revised	Revised to incorporate an education component – the City first needs to ensure residents are aware of the need and benefits of flood insurance.
Planning and Prevention	2019 - 8	Exercise to Test RI's MEDS at PODs	MEDS is intended to mitigate the spread of morbidity and mortality during public health emergencies (such as large-scale disease outbreak or bioterrorism attack) through the timely provision of countermeasures. The City of Providence should: • Prepare to receive and dispense medical countermeasures to their entire population within 48 hours of the decision to do so as part of the federal Cities Readiness Initiative • Conduct annual exercises of POD • Utilize POD for flu vaccine and TDAP/seasonal flu vaccinations • Train staff, volunteers, and medical professionals	Completed	Completed during the COVID-19 pandemic.

Category	2019 Action Number	Title	Description	Status	Notes
Planning and Prevention	2019 - 9	Develop Climate Resilience Checklist New Construction	Checklist to inform the design of all new construction and major rehabilitation projects to be evaluated based on climate change variables, including temperature, precipitation, and SLR. This checklist will inform future policy decisions, as well as help guide developers to consider long-term climate impacts.	Revised	Revised to be more actionable.
Planning and Prevention	2019 - 10	Develop Report to Reflect Long-Term Monitoring of Hurricane Barrier Efficacy	The City of Providence continues to investigate the impacts of climate change on the frequency of flood events within the City, more recently with a focus on the Fox Point Hurricane Barrier. A 2016 analysis quantitatively assessed risks and potential economic losses due to SLR, as well as informing the timing of decisions for future climate resilience investments. The primary concern is whether the FPHB will continue to protect against future storm surge due to sensitivity of the SLR projection used in the long-term. Results of this analysis indicate if a low-probability, high SLR projection is used, then the optimal strategy is to build a new, taller barrier by the end of the century. However, under the highest-probability, lower SLR projections, the existing barrier is expected to be cost effective in protecting the City from storm surge well into the 22nd century (assuming it can be maintained past its design lifetime). Prior to development of this report, the City should implement a public engagement process to inform community members and other stakeholders of the long-term impacts of climate change on the City's waterfront (north of the FPHB) and to create guiding principles and values for how to manage these impacts going forward. Due to the increase in the frequency of tidal flooding (so-called nuisance flooding), tide heights that prompt a precautionary closing of the FPHB occur about 10 times a year, today. However, they would occur more than weekly by 2050 and twice daily by 2100. While it is anticipated the FPHB will continue to mitigate nuisance flooding through 2100, questions remain about whether	Revised	Revised for succinctness and clarity.

Category	2019 Action Number	Title	Description	Status	Notes
			it can withstand near- constant use, as projected by 2050. A 2016 analysis determined the most cost-effective approach to address tidal flooding is to raise the threshold at which the FPHB is shut and prepare the waterfront to be periodically flooded, rather than invest in infrastructure to stop the infiltration of water. The construction of sea walls to prevent nuisance flooding was also an examined alternative of this analysis. A public engagement process should focus on whether the community wants to invest in sea walls (and accept the resulting change in character of low-lying waterfront areas) or maintain current views and character and accept periodic flooding. If the construction of sea walls was determined to be the preferred alternative, the 2016 analysis suggested construction begin in 2040 to 2050. This report (every 5 years, and in advance of the next Plan update) should include findings from federal, state and local agencies and leaders who will continue to monitor climate change projections in order to inform the timing of decisions about the future of the hurricane barrier (current analysis suggests a decision be made by 2050).		
Planning and Prevention	2019 - 11	Encourage Port-Area Businesses Participate in Green Marine	Support development of green port initiatives designed to encourage port operators to adopt best practices in areas such as stormwater management, green infrastructure, renewable energy, energy conservation, air quality, habitat protection, living shorelines, public access, and future climate change considerations for operations and expansion plans. Enforce compliance with hazard mitigation and debris management regulations and work with the Harbormaster and others to manage the cleanup of large debris after storms, including derelict vessels, damaged and derelict piers, and downed tree limbs.	Revised	The portion of this action focused on cleanup management and compliance is completed.

Category	2019 Action Number	Title	Description	Status	Notes
Planning and Prevention	2019 - 12	Develop Stakeholder Committee to Execute Phase III of UNBRSM (Stormwater Utility)	A long term, sustainable solution to stormwater management is needed in the Upper Narragansett Bay region due to real, growing, shared and unresolved challenges in managing stormwater. City staff identified several concerns regarding limited public awareness about a stormwater utility within the City, including aging infrastructure, flooding problems (local streets), MS4 permit compliance, and water quality concerns. City staff also indicated a significant gap in funding for routine maintenance of the CSS and MS4 systems, as well as capital improvements to address water quality. A public education/awareness campaign perhaps hosted on the City's website could provide the information necessary for the City to make more informed decisions on the topic.	Revised	This action is being resumed and prioritized by the Smiley Administration with a consultant hired to do this evaluation in parallel tracks with the City's community engagement. This action is revised to take a comprehensive look at future storm water analyses and to see what changes are needed (e.g. ordinances, etc.).
Planning and Prevention	2019 - 13	Support Green Infrastructure Techniques/Applications	The City already encourages the use of green infrastructure techniques/applications in development/redevelopment proposals. This is a continuation of standard operating procedures to reduce flooding, minimize impacts on stormwater systems, and improve/protect water quality.	Consolidated	
Planning and Prevention	2019 - 14	Develop Flood Resiliency Plan for Woonasquatucket River	The Woonasquatucket River corridor is a recreational and natural resource amenity for residents, workers and businesses in the Cith of Providence. The corridor floods periodically jeopardizing public access, recreation opportunities and habitat for wildlife.	Not Completed	
Property Protection	2019 - 15	New Location Vital Municipal Documents	For the most part, City Hall is protected from serious flooding by the Fox Point Hurricane Barrier. In the unlikely event that the FPHB should fail, the City's Department of Public Property must insure that vital documents are stored in upper stories or in flood-proof cabinets or located outside of a flood zone.	Revised	Revised to include all municipal documents throughout the City and to include additional hazards.

Category	2019 Action Number	Title	Description	Status	Notes
Property Protection	2019 - 16	Retrofit Older Buildings for Code Compliance	Like City Hall, Downtown Providence is protected from serious flooding by the Fox Point Hurricane Barrier. Moreover, most new buildings are earthquake resistant. Some buildings both in and out of downtown would require some retrofitting. Buildings constructed after the end of the World War II would have been designed according to then- accepted structural engineering practice, resembling current code requirements, to withstand hurricane force winds. Some pre-war buildings may not have utilized structural engineering criteria resembling current code requirements. Structural analysis should be provided by property owners to determine which buildings are structurally consistent with current code requirements and currently accepted engineering practice.	Revised	Revised to focus on all disasters and broken into multiple actions to reflect the multi-step process.
Property Protection	2019 - 17	Develop Dam Safety Notification System	Establish a notification system for dam safety to coordinate the actions of officials at the federal, state, and local levels. The system should use the process developed by the National Weather Service for severe weather, including a dam advisory, a dam watch, and a dam warning.	Completed	Providence Water maintains Dam Emergency Action Plans for each of its 11 dams. These plans are updated on a 5-year interval. In addition, the 2 high hazard dams are inspected every 2 years with the remaining dams inspected every 5 years.
Property Protection	2019 - 18	Conduct Risk Assessment of Coastal/Riverine Flooding and Stormwater Infrastructure	Identify at-risk structures, then develop projects and/or policies to address risks and establish process for maintenance of stormwater ponds.	Not Completed	
Natural Resource Protection	2019 - 19	Facilitate Water Supply Redundancy Across Districts	Assist water suppliers in developing local Emergency Interconnection Programs. Emergency water system interconnections provide redundancy of supply and the ability to	Not Completed	Providence Water maintains an Emergency

Category	2019 Action Number	Title	Description	Status	Notes
			address water emergencies rapidly and efficiently across water supply districts particularly in small systems throughout the state.		Management Plan that identifies emergency interconnections with various Wholesale Water Districts. This plan is updated on a 5-year interval. Providence Water is currently pursuing an emergency interconnection with the Pawtucket Water Supply Board.
Natural Resource Protection	2019 - 20	Ensure Spillway Management/Coordination with Suppliers/Municipalities	Advance common goal setting and communication between water suppliers that manage reservoirs and downstream municipalities. Ensure downstream flood mitigation via proactive spillway management without adverse impacts on safe yield.	Completed	Providence Water maintains a website that provides real-time Scituate Reservoir and Weather Data, including elevation and downstream discharge flow data.
Natural Resource Protection	2019 - 21	Minimize Impervious Surface Coverage	There may be opportunities to include drainage and/or Low Impact Development techniques, such as infiltration strips and reduced pavement, in existing commercial and municipal parking lots that are being resurfaced. As the City continues to assess the feasibility of a Stormwater Management Utility District, provisions should be made to incorporate the development of criteria relative to incentive credits for stormwater improvements across three typologies: retrofit of existing paved surfaces (reductions); new/expansion of parking for commercial sites; and residential conversions. The City should also consult the Urban Forest Management Plan.	Revised	Revised to address extreme heat as well as flooding.

Category	2019 Action Number	Title	Description	Status	Notes
Natural Resource Protection	2019 - 22	Develop Erosion Mitigation Strategies for Shoreline Areas	Develop erosion mitigation strategies for shoreline areas including India Point, Richmond Square, and the Seekonk River along River Drive, and promote living shorelines along currently hardened shoreline where appropriate and feasible.	Revised	Revised to be more actionable.
Structural Projects	2019 - 23	Support Resilient Strategies for NBC's Facilities	NBC is currently developing a climate resiliency plan to ensure the continuity of their operations based on SLR and climate change projections anticipated for the City of Providence and Rhode Island.	Not Completed	
Emergency Services	2019 - 24	Develop Partnerships for Business Continuity Plans	PEMA, in coordination with the Rhode Island Alliance for Business will develop strategies to help local businesses in flood prone areas recover from the effects of a natural disaster. These strategies will include organizing business owners for collective clean-up of their properties after a disaster and the creation of a list of businesses and the people connected with those businesses that are authorized to enter the businesses in the period immediately following a disaster. This list would be used by the Providence Police Department in their role of guarding properties after a disaster. The Providence Police Department. will develop criteria for determining when safety considerations outweigh the rights of a given business owner to access their property.	Revised	Revised to better reflect role of the Providence Police Department.
Emergency Services	2019 - 25	Evaluate Long-Term Solution for Flooding at Atwells Avenue Fire Station	The City's Fire Station on Atwells Avenue at Valley Street is in a floodplain and floods periodically.	Not Completed	This action was deemed financially infeasible during the last Plan cycle, but will be reevaluated for this Plan.
Emergency Services	2019 - 26	Enhance Coordination between City/Wireless Providers	Wireless providers have capabilities during emergencies that could be coordinated with various municipal departments for enhanced emergency services and recovery City-wide, including: • Establish a virtual bridge with PEMA	Revised	Revised to be more feasible as the City does not have jurisdiction as written; the

Category	2019 Action Number	Title	Description	Status	Notes
			• Presence and communication line to the EOC • Primary point of contact and direct line for more proactive coordination • Provide priority access to emergency personnel • Share 24/7 monitoring of coverage/internal plans during emergencies • Consider linking network assets to shelters/gathering locations • Share deployable assets during emergencies such as mobile cell towers and generators		coordination must involve the State.
Planning and Prevention	2019 - 27	Work with RIDOT to Prioritize Transportation Asset Improvements	RIDOT has conducted several studies over the past few years evaluating impacts to transportation assets impacted by various SLR scenarios. Most recently, RIDOT adopted NOAA's "High Model" SLR projection which anticipates an increase of 8.99 feet by 2100. The study is intended to be a resource for the State and affected communities to incorporate SLR data into informed decision-making regarding spending, planning, goal setting, communication and capacity building, and for additional analysis. This "High Model" should be the baseline for planning purposed regarding improvements to transportation assets throughout the City.	Revised	Revised for clarity and succinctness.
Planning and Prevention	2019 - 28	Ensure Agency/Municipality Data Consistency	Updating, coordinating, and standardizing foundational resilience data including GIS layers (e.g. STORMTOOLS, critical infrastructure, precipitation projections) and related metadata should be centralized. Hosting coordinated data will provide support for municipal/agency decision-making on infrastructure/public facility investments.	Completed	The City maintains a robust data portal with GIS layers and has the infrastructure in place to accommodate future layers.
Planning and Prevention	2019 - 29	Develop/Maintain Database of	Work with the State to include how technological and human-caused threats and hazards impact communities, in addition to	Completed	This Plan has evaluated how technological and human-caused threats

Category	2019 Action Number	Title	Description	Status	Notes
		Technologic/Human-Caused Hazards	documenting frequency and intensity of past threats and future probabilities.		and hazards impact communities and documented frequency, intensity, and future probabilities. The Rhode Island State Hazard Mitigation Plan was referenced when creating this Plan and RIEMA was involved through the Local Hazard Mitigation Planning Committee.
Planning and Prevention	2019 - 30	Consider Acquisition of Repetitive Flood Loss Properties	The City of Providence now includes 24 (8 residential and 16 non-residential) repetitive flood loss properties, as well as properties subject to periodic flooding. The City will work with private property owners in these areas and FEMA to identify an acquisition project(s), obtain approval by the State and FEMA, and seek funding to purchase the property. By purchasing these residential properties, the City is utilizing an effective program designed to move people and property away from high-risk areas to reduce disaster losses. The buildings are either demolished or relocated, and the land is then restricted to open space, recreation, or wetlands in perpetuity.	Revised	
Planning and Prevention	2019 - 31	Develop Education/Outreach Campaign to Mitigate Cyber Threats	Work with the State to develop an education/outreach campaign for the public and private sector on ways to mitigate cyber threats affecting personal, private, municipal, and state agency security and other sensitive information.	Cancelled	This is not feasible for this update cycle given the current availability of resources within the State and City cyber teams.

Category	2019 Action Number	Title	Description	Status	Notes
Planning and Prevention	2019 - 32	Design/Implement Targeted Strategy for Energy Security	This strategy should address risks specific to discrete critical infrastructure assets, including hospitals, police and fire, water and wastewater infrastructure, nursing homes, shelters, fueling stations, and grocery stores. Smart energy security investments at these locations and energy resilience solutions could alleviate the impacts of power outages and fuel supply disruptions in energy emergencies (i.e. backup generation, fuel reserves, distributed generation, combined heat and power, energy storage, and microgrids).	Revised	Revised to reflect a specific deliverable of an energy security plan.
Planning and Prevention	2019 - 33	Update Fox Point Hurricane Barrier Coordination Guidebook	The NBC will be included in the communication protocol outlined in the Fox Point Hurricane Barrier Coordination Guidebook since the operation of the FPHB can have a significant impact on the Fields Point Wastewater Treatment Facility and large portions of the sewerage collection system.	Completed	This Plan is updated annually. Feedback is gathered from all partners, including NBC along with USACE, DPW, and PEMA, and the Plan is promulgated to all parties. There are also ongoing projects between agencies to make the Plan even better moving forward. But this plan is regularly updated and done so in coordination with all parties.
Planning and Prevention	2019 - 34	Host Annual Workshop/Tabletop Exercise on Climate Change Projections	This workshop/tabletop exercise is an evolution of the “Game of Floods” event hosted in 2018 in the City of Providence with great success. It is an engaging way for decision-makers to understand long-term climate risks, conduct vulnerability assessments, prioritize assets, and mitigate impacts.	Revised	Revised to better reflect the City’s resources – annual exercises are infeasible.

Table 4-2. Updated list of mitigation actions

Category	2019 Action Number	2024 Action Number	Title	Description	Hazard(s) Addressed
Public Education and Awareness	2019 - 4	2024 - 1	Collaborate with RIEMA and RIDOT on Evacuation Efforts and Education	RIEMA and RIDOT, in collaboration, lead evacuation planning and outreach for the State. The City should work with RIEMA and RIDOT though to make sure plans are updated and residents are aware of evacuation signs and protocols through an education outreach program.	Coastal Flooding/Sea Level Rise; Hurricane
Public Education and Awareness	2019 - 6	2024 - 2	Create a Public Outreach Program on Floodplain Compliance	The Department of Inspection and Standards enforce compliance of building permits with floodplain standards. A public outreach program would inform residents and contractors in the application process.	Coastal Flooding/Sea Level Rise; Riverine Flooding
Public Education and Awareness	-	2024 - 3	Create an "Adopt a Storm Drain" Program	Engage community members in the maintenance and upkeep of storm drains in their neighborhoods. Under this Program, participants, including individuals, families, businesses, and organizations, volunteer to "adopt" a storm drain and commit to keeping it clear of debris, leaves, and litter. The Program would provide volunteers with the necessary tools, safety guidelines, and educational resources to ensure effective and safe storm drain maintenance. Regular monitoring and reporting by volunteers could also help the City identify and address larger drainage issues.	Urban Flooding
Public Education and Awareness	-	2024 - 4	Create and Update a Lithium Ion Battery Outreach Campaign	Involves developing an ongoing educational initiative to inform the public about the safe use, storage, and disposal of lithium-ion batteries. The campaign will utilize various communication channels, including social media, community workshops, informational pamphlets, and partnerships with local organizations, to disseminate vital information. Regular updates will ensure that the campaign remains relevant and incorporates the latest safety guidelines, technological advancements, and regulatory changes. The goal is to raise awareness about the potential hazards of lithium-ion batteries and promote best practices to prevent accidents and environmental harm.	Conflagration; Electrification

Public Education and Awareness	2019 - 2	2024 - 5	Educate Homeowners and Contractors on the Benefits of Current Standards	The Department of Inspection and Standards will provide information to contractors and homeowners on risks of building in hazard-prone areas and inform builders and homeowners of the benefits of building and renovating structures to current standards. The City will use FEMA's Home Builder's Guide to Coastal Construction (Publication #499), FEMA's Coastal Construction Manual, (Publication #55CD Third Edition), No Adverse Impact (NAI) Coastal Land Management Guidelines developed by the Association of State Floodplain Managers, Rhode Island Coastal Properties Guide, and other FEMA publications, as applicable.	Coastal Flooding/Sea Level Rise; Hurricane; Riverine Flooding
Public Education and Awareness	2019 - 2	2024 - 6	Enforce Climate Change-Related Policies	The City will promote and support enforcement of the latest policy revisions related to climate change and distribute literature related to mitigation techniques including information from the Institute of Business and Home Safety, retrofit methodology (FEMA's library of technical bulletins), grant/loan sources, and insurance options.	All Hazards
Public Education and Awareness	2019 - 7	2024 - 7	Evaluate Flood Insurance Feasibility	As a densely populated urban center, the City of Providence not only is at risk of riverine and coastal flooding, but also urban flooding. Residents at risk of urban flooding are often less aware of the risk and uninformed about insurance options or lack the means to acquire flood insurance. The City should take the following steps: 1. Educate the public about flood risk, especially urban flooding 2. Conduct a study to determine resources to help fund flood insurance in underserved communities 3. Re-evaluate the feasibility of CRS: The City evaluated the feasibility of enrolling in the CRS program in 2013, 2015, 2018, and 2024. In all instances, it was determined as not cost-beneficial to pursue enrolling given the lack of community interest, limited number of existing policies, and limited capacity of staff to complete.	Coastal Flooding/Sea Level Rise; Riverine Flooding; Urban Flooding
Public Education and Awareness	2019 - 3	2024 - 8	Hire a Municipal Certified Floodplain Manager	Personnel from the Inspection and Standards Department should become a Certified Floodplain Manager (CFM) through the Association of State Floodplain Managers and serve as the City's Floodplain Coordinator. In addition to providing floodplain coordination information to the public, a CFM can assist with	Coastal Flooding/Sea Level Rise; Riverine Flooding

				floodplain mapping, certificates and floodplain mitigation alternatives.	
Public Education and Awareness	2019 - 2	2024 - 9	Research Public and Private Partnership Incentives to Implement Mitigation	The City will research options and the feasibility of public/private partnership incentives to implement mitigation measures in coordination with local, state, and federal funding opportunities. Incentives could include tax incentives, cost-sharing, and regulatory streamlining or acceleration of the permit process for those who implement mitigation activities.	All Hazards
Public Education and Awareness	-	2024 - 10	Upgrade the Sirens at the Port to Improve Alert and Warning	Involves replacing or enhancing the existing siren system to ensure more reliable and effective communication during emergencies. The upgrade could includes installing modern sirens with better sound coverage, increased volume, and advanced features such as voice messaging capabilities. The upgrade could also integrate the sirens with other emergency alert systems to provide a coordinated and comprehensive warning mechanism.	CBRNE/Hazardous Materials Release
Property Protection	2019 - 16	2024 - 11	Conduct an Assessment of Critical Buildings to Understand Existing Protections	Evaluate the safety measures, structural integrity, and resilience of key infrastructure within the City. This process includes inspecting buildings for compliance with current safety standards, identifying vulnerabilities, and assessing the effectiveness of existing protective and mitigation measures. The assessment will be carried out by professionals using a combination of on-site inspections, review of building plans, and consultations with building managers and emergency personnel. Action 2024 - 16 will create the list of buildings that require assessments.	All Hazards
Property Protection	2019 - 18	2024 - 12	Conduct Risk Assessment of Coastal/Riverine Flooding and Stormwater Infrastructure	Identify at-risk structures, then develop projects and/or policies to address risks and establish process for maintenance of stormwater ponds.	Coastal Flooding/Sea Level Rise; Riverine Flooding
Property Protection	-	2024 - 13	Create a Post-Earthquake Dam Inspection Process	Develop a structured protocol for assessing the integrity and safety of dams immediately following an earthquake. This process includes predefined steps for rapid mobilization of inspection teams, detailed checklists for evaluating structural damage, and criteria for determining the urgency of repairs. It also involves training personnel in earthquake-specific inspection techniques, establishing communication channels for reporting findings, and	Dam Inundation; Earthquake; Riverine Flooding

				coordinating with emergency management agencies to ensure swift and effective response.	
Property Protection	-	2024 - 14	Create a Prioritized Investment List to Harden Critical Buildings	Identify and rank the most essential structures that require upgrades and reinforcements to withstand various hazards. This process includes analyzing the assessment conducted in Action 2024 - 11, estimating the cost of necessary improvements, and determining the potential benefits of these investments. The resulting list will guide the allocation of resources to enhance the resilience of critical infrastructure, ensuring that the most crucial buildings receive attention first. The list will also be used to inform the City's Capital Improvement Plan.	All Hazards
Property Protection	-	2024 - 15	Create an All-Hazards Design Standard for Critical Buildings Undergoing Renovations	Develop comprehensive guidelines to ensure that renovated structures are resilient against a wide range of potential hazards. This standard will encompass design principles that address natural, human-caused, and technological risks and are intended to optimize the City's resources and efforts; while critical buildings are already undergoing renovations (e.g. because of vulnerabilities identified in Action 2024 - 11), ensure the building incorporates additional, easily implemented standards to mitigate against potential hazards.	All Hazards
Property Protection	-	2024 - 16	Create an Inventory of Critical Buildings	Create a list of critical buildings essential to the functioning of the City, including hospitals, fire stations, police stations, schools, government buildings, and major utility facilities. The process may include gathering data through surveys, inspections, and consultations with various stakeholders.	All Hazards
Property Protection	2019 - 15	2024 - 17	Digitize Vital Municipal Documents	The City currently stores vital municipal documents in locations susceptible to damage or destruction (e.g. within flood zones, in condemned buildings, etc.). The City needs to digitize the documents to prevent damage or destruction these documents.	All Hazards
Property Protection	-	2024 - 18	Provide Generators at Various Critical Buildings	Install backup power systems to ensure continuous operation during power outages. These generators will be strategically placed at essential facilities based on the list of vulnerabilities determined in the above mitigation action.	All Hazards
Property Protection	2019 - 15	2024 - 19	Relocate Vital Municipal Documents	The City currently stores vital municipal documents in locations susceptible to damage or destruction (e.g. within flood zones, in	All Hazards

				condemned buildings, etc.). The City needs to find new locations not susceptible to damage or destruction to store these documents.	
Natural Resource Protection	2019 - 19	2024 - 20	Facilitate Water Supply Redundancy Across Districts	Assist water suppliers in developing local emergency interconnection programs. Emergency water system interconnections provide redundancy of supply and the ability to address water emergencies rapidly and efficiently across water supply districts particularly in small systems throughout the State.	CBRNE/Hazardous Materials Release; Drought; Extreme Heat; Infrastructure/Utility Failure
Natural Resource Protection	2019 - 22	2024 - 21	Identify Erosion Mitigation Strategies in the Shoreline Areas	Identify the potential for developing erosion mitigation strategies for shoreline areas including India Point, Richmond Square, and the Seekonk River along River Drive	Coastal Flooding/Sea Level Rise; Riverine Flooding
Natural Resource Protection	2019 - 21	2024 - 22	Minimize Impervious Surface Coverage throughout the City	Minimize impervious surfaces within the City to decrease the impacts of flooding and extreme heat (heat island effect). This could involve replacing traditional concrete and asphalt with permeable pavements in public spaces, incentivizing the installation of green roofs on commercial and residential buildings, and expanding green spaces and tree canopies through urban planning initiatives. Implementation could be supported by revising building codes, offering tax incentives, and creating educational campaigns to promote the adoption of these practices by private property owners.	Extreme Heat; Urban Flooding
Structural Projects	2019 - 23	2024 - 23	Support Resilient Strategies for NBC's Facilities	NBC is currently developing a climate resiliency plan to ensure the continuity of their operations based on SLR and climate change projections anticipated for the City of Providence and Rhode Island.	Coastal Flooding/Sea Level Rise
Emergency Services	2019 - 24	2024 - 24	Develop Partnerships for Business Continuity Plans	PEMA, in coordination with the Rhode Island Alliance for Business will develop strategies to help local businesses in flood prone areas recover from the effects of a natural disaster. These strategies will include organizing business owners for collective clean-up of their properties after a disaster and the creation of a list of businesses and the people connected with those businesses that are authorized to enter the businesses in the period immediately following a disaster. The Police Department will develop criteria for determining when safety considerations	Coastal Flooding/Sea Level Rise; Riverine Flooding; Urban Flooding

				outweigh the rights of a given business owner to access their property.	
Emergency Services	2019 - 26	2024 - 25	Enhance Coordination between City and Wireless Providers via the State	Wireless providers have capabilities during emergencies that could allow for enhanced emergency services and recovery, such as establishing virtual bridges, sharing 24/7 monitoring of coverage and internal plans during emergencies, linking network assets to shelters and gathering locations, and sharing deployable assets during emergencies, such as mobile cell towers and generators. These capabilities are typically coordinated at the State-level, but no process is in place in the City to effectively communicate with the State. Develop a process to understand information from the State	All Hazards
Emergency Services	2019 - 25	2024 - 26	Evaluate Long-Term Solution for Flooding at Atwells Avenue Fire Station	The City's fire station on Atwells Avenue at Valley Street is in a floodplain and floods periodically.	Riverine Flooding
Emergency Services	-	2024 - 27	Maintain a Working Relationship with the Fusion Center and Continue to Invest in Technology, Techniques, and Systems	The Fusion Center, a hub for intelligence and information gathering, plays a critical role in coordinating efforts among various agencies. The Providence Police Department should maintain ongoing collaboration and resource allocation to enhance information sharing and emergency response capabilities. A working relationship includes regular communication, joint training exercises, and technological upgrades to ensure effective data sharing, analysis of threats, and response to emergencies. Investment in advanced technologies and systems supports the continuous improvement of these collaborative efforts.	Civil Disturbance/Unrest; Terrorism/Active Threat
Planning and Prevention	2019 - 30	2024 - 28	Acquire Repetitive Loss Properties	The City has 24 repetitive loss properties and 7 severe repetitive loss properties. The City should work with private property owners in these areas and FEMA on acquisition projects, on obtaining approval by the State and FEMA, and on seeking funding to purchase the properties. By purchasing these residential properties, the City is utilizing an effective program designed to move people and property away from high-risk areas to reduce disaster losses. The buildings are either demolished or relocated, and the land is then restricted to open space, recreation, or wetlands in perpetuity.	Coastal Flooding/Sea Level Rise; Riverine Flooding

Planning and Prevention	2019 - 12	2024 - 29	Conduct Future Stormwater Analysis	A long term, sustainable solution to stormwater management is needed City-wide due to real, growing, shared and unresolved challenges in managing stormwater. The City should conduct a study to evaluate future stormwater demand and capacity throughout the City. The study should take a comprehensive look at stormwater to see what changes are needed (e.g. ordinances, etc.).	Urban Flooding
Planning and Prevention	-	2024 - 30	Continue to Train and Update Plan Policies and Protocols Based on National Best Practices and Lessons Learned	Continue to refine and enhance the plans and protocols regarding cybersecurity developed in the above action based on national best practices and lessons learned. Updates will reflect the latest national guidelines and integrate lessons learned from past incidents and exercises. Updates will also coincide with continuous training for staff to ensure they are well-versed in current best practices and capable of responding effectively to emergencies.	Cybersecurity
Planning and Prevention	-	2024 - 31	Create a City-Wide Stormwater Master Plan	Develop a comprehensive strategy for managing stormwater across the entire City. This Plan will assess current stormwater infrastructure, but will focus mainly on future conditions to ensure the City is prepared for the changing climate and demands. The Plan will incorporate best practices for sustainable stormwater management, such as green infrastructure, improved drainage systems, and enhanced maintenance protocols. The Plan will also outline funding mechanisms, regulatory compliance measures, and community engagement strategies to ensure successful implementation and long-term sustainability.	Urban Flooding
Planning and Prevention	2019 - 32	2024 - 32	Create Energy Security Plan	The City should create an energy security plan. The plan should address risks specific to discrete critical infrastructure assets as smart energy security investments at these locations and energy resilience solutions could alleviate the impacts of power outages and fuel supply disruptions in energy emergencies (i.e. backup generation, fuel reserves, distributed generation, combined heat and power, energy storage, and microgrids). The plan should recognize differences in future conditions from climate change.	Electrification; Infrastructure/Utility Failure
Planning and Prevention	2019 - 14	2024 - 33	Develop a Flood Resiliency Plan for Woonasquatucket River	The Woonasquatucket River corridor is a recreational and natural resource amenity for residents, workers and businesses in the City of Providence. The corridor floods periodically jeopardizing public access, recreation opportunities and habitat for wildlife.	Riverine Flooding

Planning and Prevention	2019 - 9	2024 - 34	Develop a Climate Resilience Checklist	Create a climate change resilience checklist for all new construction and major rehabilitation projects so that developers are informed and consider long term impacts.	All Hazards
Planning and Prevention	2019 - 11	2024 - 35	Encourage Port-Area Businesses to Participate in Green Marine	Support development of green port initiatives designed to encourage port operators to adopt best practices in areas such as stormwater management, green infrastructure, renewable energy, energy conservation, air quality, habitat protection, living shorelines, public access, and future climate change considerations for operations and expansion plans.	All Hazards
Planning and Prevention	-	2024 - 36	Enhance Plans and Protocols Regarding Cybersecurity	Develop and implement comprehensive strategies to protect the City's digital infrastructure from cyber threats. Enhancements could include updating existing cybersecurity policies, conducting regular risk assessments, and implementing advanced security measures such as multi-factor authentication, encryption, and intrusion detection systems. It also could involve training employees on cybersecurity best practices, establishing incident response plans, and collaborating with cybersecurity experts to stay ahead of emerging threats.	Cybersecurity
Planning and Prevention	-	2024 - 37	Establish a Maintenance Standard for Dredging of the Pleasant Valley Parkway	Create a systematic plan for regularly removing sediment and debris from the water channels of the Pleasant Valley Parkway. This plan will define the frequency, methods, and areas for dredging, ensuring clear and functional waterways. It will include environmentally responsible practices, sediment quality assessments, and proper disposal methods. Additionally, it will outline monitoring procedures to evaluate the effectiveness and impact of the dredging efforts.	Riverine Flooding
Planning and Prevention	2019 - 34	2024 - 38	Host Workshop or Tabletop Exercise on Climate Change Projections	Within each Plan update cycle, the City should host a workshop or tabletop exercise that provides an engaging way for decision-makers to understand long-term climate risks, conduct vulnerability assessments, prioritize assets, and mitigate impacts.	All Hazards
Planning and Prevention	-	2024 - 39	Regularly Dredge the Pleasant Valley Parkway	Perform the dredging of the Pleasant Valley Parkway based on the standards and planning established in the above action.	Riverine Flooding
Planning and Prevention	-	2024 - 40	Regularly Exercise the Fox Point Hurricane Barrier Road Plates	Regularly exercise the Fox Point Hurricane Barrier road plates to ensure the plates are operational and maintained. Exercises can involve scheduled drills to ensure that the road plates can be	Coastal Flooding/Sea Level Rise; Hurricane

				quickly and effectively deployed when needed as well as inspections and applicable repairs of the plates.	
Planning and Prevention	-	2024 - 41	Review and Update Plans, Policies and Procedures Regarding Storage of Battery Powered Mobility Devices	Involves a thorough evaluation and enhancement of existing guidelines to ensure the safe storage of battery powered mobility devices. The review and updates include assessing current storage practices, identifying potential hazards, and incorporating the latest safety standards and technological advancements. Updated plans will provide clear instructions on safe storage locations, proper maintenance, fire prevention measures, and emergency response protocols.	Conflagration; Electrification
Planning and Prevention	2019 - 27	2024 - 42	Understand and Address Impacts to Transportation Assets	Assess and address the impact of changing conditions, like climate change and the Washington Bridge construction on City transportation assets.	All Hazards
Planning and Prevention	2019 - 10	2024 - 43	Understand the Future Efficacy of the Hurricane Barrier	The City of Providence, in collaboration with USACE, continues to investigate the impacts of climate change on the frequency of flood events within the City, more recently with a focus on the Fox Point Hurricane Barrier. The USACE leads the analyses and reports. The City should continue to work with USACE to understand the efficacy of Hurricane Barrier, especially with regards to changing conditions, like sea-level rise.	Coastal Flooding/Sea Level Rise; Hurricane

4.2.3.1 Action 2024 - 1: Collaborate with RIEMA and RIDOT on Evacuation Efforts and Education

- Category: Public Education and Awareness
- Description: RIEMA and RIDOT, in collaboration, lead evacuation planning and outreach for the State. The City should work with RIEMA and RIDOT though to make sure plans are updated and residents are aware of evacuation signs and protocols through an education outreach program.
- Hazard(s) Addressed: Coastal Flooding/Sea Level Rise; Hurricane
- Lead Agency Assigned: PEMA
- Partner Agency Assigned: Department of Public Works; Rhode Island Department of Transportation
- Time Frame: Short Term
- Cost Estimate: Staff Time
- Potential Funding Sources: City of Providence Budget
- Benefits: Provides protection of life; Increases institutional awareness of hazards; Accelerates evacuation

4.2.3.2 Action 2024 - 2: Create a Public Outreach Program on Floodplain Compliance

- Category: Public Education and Awareness
- Description: The Department of Inspection and Standards enforce compliance of building permits with floodplain standards. A public outreach program would inform residents and contractors in the application process.
- Hazard(s) Addressed: Coastal Flooding/Sea Level Rise; Riverine Flooding
- Lead Agency Assigned: Department of Inspection and Standards
- Partner Agency Assigned: Department of Planning and Development
- Time Frame: Short Term
- Cost Estimate: Staff Time
- Potential Funding Sources: FEMA Flood Mitigation Assistance Program
- Benefits: Increases public awareness by educating residents about floodplain regulations and the importance of compliance, leading to better community understanding and engagement; Enhances regulatory compliance; Promotes responsible development; Reduces risk by informing property owners and residents about how to protect themselves and their properties from flood risks

4.2.3.3 Action 2024 - 3: Create an ""Adopt a Storm Drain"" Program

- Category: Public Education and Awareness
- Description: Engage community members in the maintenance and upkeep of storm drains in their neighborhoods. Under this Program, participants, including individuals, families, businesses, and organizations, volunteer to ""adopt"" a storm drain and commit to keeping it clear of debris, leaves, and litter. The Program would provide volunteers with the necessary tools, safety guidelines, and educational resources to ensure effective and safe storm drain maintenance. Regular monitoring and reporting by volunteers could also help the City identify and address larger drainage issues.
- Hazard(s) Addressed: Urban Flooding
- Lead Agency Assigned: Department of Public Works

- Partner Agency Assigned: PEMA; Mayor's Office of Community Relations
- Time Frame: Medium Term
- Cost Estimate: Staff Time
- Potential Funding Sources: City of Providence Budget; Stormwater Project Accelerator; Narragansett Bay and Water Restoration Fund
- Benefits: Improves drainage efficiency in storm drains, enhancing the ability to manage stormwater and reducing the risk of localized flooding; Fosters a sense of community ownership and responsibility, encouraging residents to take an active role in maintaining their neighborhoods; Reduces maintenance costs by leveraging volunteer efforts

4.2.3.4 Action 2024 - 4: Create and Update a Lithium Ion Battery Outreach Campaign

- Category: Public Education and Awareness
- Description: Involves developing an ongoing educational initiative to inform the public about the safe use, storage, and disposal of lithium-ion batteries. The campaign will utilize various communication channels, including social media, community workshops, informational pamphlets, and partnerships with local organizations, to disseminate vital information. Regular updates will ensure that the campaign remains relevant and incorporates the latest safety guidelines, technological advancements, and regulatory changes. The goal is to raise awareness about the potential hazards of lithium-ion batteries and promote best practices to prevent accidents and environmental harm.
- Hazard(s) Addressed: Conflagration; Electrification
- Lead Agency Assigned: Providence Fire Department
- Partner Agency Assigned:
- Time Frame: Short Term
- Cost Estimate: Staff Time
- Potential Funding Sources: City of Providence Budget; Fire Prevention and Safety Grant
- Benefits: Increases public safety through public education; Enhances community awareness in how to handle and respond to potential hazards associated with lithium-ion batteries, leading to reduced incidents and better response; Reduces the burden on emergency services by preventing incidents and promoting community resilience; Fosters community involvement and responsibility, encouraging residents to participate in safety and environmental initiatives

4.2.3.5 Action 2024 - 5: Educate Homeowners and Contractors on the Benefits of Current Standards

- Category: Public Education and Awareness
- Description: The Department of Inspection and Standards will provide information to contractors and homeowners on risks of building in hazard-prone areas and inform builders and homeowners of the benefits of building and renovating structures to current standards. The City will use FEMA's Home Builder's Guide to Coastal Construction (Publication #499), FEMA's Coastal Construction Manual, (Publication #55CD Third Edition), No Adverse Impact (NAI) Coastal Land Management

Guidelines developed by the Association of State Floodplain Managers, Rhode Island Coastal Properties Guide, and other FEMA publications, as applicable.

- Hazard(s) Addressed: Coastal Flooding/Sea Level Rise; Hurricane; Riverine Flooding
- Lead Agency Assigned: Department of Inspection and Standards
- Partner Agency Assigned: Department of Planning and Development
- Time Frame: Short Term
- Cost Estimate: Staff Time
- Potential Funding Sources: City of Providence Budget
- Benefits: Increases institutional awareness of hazards for contractors and homeowners;
- Increases property protection and improves resiliency

4.2.3.6 Action 2024 - 6: Enforce Climate Change-Related Policies

- Category: Public Education and Awareness
- Description: The City will promote and support enforcement of the latest policy revisions related to climate change and distribute literature related to mitigation techniques including information from the Institute of Business and Home Safety, retrofit methodology (FEMA's library of technical bulletins), grant/loan sources, and insurance options.
- Hazard(s) Addressed: All Hazards
- Lead Agency Assigned: Department of Inspection and Standards
- Partner Agency Assigned: Department of Planning and Development
- Time Frame: Medium Term
- Cost Estimate: Staff Time
- Potential Funding Sources: City of Providence Budget
- Benefits: Increases institutional awareness of hazards for contractors and homeowners;
- Increases property protection and improves resiliency

4.2.3.7 Action 2024 - 7: Evaluate Flood Insurance Feasibility

- Category: Public Education and Awareness
- Description: As a densly populated urban center, the City of Providence not only is at risk of riverine and coastal flooding, but also urban flooding. Residents at risk of urban flooding are often less aware of the risk and uninformed about insurance options or lack the means to acquire flood insurance. The City should take the following steps:
  1. Educate the public about flood risk, especially urban flooding
  2. Conduct a study to determine resources to help fund flood insurance in underserved communities
  3. Re-evaluate the feasibility of CRS: The City evaluated the feasibility of enrolling in the CRS program in 2013, 2015, 2018, and 2024. In all instances, it was determined as not cost-beneficial to pursue enrolling given the lack of community interest, limited number of existing policies, and limited capacity of staff to complete.
- Hazard(s) Addressed: Coastal Flooding/Sea Level Rise; Riverine Flooding; Urban Flooding

- Lead Agency Assigned: Department of Inspection and Standards; Department of Planning and Development
- Partner Agency Assigned: Rhode Island Emergency Management Agency
- Time Frame: Medium Term
- Cost Estimate: Moderate
- Potential Funding Sources: City of Providence Budget
- Benefits: Increases institutional awareness of flooding hazards for homeowners; Lessens financial burden of recovery; Reduces flood insurance policy premiums

4.2.3.8 Action 2024 - 8: Hire a Municipal Certified Floodplain Manager

- Category: Public Education and Awareness
- Description: Personnel from the Inspection and Standards Department should become a Certified Floodplain Manager (CFM) through the Association of State Floodplain Managers and serve as the City's Floodplain Coordinator. In addition to providing floodplain coordination information to the public, a CFM can assist with floodplain mapping, certificates and floodplain mitigation alternatives.
- Hazard(s) Addressed: Coastal Flooding/Sea Level Rise; Riverine Flooding
- Lead Agency Assigned: Department of Inspection and Standards
- Partner Agency Assigned: Department of Planning and Development
- Time Frame: Short Term
- Cost Estimate: Staff Time
- Potential Funding Sources: City of Providence Budget
- Benefits: Provides expertise in floodplain management by bringing specialized knowledge and skills, ensuring that the City's floodplain management practices are effective and up-to-date; Reduces flood risk by developing and implementing flood mitigation strategies; Enhances planning and development by contributing to better planning and zoning decisions

4.2.3.9 Action 2024 - 9: Research Public and Private Partnership Incentives to Implement Mitigation

- Category: Public Education and Awareness
- Description: The City will research options and the feasibility of public/private partnership incentives to implement mitigation measures in coordination with local, state, and federal funding opportunities. Incentives could include tax incentives, cost-sharing, and regulatory streamlining or acceleration of the permit process for those who implement mitigation activities.
- Hazard(s) Addressed: All Hazards
- Lead Agency Assigned: Department of Inspection and Standards
- Partner Agency Assigned: Department of Planning and Development
- Time Frame: Medium Term
- Cost Estimate: Staff Time
- Potential Funding Sources: City of Providence Budget
- Benefits: Enhances resource allocation by leveraging partnerships to optimize the use of available resources; Increases project feasibility by providing additional financial and technical support;

Strengthens community resilience by combining the strengths and resources of public and private sectors

4.2.3.10 Action 2024 - 10: Upgrade the Sirens at the Port to Improve Alert and Warning

- Category: Public Education and Awareness
- Description: Involves replacing or enhancing the existing siren system to ensure more reliable and effective communication during emergencies. The upgrade could includes installing modern sirens with better sound coverage, increased volume, and advanced features such as voice messaging capabilities. The upgrade could also integrate the sirens with other emergency alert systems to provide a coordinated and comprehensive warning mechanism.
- Hazard(s) Addressed: CBRNE/Hazardous Materials Release
- Lead Agency Assigned: PEMA
- Partner Agency Assigned:
- Time Frame: Medium Term
- Cost Estimate: Significant
- Potential Funding Sources: City of Providence Budget; Hazard Mitigation Grant Program
- Benefits: Enhances emergency communication by providing clear and loud alerts, ensuring that all individuals in the Port area are promptly informed about emergencies; Enable quicker evacuations and responses, reducing the risk of injuries and fatalities during critical incidents; Creates a cohesive and efficient communication network, enhancing the overall effectiveness of emergency management efforts

4.2.3.11 Action 2024 - 11: Conduct an Assessment of Critical Buildings to Understand Existing Protections

- Category: Property Protection
- Description: Evaluate the safety measures, structural integrity, and resilience of key infrastructure within the City. This process includes inspecting buildings for compliance with current safety standards, identifying vulnerabilities, and assessing the effectiveness of existing protective and mitigation measures. The assessment will be carried out by professionals using a combination of on-site inspections, review of building plans, and consultations with building managers and emergency personnel. Action 2024 - 16 will create the list of buildings that require assessments.
- Hazard(s) Addressed: All Hazards
- Lead Agency Assigned: Department of Public Property
- Partner Agency Assigned: PEMA
- Time Frame: Long Term
- Cost Estimate: Significant
- Potential Funding Sources: City of Providence Budget
- Benefits: Provides the City with an understanding of known vulnerabilities; Improves preparedness by allowing for more informed planning and resource allocation to enhance the resilience of essential infrastructure

4.2.3.12 Action 2024 - 12: Conduct Risk Assessment of Coastal/Riverine Flooding and Stormwater Infrastructure

- Category: Property Protection
- Description: Identify at-risk structures, then develop projects and/or policies to address risks and establish process for maintenance of stormwater ponds.
- Hazard(s) Addressed: Coastal Flooding/Sea Level Rise; Riverine Flooding
- Lead Agency Assigned: Department of Public Works; Narragansett Bay Commission
- Partner Agency Assigned: Rhode Island Department of Environmental Management
- Time Frame: Long Term
- Cost Estimate: Moderate
- Potential Funding Sources: Pre-Disaster Mitigation Program; Hazard Mitigation Grant Program
- Benefits: Identifies vulnerabilities by assessing the risk of coastal and riverine flooding and evaluating the current condition of stormwater infrastructure, allowing for targeted improvements; Informs mitigation strategies by providing detailed risk analysis, enabling the development of effective and prioritized mitigation measures to protect against flooding; Supports grant applications by providing documented risk assessments that can strengthen applications for funding and grants aimed at flood mitigation and infrastructure improvements

4.2.3.13 Action 2024 - 13: Create a Post-Earthquake Dam Inspection Process

- Category: Property Protection
- Description: Develop a structured protocol for assessing the integrity and safety of dams immediately following an earthquake. This process includes predefined steps for rapid mobilization of inspection teams, detailed checklists for evaluating structural damage, and criteria for determining the urgency of repairs. It also involves training personnel in earthquake-specific inspection techniques, establishing communication channels for reporting findings, and coordinating with emergency management agencies to ensure swift and effective response.
- Hazard(s) Addressed: Dam Inundation; Earthquake; Riverine Flooding
- Lead Agency Assigned: Department of Public Works
- Partner Agency Assigned: PEMA
- Time Frame: Medium Term
- Cost Estimate: Staff Time
- Potential Funding Sources: City of Providence Budget; Emergency Management Performance Grant
- Benefits: Enhances safety as prompt inspections ensure that any damage to dams is quickly identified and addressed, reducing the risk of dam failures and subsequent flooding; Improves preparedness through trained personnel with defined plans; Increases public trust in the City's ability to manage and mitigate the impacts of natural disasters

4.2.3.14 Action 2024 - 14: Create a Prioritized Investment List to Harden Critical Buildings

- Category: Property Protection

- Description: Identify and rank the most essential structures that require upgrades and reinforcements to withstand various hazards. This process includes analyzing the assessment conducted in Action 2024 - 11, estimating the cost of necessary improvements, and determining the potential benefits of these investments. The resulting list will guide the allocation of resources to enhance the resilience of critical infrastructure, ensuring that the most crucial buildings receive attention first. The list will also be used to inform the City's Capital Improvement Plan.
- Hazard(s) Addressed: All Hazards
- Lead Agency Assigned: Department of Public Property
- Partner Agency Assigned: PEMA
- Time Frame: Long Term
- Cost Estimate: Significant
- Potential Funding Sources: City of Providence Budget
- Benefits: Optimizes resource allocation by ensuring that limited resources are directed towards the most critical and vulnerable buildings; Strengthens critical buildings to reduce their susceptibility to damage, ensuring continuity of essential services during and after emergencies; Provides a clear roadmap for future infrastructure improvements, facilitating long-term planning and decision-making

4.2.3.15 Action 2024 - 15: Create an All-Hazards Design Standard for Critical Buildings Undergoing Renovations

- Category: Property Protection
- Description: Develop comprehensive guidelines to ensure that renovated structures are resilient against a wide range of potential hazards. This standard will encompass design principles that address natural, human-caused, and technological risks and are intended to optimize the City's resources and efforts; while critical buildings are already undergoing renovations (e.g. because of vulnerabilties identified in Action 2024 - 11), ensure the building incorporates additional, easily implemented standards to mitigate against potential hazards.
- Hazard(s) Addressed: All Hazards
- Lead Agency Assigned: Department of Public Property
- Partner Agency Assigned: Department of Planning and Development; PEMA
- Time Frame: Long Term
- Cost Estimate: Staff Time
- Potential Funding Sources: City of Providence Budget
- Benefits: Provides standardization in resiliency measures in critical buildings; Increases cost efficiency by taking advantage of existing construction activities and minimizing the need for separate, future projects

4.2.3.16 Action 2024 - 16: Create an Inventory of Critical Buildings

- Category: Property Protection
- Description: Create a list of critical buildings essential to the functioning of the City, including hospitals, fire stations, police stations, schools, government buildings, and major utility facilities. The

process may include gathering data through surveys, inspections, and consultations with various stakeholders.
- Hazard(s) Addressed: All Hazards
- Lead Agency Assigned: Department of Public Property
- Partner Agency Assigned: PEMA
- Time Frame: Short Term
- Cost Estimate: Staff Time
- Potential Funding Sources: City of Providence Budget
- Benefits: Helps in assessing vulnerabilities and implementing targeted measures to protect the essential structures from various hazards; Allows emergency services to quickly locate and prioritize critical buildings during disasters, enhancing the efficiency and effectiveness of the response

4.2.3.17 Action 2024 - 17: Digitize Vital Municipal Documents

- Category: Property Protection
- Description: The City currently stores vital municipal documents in locations susceptible to damage or destruction (e.g. within flood zones, in condemned buildings, etc.). The City needs to digitize the documents to prevent damage or destruction these documents.
- Hazard(s) Addressed: All Hazards
- Lead Agency Assigned: City Archivist; Department of Public Property; Law Department Public Records Unit
- Partner Agency Assigned: Department of Planning and Development
- Time Frame: Medium Term
- Cost Estimate: Moderate
- Potential Funding Sources: City of Providence Budget; Hazard Mitigation Grant Program
- Benefits: Ensures document preservation by protecting vital municipal records from physical damage, loss, or deterioration; Enhances accessibility by making documents easily searchable and retrievable; Facilitates compliance by ensuring that records management practices meet regulatory and legal requirements

4.2.3.18 Action 2024 - 18: Provide Generators at Various Critical Buildings

- Category: Property Protection
- Description: Install backup power systems to ensure continuous operation during power outages. These generators will be strategically placed at essential facilities based on the list of vulnerabilities determined in the above mitigation action.
- Hazard(s) Addressed: All Hazards
- Lead Agency Assigned: Department of Public Property
- Partner Agency Assigned: PEMA
- Time Frame: Long Term
- Cost Estimate: Significant
- Potential Funding Sources: City of Providence Budget; Hazard Mitigation Grant Program

- Benefits: Ensures continuous power supply during outages to maintain essential services such as healthcare, emergency response, and public safety, reducing the risk to human life and property and improving operational efficiency; Allows for cost savings by preventing operational downtime and potential damage to sensitive equipment; Boosts public trust in the City's ability to manage crises effectively and provide necessary services without interruption

4.2.3.19 Action 2024 - 19: Relocate Vital Municipal Documents

- Category: Property Protection
- Description: The City currently stores vital municipal documents in locations susceptible to damage or destruction (e.g. within flood zones, in condemned buildings, etc.). The City needs to find new locations not susceptible to damage or destruction to store these documents.
- Hazard(s) Addressed: All Hazards
- Lead Agency Assigned: City Archivist; Department of Public Property; Law Department Public Records Unit
- Partner Agency Assigned: Department of Planning and Development
- Time Frame: Medium Term
- Cost Estimate: Significant
- Potential Funding Sources: City of Providence Budget; Hazard Mitigation Grant Program
- Benefits: Ensures document preservation by protecting vital municipal records from physical damage, loss, or deterioration; Ensures compliance by meeting regulatory and legal requirements for document storage and protection

4.2.3.20 Action 2024 - 20: Facilitate Water Supply Redundancy Across Districts

- Category: Natural Resource Protection
- Description: Assist water suppliers in developing local emergency interconnection programs. Emergency water system interconnections provide redundancy of supply and the ability to address water emergencies rapidly and efficiently across water supply districts particularly in small systems throughout the State.
- Hazard(s) Addressed: CBRNE/Hazardous Materials Release; Drought; Extreme Heat; Infrastructure/Utility Failure
- Lead Agency Assigned: Rhode Island Water Resources Board
- Partner Agency Assigned: Rhode Island Department of Health
- Time Frame: Long Term
- Cost Estimate: Staff Time
- Potential Funding Sources: Drinking Water State Revolving Fund
- Benefits: Ensures continuous water supply by creating multiple sources and backup systems, preventing disruptions in water service during emergencies or maintenance activities; Increases resilience by diversifying water supply sources and infrastructure

4.2.3.21 Action 2024 - 21: Identify Erosion Mitigation Strategies in the Shoreline Areas

- Category: Natural Resource Protection

- Description: Identify the potential for developing erosion mitigation strategies for shoreline areas including India Point, Richmond Square, and the Seekonk River along River Drive
- Hazard(s) Addressed: Coastal Flooding/Sea Level Rise; Riverine Flooding
- Lead Agency Assigned: Department of Parks; Department of Planning and Development; Department of Public Works
- Partner Agency Assigned: Rhode Island Coastal Resources Management Council
- Time Frame: Medium Term
- Cost Estimate: Moderate
- Potential Funding Sources: City of Providence Budget; Ocean State Climate Adaptation and Resilience Fund; Narragansett Bay and Water Restoration Fund
- Benefits: Protects coastal infrastructure and reduces property damage; Preserves natural habitats; Improves water quality

4.2.3.22 Action 2024 - 22: Minimize Impervious Surface Coverage throughout the City

- Category: Natural Resource Protection
- Description: Minimize impervious surfaces within the City to decrease the impacts of flooding and extreme heat (heat island effect). This could involve replacing traditional concrete and asphalt with permeable pavements in public spaces, incentivizing the installation of green roofs on commercial and residential buildings, and expanding green spaces and tree canopies through urban planning initiatives. Implementation could be supported by revising building codes, offering tax incentives, and creating educational campaigns to promote the adoption of these practices by private property owners.
- Hazard(s) Addressed: Extreme Heat; Urban Flooding
- Lead Agency Assigned: Department of Planning and Development
- Partner Agency Assigned: Department of Sustainability
- Time Frame: Medium Term
- Cost Estimate: Moderate
- Potential Funding Sources: City of Providence Budget; Stormwater Project Accelerator; Narragansett Bay and Water Restoration Fund
- Benefits: Reduces flooding risk and heat island effects; Enhances aesthetic appeal by incorporating more green spaces and natural landscapes; Improves water quality by filtering pollutants through soil and vegetation; Improves air quality by increasing vegetation

4.2.3.23 Action 2024 - 23: Support Resilient Strategies for NBC's Facilities

- Category: Structural Projects
- Description: NBC is currently developing a climate resiliency plan to ensure the continuity of their operations based on SLR and climate change projections anticipated for the City of Providence and Rhode Island.
- Hazard(s) Addressed: Coastal Flooding/Sea Level Rise
- Lead Agency Assigned: Narragansett Bay Commission
- Partner Agency Assigned: Department of Public Works; Department of Sustainability

- Time Frame: Medium Term
- Cost Estimate: Staff Time
- Potential Funding Sources: Narragansett Bay Commission
- Benefits: Enhances operational continuity; Encourages innovation by adopting advanced technologies and practices that improve resilience; Increases preparedness by focusing on future conditions

4.2.3.24 Action 2024 - 24: Develop Partnerships for Business Continuity Plans

- Category: Emergency Services
- Description: PEMA, in coordination with the Rhode Island Alliance for Business will develop strategies to help local businesses in flood prone areas recover from the effects of a natural disaster.
- These strategies will include organizing business owners for collective clean-up of their properties after a disaster and the creation of a list of businesses and the people connected with those businesses that are authorized to enter the businesses in the period immediately following a disaster. The Police Department will develop criteria for determining when safety considerations outweigh the rights of a given business owner to access their property.
- Hazard(s) Addressed: Coastal Flooding/Sea Level Rise; Riverine Flooding; Urban Flooding
- Lead Agency Assigned: PEMA
- Partner Agency Assigned: Rhode Island Alliance for Business
- Time Frame: Medium Term
- Cost Estimate: Staff Time
- Potential Funding Sources: Private Funds
- Benefits: Accelerates recovery times and minimizes financial loss from disruption of services; Fosters public and private partnerships within the City

4.2.3.25 Action 2024 - 25: Enhance Coordination between City and Wireless Providers via the State

- Category: Emergency Services
- Description: Wireless providers have capabilities during emergencies that could allow for enhanced emergency services and recovery, such as establishing virtual bridges, sharing 24/7 monitoring of coverage and internal plans during emergencies, linking network assets to shelters and gathering locations, and sharing deployable assets during emergencies, such as mobile cell towers and generators. These capabilities are typically coordinated at the State-level, but no process is in place in the City to effectively communicate with the State. Develop a process to understand information from the State
- Hazard(s) Addressed: All Hazards
- Lead Agency Assigned: PEMA
- Partner Agency Assigned: Rhode Island Emergency Management Agency; Wireless Providers
- Time Frame: Medium Term
- Cost Estimate: Staff Time
- Potential Funding Sources: City of Providence Budget; Private Funds

- Benefits: Expedites recovery and increases continuity of operations; Fosters public and private partnerships within the City and State

4.2.3.26 Action 2024 - 26: Evaluate Long-Term Solution for Flooding at Atwells Avenue Fire Station

- Category: Emergency Services
- Description: The City's fire station on Atwells Avenue at Valley Street is in a floodplain and floods periodically.
- Hazard(s) Addressed: Riverine Flooding
- Lead Agency Assigned: Providence Fire Department
- Partner Agency Assigned: PEMA
- Time Frame: Medium Term
- Cost Estimate: Staff Time
- Potential Funding Sources: City of Providence Budget; Hazard Mitigation Grant Program
- Benefits: Minimize flood losses and damages; Increase continuity of operations

4.2.3.27 Action 2024 - 27: Maintain a Working Relationship with the Fusion Center and Continue to Invest in Technology, Techniques, and Systems

- Category: Emergency Services
- Description: The Fusion Center, a hub for intelligence and information gathering, plays a critical role in coordinating efforts among various agencies. The Providence Police Department should maintain ongoing collaboration and resource allocation to enhance information sharing and emergency response capabilities. A working relationship includes regular communication, joint training exercises, and technological upgrades to ensure effective data sharng, analysis of threats, and response to emergencies. Investment in advanced technologies and systems supports the continuous improvement of these collaborative efforts.
- Hazard(s) Addressed: Civil Disturbance/Unrest; Terrorism/Active Threat
- Lead Agency Assigned: Providence Police Department
- Partner Agency Assigned:
- Time Frame: Medium Term
- Cost Estimate: Staff Time
- Potential Funding Sources: City of Providence Budget
- Benefits: Improves coordination and information sharing between the Fusion Center and the Providence Police Department for better identification and management of potential threats, enhancing overall security; Ensures that emergency responders have access to real-time data and advanced tools, facilitating faster and more effective responses to incidents; Fosters a unified approach to public safety; Allows for more accurate and timely detection of emerging threats, reducing the risk of incidents

4.2.3.28 Action 2024 - 28: Acquire Repetitive Loss Properties

- Category: Planning and Prevention

- Description: The City has 24 repetitive loss properties and 7 severe repetitive loss properties. The City should work with private property owners in these areas and FEMA on acquisition projects, on obtaining approval by the State and FEMA, and on seeking funding to purchase the properties. By purchasing these residential properties, the City is utilizing an effective program designed to move people and property away from high-risk areas to reduce disaster losses. The buildings are either demolished or relocated, and the land is then restricted to open space, recreation, or wetlands in perpetuity.
- Hazard(s) Addressed: Coastal Flooding/Sea Level Rise; Riverine Flooding
- Lead Agency Assigned: Law Department
- Partner Agency Assigned: Department of Planning and Development; PEMA; Rhode Island Emergency Management Agency
- Time Frame: Long Term
- Cost Estimate: Significant
- Potential Funding Sources: City of Providence Budget; Hazard Mitigation Grant Program
- Benefits: Reduces flooding losses and damages; Increases open spaces, green spaces, and recreational spaces

4.2.3.29 Action 2024 - 29: Conduct Future Stormwater Analysis

- Category: Planning and Prevention
- Description: A long term, sustainable solution to stormwater management is needed City-wide due to real, growing, shared and unresolved challenges in managing stormwater. The City should conduct a study to evaluate future stormwater demand and capacity throughout the City. The study should take a comprehensive look at stormwater to see what changes are needed (e.g. ordiances, etc.).
- Hazard(s) Addressed: Urban Flooding
- Lead Agency Assigned: Department of Sustainability
- Partner Agency Assigned:
- Time Frame: Medium Term
- Cost Estimate: Minimal
- Potential Funding Sources: City of Providence Budget; Stormwater Project Accelerator; Narragansett Bay and Water Restoration Fund
- Benefits: Improves flood risk management by identifying potential flooding areas and developing effective mitigation strategies to prevent and manage flood events; Enhances infrastructure planning and resiliency by providing data that informs the design and construction of stormwater systems, ensuring they can handle future storm events

4.2.3.30 Action 2024 - 30: Continue to Train and Update Plan Policies and Protocols Based on National Best Practices and Lessons Learned

- Category: Planning and Prevention
- Description: Continue to refine and enhance the plans and protocols regarding cybersecurity developed in the above action based on national best practices and lessons learned. Updates will reflect the latest national guidelines and integrate lessons learned from past incidents and exercises.

Updates will also coincide with continuous training for staff to ensure they are well-versed in current best practices and capable of responding effectively to emergencies.

- Hazard(s) Addressed: Cybersecurity
- Lead Agency Assigned: Information Technology Department
- Partner Agency Assigned:
- Time Frame: Medium Term
- Cost Estimate: Staff Time
- Potential Funding Sources: City of Providence Budget; Emergency Management Performance Grant
- Benefits: Ensures that the City's emergency response strategies are current and effective, improving overall preparedness; Ensures that staff are knowledgeable and skilled in the latest best practices, leading to more efficient and effective responses during emergencies; Increases adaptability by integrating lessons learned from past incidents

4.2.3.31 Action 2024 - 31: Create a City-Wide Stormwater Master Plan

- Category: Planning and Prevention
- Description: Develop a comprehensive strategy for managing stormwater across the entire City. This Plan will assess current stormwater infrastructure, but will focus mainly on future conditions to ensure the City is prepared for the changing climate and demands. The Plan will incorporate best practices for sustainable stormwater management, such as green infrastructure, improved drainage systems, and enhanced maintenance protocols. The Plan will also outline funding mechanisms, regulatory compliance measures, and community engagement strategies to ensure successful implementation and long-term sustainability.
- Hazard(s) Addressed: Urban Flooding
- Lead Agency Assigned: Department of Public Works
- Partner Agency Assigned:
- Time Frame: Medium Term
- Cost Estimate: Moderate
- Potential Funding Sources: City of Providence Budget; Stormwater Project Accelerator; Narragansett Bay and Water Restoration Fund
- Benefits: Encourages preparedness and mitigation to avoid future flooding damage and recovery; Ensures a coordinated approach for the City; Allows for prioritization of projects and efficient allocation of resources; Helps manage stormwater in an environmentally friendly way, improving water quality and supporting urban ecosystems

4.2.3.32 Action 2024 - 32: Create Energy Security Plan

- Category: Planning and Prevention
- Description: The City should create an energy security plan. The plan should address risks specific to discrete critical infrastructure assets as smart energy security investments at these locations and energy resilience solutions could alleviate the impacts of power outages and fuel supply disruptions in energy emergencies (i.e. backup generation, fuel reserves, distributed generation, combined heat

and power, energy storage, and microgrids). The plan should recognize differences in future conditions from climate change.
- Hazard(s) Addressed: Electrification; Infrastructure/Utility Failure
- Lead Agency Assigned: Department of Planning and Development
- Partner Agency Assigned: Utility Providers
- Time Frame: Long Term
- Cost Estimate: Staff Time
- Potential Funding Sources: City of Providence Budget; Emergency Management Performance Grant
- Benefits: Ensures reliable power supply by developing strategies to maintain consistent energy availability, preventing disruptions during emergencies; Enhances public safety by ensuring that essential services, such as healthcare and emergency response, have access to reliable power during crises; Encourages technological innovation by promoting the adoption of advanced energy technologies and smart grid solutions

4.2.3.33 Action 2024 - 33: Develop a Flood Resiliency Plan for Woonasquatucket River

- Category: Planning and Prevention
- Description: The Woonasquatucket River corridor is a recreational and natural resource amenity for residents, workers and businesses in the City of Providence. The corridor floods periodically jeopardizing public access, recreation opportunities and habitat for wildlife.
- Hazard(s) Addressed: Riverine Flooding
- Lead Agency Assigned: Department of Sustainability; PEMA
- Partner Agency Assigned: Woonasquatucket River Watershed Council
- Time Frame: Medium Term
- Cost Estimate: Significant
- Potential Funding Sources: City of Providence Budget; Ocean State Climate Adaptation and Resilience Fund; Narragansett Bay and Water Restoration Fund
- Benefits: Reduces flood risk and losses by implementing measures to prevent and manage flooding; Minimizes disturbance
- to wildlife habitat; Increases continuity of operations

4.2.3.34 Action 2024 - 34: Develop a Climate Resilience Checklist

- Category: Planning and Prevention
- Description: Create a climate change resilience checklist for all new construction and major rehabilitation projects so that developers are informed and consider long term impacts.
- Hazard(s) Addressed: All Hazards
- Lead Agency Assigned: Department of Planning and Development; Department of Sustainability
- Partner Agency Assigned: Department of Inspection and Standards
- Time Frame: Medium Term
- Cost Estimate: Staff Time
- Potential Funding Sources: City of Providence Budget; Hazard Mitigation Grant Program

- Benefits: Enhances preparedness and reduces vulnerability by providing a comprehensive guide for individuals and organizations to assess and improve their readiness for climate-related events; Supports informed decision-making by offering clear criteria and guidelines, helping stakeholders make better choices to enhance resilience; Improves public awareness by educating the community about climate risks and resilience strategies

4.2.3.35 Action 2024 - 35: Encourage Port-Area Businesses to Participate in Green Marine

- Category: Planning and Prevention
- Description: Support development of green port initiatives designed to encourage port operators to adopt best practices in areas such as stormwater management, green infrastructure, renewable energy, energy conservation, air quality, habitat protection, living shorelines, public access, and future climate change considerations for operations and expansion plans.
- Hazard(s) Addressed: All Hazards
- Lead Agency Assigned: Department of Planning and Development; Department of Sustainability
- Partner Agency Assigned: Environmental Protection Agency; Harbor Management Commission; Rhode Island Department of Environmental Management
- Time Frame: Medium Term
- Cost Estimate: Staff Time
- Potential Funding Sources: City of Providence Budget
- Benefits: Reduces environmental impact by promoting sustainable practices and reducing pollution in port areas; Improves operational efficiency by adopting green practices that often lead to cost savings through more efficient use of resources and energy; Supports economic growth by promoting a sustainable port area that can attract investment and development opportunities

4.2.3.36 Action 2024 - 36: Enhance Plans and Protocols Regarding Cybersecurity

- Category: Planning and Prevention
- Description: Develop and implement comprehensive strategies to protect the City's digital infrastructure from cyber threats. Enhancements could include updating existing cybersecurity policies, conducting regular risk assessments, and implementing advanced security measures such as multi-factor authentication, encryption, and intrusion detection systems. It also could involve training employees on cybersecurity best practices, establishing incident response plans, and collaborating with cybersecurity experts to stay ahead of emerging threats.
- Hazard(s) Addressed: Cybersecurity
- Lead Agency Assigned: Information Technology Department
- Partner Agency Assigned:
- Time Frame: Medium Term
- Cost Estimate: Staff Time
- Potential Funding Sources: City of Providence Budget
- Benefits: Protects sensitive data and critical systems from breaches, malware, and other cyber threats, ensuring the integrity and confidentiality of information; Prevents disruptions to essential

services, maintaining the continuous operation of City functions even during cyber incidents; Increases employee awareness of cybersecurity threats and best practices, reducing the risk of human error and insider threats

4.2.3.37 Action 2024 - 37: Establish a Maintenance Standard for Dredging of the Pleasant Valley Parkway

- Category: Planning and Prevention
- Description: Create a systematic plan for regularly removing sediment and debris from the water channels of the Pleasant Valley Parkway. This plan will define the frequency, methods, and areas for dredging, ensuring clear and functional waterways. It will include environmentally responsible practices, sediment quality assessments, and proper disposal methods. Additionally, it will outline monitoring procedures to evaluate the effectiveness and impact of the dredging efforts.
- Hazard(s) Addressed: Riverine Flooding
- Lead Agency Assigned: Department of Public Works
- Partner Agency Assigned:
- Time Frame: Short Term
- Cost Estimate: Minimal
- Potential Funding Sources: City of Providence Budget
- Benefits: Ensures proper and prolonged maintenance; Allows for better standardization of practices and evaluation of efficacy

4.2.3.38 Action 2024 - 38: Host Workshop or Tabletop Exercise on Climate Change Projections

- Category: Planning and Prevention
- Description: Within each Plan update cycle, the City should host a workshop or tabletop exercise that provides an engaging way for decision-makers to understand long-term climate risks, conduct vulnerability assessments, prioritize assets, and mitigate impacts.
- Hazard(s) Addressed: All Hazards
- Lead Agency Assigned: Department of Sustainability; PEMA
- Partner Agency Assigned: Department of Planning and Development
- Time Frame: Short Term
- Cost Estimate: Staff Time
- Potential Funding Sources: City of Providence Budget
- Benefits: Enhances understanding by educating participants about the latest climate change projections and their potential impacts on the City; improves preparedness by allowing stakeholders to explore and develop response strategies to anticipated climate-related events, enhancing overall resilience; Encourages collaboration by bringing together diverse stakeholders to discuss and coordinate climate adaptation efforts; Supports informed decision-making by providing data and scenarios that help policymakers and planners make better choices to address future climate challenges

4.2.3.39 Action 2024 - 39: Regularly Dredge the Pleasant Valley Parkway

- Category: Planning and Prevention
- Description: Perform the dredging of the Pleasant Valley Parkway based on the standards and planning established in the above action.
- Hazard(s) Addressed: Riverine Flooding
- Lead Agency Assigned: Department of Public Works
- Partner Agency Assigned:
- Time Frame: Long Term
- Cost Estimate: Significant
- Potential Funding Sources: City of Providence Budget; Ocean State Climate Adaptation and Resilience Fund; Narragansett Bay and Water Restoration Fund
- Benefits: Enhances stormwater capacity, reducing flood risks and protecting properties and infrastructure; Removes sediment and debris to improve the water quality by reducing pollutants and preventing the buildup of harmful substances

4.2.3.40 Action 2024 - 40: Regularly Exercise the Fox Point Hurricane Barrier Road Plates

- Category: Planning and Prevention
- Description: Regularly exercise the Fox Point Hurricane Barrier road plates to ensure the plates are operational and maintained. Exercises can involve scheduled drills to ensure that the road plates can be quickly and effectively deployed when needed as well as inspections and applicable repairs of the plates.
- Hazard(s) Addressed: Coastal Flooding/Sea Level Rise; Hurricane
- Lead Agency Assigned: City of Providence
- Partner Agency Assigned:
- Time Frame: Short Term
- Cost Estimate: Staff Time
- Potential Funding Sources: City of Providence Budget
- Benefits: Enhances readiness by ensuring the plates can be rapidly deployed in a hazard event; Improves reliability and lifespan as systematic maintenance and testing help identify and address potential issues before they become critical

4.2.3.41 Action 2024 - 41: Review and Update Plans, Policies and Procedures Regarding Storage of Battery Powered Mobility Devices

- Category: Planning and Prevention
- Description: Involves a thorough evaluation and enhancement of existing guidelines to ensure the safe storage of battery powered mobility devices. The review and updates include assessing current storage practices, identifying potential hazards, and incorporating the latest safety standards and technological advancements. Updated plans will provide clear instructions on safe storage locations, proper maintenance, fire prevention measures, and emergency response protocols.
- Hazard(s) Addressed: Conflagration; Electrification

- Lead Agency Assigned: Providence Fire Department
- Partner Agency Assigned:
- Time Frame: Medium Term
- Cost Estimate: Staff Time
- Potential Funding Sources: City of Providence Budget; Fire Prevention and Safety Grant
- Benefits: Helps mitigate risks associated with the storage of battery-powered mobility devices, reducing the likelihood of fires and other accidents; Promotes awareness and best practices among users and facility managers, fostering a culture of safety

4.2.3.42 Action 2024 - 42: Understand and Address Impacts to Transportation Assets

- Category: Planning and Prevention
- Description: Assess and address the impact of changing conditions, like climate change and the Washington Bridge construction on City transportation assets.
- Hazard(s) Addressed: All Hazards
- Lead Agency Assigned: Rhode Island Department of Transportation
- Partner Agency Assigned: Department of Planning and Development; Department of Public Works
- Time Frame: Medium Term
- Cost Estimate: Moderate
- Potential Funding Sources: Transportation Improvement Plan
- Benefits: Enhances infrastructure resilience and safety by identifying vulnerabilities in transportation assets and implementing measures to protect them from climate-related and other impacts; Supports efficient transportation by maintaining and improving the functionality of transportation assets; Facilitates informed planning by providing data and insights that guide future investments and improvements in transportation infrastructure; Enhances community connectivity by maintaining and improving transportation routes

4.2.3.43 Action 2024 - 43: Understand the Future Efficacy of the Hurricane Barrier

- Category: Planning and Prevention
- Description: The City of Providence, in collaboration with USACE, continues to investigate the impacts of climate change on the frequency of flood events within the City, more recently with a focus on the Fox Point Hurricane Barrier. The USACE leads the analyses and reports. The City should continue to work with USACE to understand the efficacy of Hurricane Barrier, especially with regards to changing conditions, like sea-level rise.
- Hazard(s) Addressed: Coastal Flooding/Sea Level Rise; Hurricane
- Lead Agency Assigned: City of Providence
- Partner Agency Assigned: United States Army Corp of Engineers
- Time Frame: Short Term
- Cost Estimate: Staff Time
- Potential Funding Sources: City of Providence Budget; Ocean State Climate Adaptation and Resilience Fund

- Benefits: Enhances flood protection and community safety by assessing the current and future effectiveness of the FPHB, ensuring it can withstand anticipated storm intensities and sea level rise; Improves planning and maintenance by identifying potential weaknesses or required upgrades

4.2.4 Prioritization of Mitigation Actions

Each of the mitigation actions was given a priority score based on the expected time frame and cost of the action. Actions with lower financial and time requirements were given higher priority scores. The benefits of each action were also qualitatively evaluated to compare costs versus benefits. A more detailed cost-benefit analysis that determines the future risk reduction benefits of a hazard mitigation project and compares those benefits to its costs will be conducted at the time of application for those proposed mitigation actions that the City may apply for FEMA funding for. Applicants and sub-applicants must use FEMA approved methodologies and tools, such as the Benefit-Cost Analysis Toolkit, to demonstrate the cost-effectiveness of their projects. The result is a Benefit-Cost Ratio, and a project is considered cost effective when the Benefit-Cost Ratio is 1.0 or greater. Depending on the project, either a full Benefit-Cost Analysis will be completed by entering documented values into the FEMA Benefit-Cost Analysis Toolkit, which calculates a benefit-cost ratio or, if the project meets specified criteria, a streamlined Benefit-Cost Analysis may be completed (FEMA's cost-effectiveness requirement is never waived).

Table 4-3 provides the priority scoring from the matrix between cost and time frame. Table 4-4 lists the mitigation actions with their identified score.

Table 4-3. Priority matrix based on cost and time frame

	Staff Time	Minimal	Moderate	Significant
Short Term	1	2	3	4
Medium Term	2	3	4	5
Long Term	3	4	5	6

Table 4-4. Mitigation actions with priority scores

2024 Action Number	Title	Time Frame	Cost Estimate	Prioritization Score	Benefits
2024 - 2	Create a Public Outreach Program on Floodplain Compliance	Short Term	Staff Time	1	Increases public awareness by educating residents about floodplain regulations and the importance of compliance, leading to better community understanding and engagement; Enhances regulatory compliance; Promotes responsible development; Reduces risk by informing property owners and residents about how to

2024 Action Number	Title	Time Frame	Cost Estimate	Prioritization Score	Benefits
					protect themselves and their properties from flood risks
2024 - 4	Create and Update a Lithium Ion Battery Outreach Campaign	Short Term	Staff Time	1	Increases public safety through public education; Enhances community awareness in how to handle and respond to potential hazards associated with lithium-ion batteries, leading to reduced incidents and better response; Reduces the burden on emergency services by preventing incidents and promoting community resilience; Fosters community involvement and responsibility, encouraging residents to participate in safety and environmental initiatives
2024 - 5	Educate Homeowners and Contractors on the Benefits of Current Standards	Short Term	Staff Time	1	Increases institutional awareness of hazards for contractors and homeowners; Increases property protection and improves resiliency
2024 - 8	Hire a Municipal Certified Floodplain Manager	Short Term	Staff Time	1	Provides expertise in floodplain management by bringing specialized knowledge and skills, ensuring that the City's floodplain management practices are effective and up-to-date; Reduces flood risk by developing and implementing flood mitigation strategies; Enhances planning and development by contributing to better planning and zoning decisions
2024 - 16	Create an Inventory of Critical Buildings	Short Term	Staff Time	1	Helps in assessing vulnerabilities and implementing targeted measures to protect the essential structures from various hazards; Allows emergency services to quickly locate and prioritize critical buildings during disasters, enhancing the efficiency and effectiveness of the response
2024 - 38	Host Workshop or Tabletop Exercise on Climate Change Projections	Short Term	Staff Time	1	Enhances understanding by educating participants about the latest climate change projections and their potential impacts on the City; improves preparedness by allowing stakeholders to explore and develop response strategies to anticipated climate-related events, enhancing overall resilience; Encourages collaboration by bringing

2024 Action Number	Title	Time Frame	Cost Estimate	Prioritization Score	Benefits
					together diverse stakeholders to discuss and coordinate climate adaptation efforts; Supports informed decision-making by providing data and scenarios that help policymakers and planners make better choices to address future climate challenges
2024 - 40	Regularly Exercise the Fox Point Hurricane Barrier Road Plates	Short Term	Staff Time	1	Enhances readiness by ensuring the plates can be rapidly deployed in a hazard event; Improves reliability and lifespan as systematic maintenance and testing help identify and address potential issues before they become critical
2024 - 43	Understand the Future Efficacy of the Hurricane Barrier	Short Term	Staff Time	1	Enhances flood protection and community safety by assessing the current and future effectiveness of the FPHB, ensuring it can withstand anticipated storm intensities and sea level rise; Improves planning and maintenance by identifying potential weaknesses or required upgrades
2024 - 1	Collaborate with RIEMA and RIDOT on Evacuation Efforts and Education	Short Term	Staff Time	2	Provides protection of life; Increases institutional awareness of hazards; Accelerates evacuation
2024 - 3	Create an "Adopt a Storm Drain" Program	Medium Term	Staff Time	2	Improves drainage efficiency in storm drains, enhancing the ability to manage stormwater and reducing the risk of localized flooding; Fosters a sense of community ownership and responsibility, encouraging residents to take an active role in maintaining their neighborhoods; Reduces maintenance costs by leveraging volunteer efforts
2024 - 6	Enforce Climate Change-Related Policies	Medium Term	Staff Time	2	Increases institutional awareness of hazards for contractors and homeowners; Increases property protection and improves resiliency
2024 - 9	Research Public and Private Partnership Incentives to Implement Mitigation	Medium Term	Staff Time	2	Enhances resource allocation by leveraging partnerships to optimize the use of available resources; Increases project feasibility by providing additional financial and technical support; Strengthens community resilience by combining the strengths and resources of public and private sectors

2024 Action Number	Title	Time Frame	Cost Estimate	Prioritization Score	Benefits
2024 - 13	Create a Post-Earthquake Dam Inspection Process	Medium Term	Staff Time	2	Enhances safety as prompt inspections ensure that any damage to dams is quickly identified and addressed, reducing the risk of dam failures and subsequent flooding; Improves preparedness through trained personnel with defined plans; Increases public trust in the City's ability to manage and mitigate the impacts of natural disasters
2024 - 23	Support Resilient Strategies for NBC's Facilities	Medium Term	Staff Time	2	Enhances operational continuity; Encourages innovation by adopting advanced technologies and practices that improve resilience; Increases preparedness by focusing on future conditions
2024 - 24	Develop Partnerships for Business Continuity Plans	Medium Term	Staff Time	2	Accelerates recovery times and minimizes financial loss from disruption of services; Fosters public and private partnerships within the City
2024 - 25	Enhance Coordination between City and Wireless Providers via the State	Medium Term	Staff Time	2	Expedites recovery and increases continuity of operations; Fosters public and private partnerships within the City and State
2024 - 26	Evaluate Long-Term Solution for Flooding at Atwells Avenue Fire Station	Medium Term	Staff Time	2	Minimize flood losses and damages; Increase continuity of operations
2024 - 27	Maintain a Working Relationship with the Fusion Center and Continue to Invest in Technology, Techniques, and Systems	Medium Term	Staff Time	2	Improves coordination and information sharing between the Fusion Center and the Providence Police Department for better identification and management of potential threats, enhancing overall security; Ensures that emergency responders have access to real-time data and advanced tools, facilitating faster and more effective responses to incidents; Fosters a unified approach to public safety; Allows for more accurate and timely detection of emerging threats, reducing the risk of incidents
2024 - 30	Continue to Train and Update Plan Policies and Protocols Based on	Medium Term	Staff Time	2	Ensures that the City's emergency response strategies are current and effective, improving overall preparedness; Ensures that staff are knowledgeable and skilled in

2024 Action Number	Title	Time Frame	Cost Estimate	Prioritization Score	Benefits
	National Best Practices and Lessons Learned				the latest best practices, leading to more efficient and effective responses during emergencies; Increases adaptability by integrating lessons learned from past incidents
2024 - 34	Develop a Climate Resilience Checklist	Medium Term	Staff Time	2	Enhances preparedness and reduces vulnerability by providing a comprehensive guide for individuals and organizations to assess and improve their readiness for climate-related events; Supports informed decision-making by offering clear criteria and guidelines, helping stakeholders make better choices to enhance resilience; Improves public awareness by educating the community about climate risks and resilience strategies
2024 - 35	Encourage Port-Area Businesses to Participate in Green Marine	Medium Term	Staff Time	2	Reduces environmental impact by promoting sustainable practices and reducing pollution in port areas; Improves operational efficiency by adopting green practices that often lead to cost savings through more efficient use of resources and energy; Supports economic growth by promoting a sustainable port area that can attract investment and development opportunities
2024 - 36	Enhance Plans and Protocols Regarding Cybersecurity	Medium Term	Staff Time	2	Protects sensitive data and critical systems from breaches, malware, and other cyber threats, ensuring the integrity and confidentiality of information; Prevents disruptions to essential services, maintaining the continuous operation of City functions even during cyber incidents; Increases employee awareness of cybersecurity threats and best practices, reducing the risk of human error and insider threats
2024 - 37	Establish a Maintenance Standard for Dredging of the Pleasant Valley Parkway	Short Term	Minimal	2	Ensures proper and prolonged maintenance; Allows for better standardization of practices and evaluation of efficacy

2024 Action Number	Title	Time Frame	Cost Estimate	Prioritization Score	Benefits
2024 - 41	Review and Update Plans, Policies and Procedures Regarding Storage of Battery Powered Mobility Devices	Medium Term	Staff Time	2	Helps mitigate risks associated with the storage of battery-powered mobility devices, reducing the likelihood of fires and other accidents; Promotes awareness and best practices among users and facility managers, fostering a culture of safety
2024 - 15	Create an All-Hazards Design Standard for Critical Buildings Undergoing Renovations	Long Term	Staff Time	3	Provides standardization in resiliency measures in critical buildings; Increases cost efficiency by taking advantage of existing construction activities and minimizing the need for separate, future projects
2024 - 20	Facilitate Water Supply Redundancy Across Districts	Long Term	Staff Time	3	Ensures continuous water supply by creating multiple sources and backup systems, preventing disruptions in water service during emergencies or maintenance activities; Increases resilience by diversifying water supply sources and infrastructure
2024 - 29	Conduct Future Stormwater Analysis	Medium Term	Minimal	3	Improves flood risk management by identifying potential flooding areas and developing effective mitigation strategies to prevent and manage flood events; Enhances infrastructure planning and resiliency by providing data that informs the design and construction of stormwater systems, ensuring they can handle future storm events
2024 - 32	Create Energy Security Plan	Long Term	Staff Time	3	Ensures reliable power supply by developing strategies to maintain consistent energy availability, preventing disruptions during emergencies; Enhances public safety by ensuring that essential services, such as healthcare and emergency response, have access to reliable power during crises; Encourages technological innovation by promoting the adoption of advanced energy technologies and smart grid solutions
2024 - 7	Evaluate Flood Insurance Feasibility	Medium Term	Moderate	4	Increases institutional awareness of flooding hazards for homeowners; Lessens financial burden of recovery; Reduces flood insurance policy premiums

2024 Action Number	Title	Time Frame	Cost Estimate	Prioritization Score	Benefits
2024 - 17	Digitize Vital Municipal Documents	Medium Term	Moderate	4	Ensures document preservation by protecting vital municipal records from physical damage, loss, or deterioration; Enhances accessibility by making documents easily searchable and retrievable; Facilitates compliance by ensuring that records management practices meet regulatory and legal requirements
2024 - 21	Identify Erosion Mitigation Strategies in the Shoreline Areas	Medium Term	Moderate	4	Protects coastal infrastructure and reduces property damage; Preserves natural habitats; Improves water quality;
2024 - 22	Minimize Impervious Surface Coverage throughout the City	Medium Term	Moderate	4	Reduces flooding risk and heat island effects; Enhances aesthetic appeal by incorporating more green spaces and natural landscapes; Improves water quality by filtering pollutants through soil and vegetation; Improves air quality by increasing vegetation
2024 - 31	Create a City-Wide Stormwater Master Plan	Medium Term	Moderate	4	Encourages preparedness and mitigation to avoid future flooding damage and recovery; Ensures a coordinated approach for the City; Allows for prioritization of projects and efficient allocation of resources; Helps manage stormwater in an environmentally friendly way, improving water quality and supporting urban ecosystems
2024 - 42	Understand and Address Impacts to Transportation Assets	Medium Term	Moderate	4	Enhances infrastructure resilience and safety by identifying vulnerabilities in transportation assets and implementing measures to protect them from climate-related and other impacts; Supports efficient transportation by maintaining and improving the functionality of transportation assets; Facilitates informed planning by providing data and insights that guide future investments and improvements in transportation infrastructure; Enhances community connectivity by maintaining and improving transportation routes

2024 Action Number	Title	Time Frame	Cost Estimate	Prioritization Score	Benefits
2024 - 10	Upgrade the Sirens at the Port to Improve Alert and Warning	Medium Term	Significant	5	Enhances emergency communication by providing clear and loud alerts, ensuring that all individuals in the Port area are promptly informed about emergencies; Enable quicker evacuations and responses, reducing the risk of injuries and fatalities during critical incidents; Creates a cohesive and efficient communication network, enhancing the overall effectiveness of emergency management efforts
2024 - 12	Conduct Risk Assessment of Coastal/Riverine Flooding and Stormwater Infrastructure	Long Term	Moderate	5	Identifies vulnerabilities by assessing the risk of coastal and riverine flooding and evaluating the current condition of stormwater infrastructure, allowing for targeted improvements; Informs mitigation strategies by providing detailed risk analysis, enabling the development of effective and prioritized mitigation measures to protect against flooding; Supports grant applications by providing documented risk assessments that can strengthen applications for funding and grants aimed at flood mitigation and infrastructure improvements
2024 - 19	Relocate Vital Municipal Documents	Medium Term	Significant	5	Ensures document preservation by protecting vital municipal records from physical damage, loss, or deterioration; Ensures compliance by meeting regulatory and legal requirements for document storage and protection
2024 - 33	Develop a Flood Resiliency Plan for Woonasquatucket River	Medium Term	Significant	5	Reduces flood risk and losses by implementing measures to prevent and manage flooding; Minimizes disturbance to wildlife habitat; Increases continuity of operations
2024 - 11	Conduct an Assessment of Critical Buildings to Understand Existing Protections	Long Term	Significant	6	Provides the City with an understanding of known vulnerabilities; Improves preparedness by allowing for more informed planning and resource allocation to enhance the resilience of essential infrastructure

2024 Action Number	Title	Time Frame	Cost Estimate	Prioritization Score	Benefits
2024 - 14	Create a Prioritized Investment List to Harden Critical Buildings	Long Term	Significant	6	Optimizes resource allocation by ensuring that limited resources are directed towards the most critical and vulnerable buildings; Strengthens critical buildings to reduce their susceptibility to damage, ensuring continuity of essential services during and after emergencies; Provides a clear roadmap for future infrastructure improvements, facilitating long-term planning and decision-making
2024 - 18	Provide Generators at Various Critical Buildings	Long Term	Significant	6	Ensures continuous power supply during outages to maintain essential services such as healthcare, emergency response, and public safety, reducing the risk to human life and property and improving operational efficiency; Allows for cost savings by preventing operational downtime and potential damage to sensitive equipment; Boosts public trust in the City's ability to manage crises effectively and provide necessary services without interruption
2024 - 28	Acquire Repetitive Loss Properties	Long Term	Significant	6	Reduces flooding losses and damages; Increases open spaces, green spaces, and recreational spaces
2024 - 39	Regularly Dredge the Pleasant Valley Parkway	Long Term	Significant	6	Enhances stormwater capacity, reducing flood risks and protecting properties and infrastructure; Removes sediment and debris to improve the water quality by reducing pollutants and preventing the buildup of harmful substances

5 Implementation and Maintenance

5.1 Implementation

The Local Hazard Mitigation Committee (LHMC) realized that assigning a time frame to each recommended mitigation action is important so that activities can be coordinated with other important governmental functions, such as committee meetings and budget hearings. Assigned time frames also provide inputs to a project plan used for tracking the progress of all activities. Once the 2024 Plan receives the Federal Emergency Management Agency's (FEMA) "Approved Pending Adoption" status, the mitigation strategy will be put into motion and the City Council will adopt the Plan (within 1 year of FEMA's approval). It is recognized that progress on plan implementation may vary dependent upon available funding and capacity of staff to complete assigned tasks.

5.2 Evaluation

The LHMC will meet annually to review the status of the mitigation actions. Within 2 months of this meeting, a status report will be given to the City Plan Commission and City Council. Progress will be reviewed every 2 years at advertised public hearings held by the City Plan Commission. It is advantageous the review be conducted prior to the City's annual budget process so any locally funded projects can be considered in the budget process. The City of Providence Emergency Management Agency (PEMA) will be responsible for coordinating the review meeting with the LHMC. The group will reconvene in the first quarter of each year. Prior to the meeting, each of the participating jurisdictions will gather data to assess progress toward meeting plan objectives and goals. The evaluation will assess whether:

- Goals and objectives address current and expected conditions
- The nature or magnitude of the risks has changed
- Current resources are appropriate for implementing the plan and if different or additional resources are now available
- Actions are cost-effective
- Schedules and budgets are feasible
- Implementation problems, such as technical, political, legal or coordination issues with other agencies are present
- Outcomes have occurred as expected
- Changes in City resources have impacted Plan implementation (e.g. funding, personnel, and equipment)
- Changes in programming or government structures warrant changes to the Plan
- New agencies, departments, or staff should be included

Specifically, the LHMC will review the mitigation goals, objectives, and activities using performance-based indicators, including:

- Project completion
- Percent complete versus percent of resources allocated
- Under and over spending
- Achievement of the goals and objectives

- Resource allocation (e.g. would more money have impacted the success of the activity)

Additionally, the Committee will review the mitigation implementation strategy using performance-based indicators including:

- Timeframes
- Budgets
- Lead and support agency commitment
- Resources (funding, personnel)
- Feasibility

Finally, the Committee will evaluate how other programs and policies have conflicted or augmented planned or implemented measures. Other programs and policies can include those that address:

- Sustainability
- Economic development
- Water quality management
- Environmental protection
- Historic preservation
- Redevelopment
- Health and safety
- Recreation
- Land use and current and comprehensive planning
- Transportation
- Public education and outreach

5.3 Revision

As per 44 CFR S 201.6(d)(3), the Plan will be reviewed and revised to reflect progress in local mitigation efforts and changes in priorities and resubmitted for approval within 5 years in order to continue to be eligible for mitigation project grant funding. In order to ensure that the Plan remains current, the LHMC will meet annually. The Plan will also be evaluated and updated after a disaster, or as funding opportunities arise for the actions and projects identified in the Plan. Any updates will be reviewed and submitted to the Rhode Island Emergency Management Agency upon local approval to ensure that the State hazard mitigation strategy remains current. The City of Providence Multi-Hazard Mitigation Plan will be incorporated into the City's Comprehensive Plan, Comprehensive Emergency Management Plan for consistency, and Capital Improvement Plan for potential funding of projects, as appendices.

5.4 Continued Public Involvement

The City of Providence will continue public involvement in the Plan maintenance process through the following methods:

- The approved and adopted Plan will be posted on the City's website.
- The annual meeting of the LHMC to review the implementation of the Plan will be posted and advertised as a public meeting as per City guidelines.

- The LHMC will include the public in the preparation of the 5-year update using the same public participation process as in the development of this Plan update.

Appendix A Planning Process

A.1 Local Hazard Mitigation Committee Meeting Sign-In Sheets

A.1.1 January 9, 2024

City of Providence Hazard Mitigation Plan Update

Initial Meeting Sign-In Sheet
January 9, 2024

Name	Email Address	Phone Number
Jamie Lynch (ARC)	Jamie.Lynch@redcross.org	401-318-8091
Ryan Kopp (SIC)	rkopp@asri.org	719-214-1269
Tony Araujo	tonya@providencewater.com	401-521-6300
Peter Lapinski	plepage@providencewater.com	401-521-6300
DAVID EVERETT	deverett@providenceri.gov	401.331.3923
RAE-ANNE CULP	RAEANNE.CULP@EMA.RI.GOV	401-524-5248
Pete Ginaitt	pginaitt@ripta.com	401-255-3304
Emily Hall	ehall@crmc.ri.gov	401-783-7350
KOREN KANADJIAN	KKanadjian@RIPTA.COM	401 447 7652
Stephen Hourie	Shourie@providenceRI.Gov	440-2715
Sve Anderbois	Anderbois.Ward3@gmail.com	400-1014
Matthew Mulligan	mmulligan@providenceri.gov	401-658-6623
Le Roy Rose	LRose JR@JFW.GOV	401-598-2946
Rachel Calabro	Rachel.Calabro@dem.ri.gov	401 556 3836
Priscilla De La Cruz	pdelacruz@providenceri.gov	401-680-5992
Clara Decerbo	cdecerbo@providenceri.gov	401-648-1619
Bruce Lofgren		
Chris Harwood		
James Moore		
Jeff Emidy		
John Arzoomanian		
Marisa Albanese		
Peter Kazanian		
Steve Curtis		
TJ Ferris		

Attended Virtually

A.1.2 February 12, 2024

CLARA DECERBO
DIRECTOR

BRETT P. SMILEY
MAYOR

PROVIDENCE EMERGENCY MANAGEMENT AGENCY

Training/Meeting Name: Local Hazard Mitigation Planning Committee Meeting DATE: 2/12/2024 Time: 1:00pm

NAME	DEPT/AGENCY	PHONE	EMAIL	TIME IN/OUT
Ryan Kopp	SIC	7192141269	rkopp@asrii.org	100
SETH OWUSU	BROWN	5132957271	SETH_OWUSU@BROWN.EDU	//
Jamie Lynch	ARC	4013188091	Jamie.Lynch@redcross.org	/
Peter Gimaitt	RIPTA	4014082267	Pgimaitt@ripta.com	1
Yaniv Gal	Inspections and Standards	401-340-8714	YGal@providenceRI.gov	1 pm
Tony Arcaro	Prov Water	401-521-6300	tonya@provwater.com	1pm
David Caldcliff	PEMA	401-946-6334	DCaldcliff@Providenceri.gov	1pm
Priscilla De LaCruz	Sustainability	401-868-5993	pdelacruz@providenceri.gov	1pm
DAVID EVERETT	Planning & Dev	401.680.8520	deverett@providenceri.gov	1
Rachel Calabro	DEM	401 556 3836	rachel.calabro@dem.ri.gov	1
Matthew D Mulligan	Prov Police	401 658 6623	mmulligan@providenceri.gov	1300 hrs
Rachel Gomes	JWU	203-747-6456	rgomes@jwu.edu	1300
LeRoy Rose	JWU	401-447-1848	LROSEJR@JWU.EDU	13:00
Koren Kanadanian	RIH/HCH	401-441-7652	KKanadanian@lifespan.org	1300
Clara Decerbo	PEMA	401 648 1619	cdecerbo@providenceri.gov	1300

CLARA DECERBO
DIRECTOR

BRETT P. SMILEY
MAYOR

Virtual Attendees

PROVIDENCE EMERGENCY MANAGEMENT AGENCY

Training/Meeting Name: Local Hazard Mitigation Planning Committee Meeting DATE: 2/12/2024 Time: 1:00pm

NAME	DEPT/AGENCY	PHONE	EMAIL	TIME IN/OUT
Ariel Mallett	iParametrics			
Jeff Stevens	iParametrics			
Christopher Harwood	Brown University			
Maris Albanese	RI Energy			
Bruce Lofgren	CRMC			
Dave Ancain	NBC			
Jeff Emidy	RIHPHC			
John Arzoomanian	PWD Public Property			
Peter Kazarian	PPSD			
Stephen Houle	Prov Fire			

A.1.3 March 15, 2024

CLARA DECERBO
DIRECTOR

BRETT P. SMILEY
MAYOR

Virtual Attendees

PROVIDENCE EMERGENCY MANAGEMENT AGENCY

Training/Meeting Name: Local Hazard Mitigation Planning Committee Meeting DATE: 2/12/2024 Time: 1:00pm

NAME	DEPT/AGENCY	PHONE	EMAIL	TIME IN/OUT
Ariel Mallett	iParametrics			
Jeff Stevens	iParametrics			
Christopher Harwood	Brown University			
Maris Albanese	RI Energy			
Bruce Lofgren	CEMC			
Dave Ancain	NBC			
Jeff Enidy	RIHPHC			
John Arzoomanian	PUD Public Property			
Peter Kazanan	PPSD			
Stephen Houle	Prov Fire			

CLARA DECERBO
DIRECTOR

BRETT P. SMILEY
MAYOR

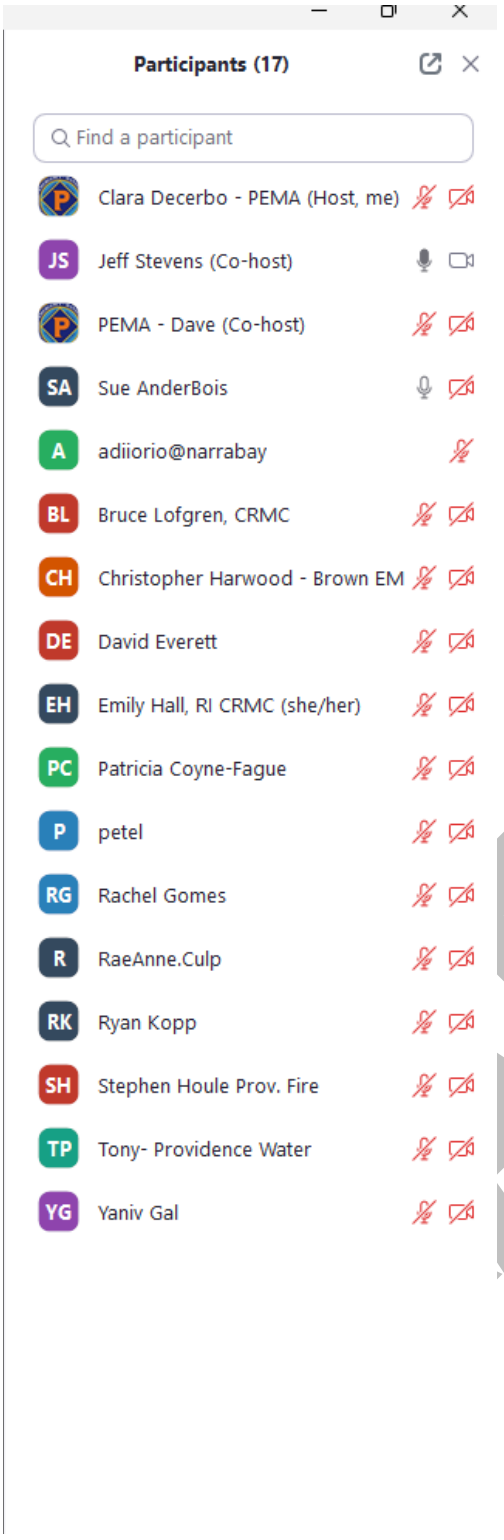
Virtual Attendees

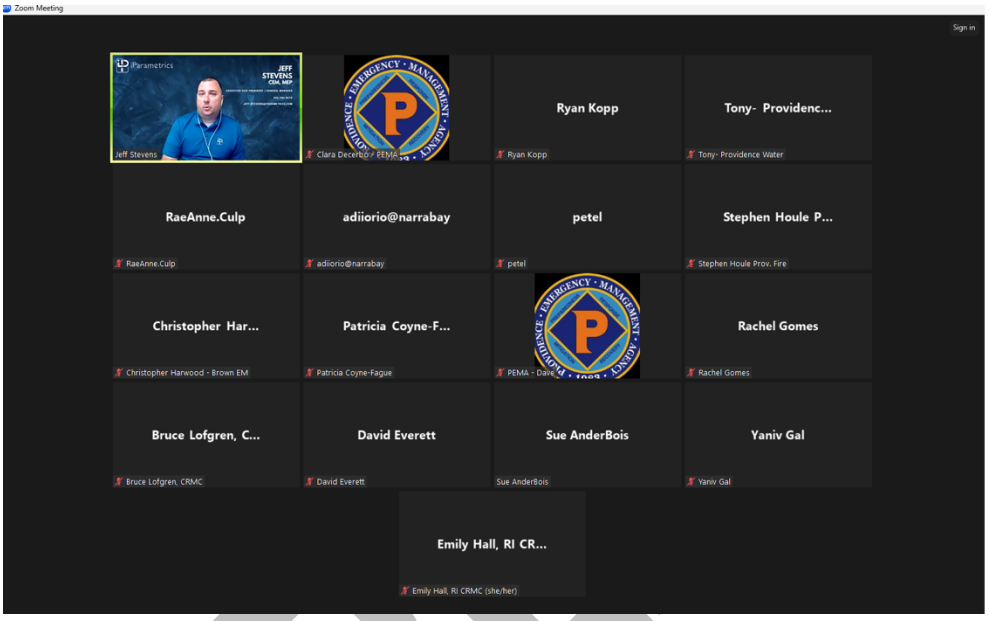
PROVIDENCE EMERGENCY MANAGEMENT AGENCY

Training/Meeting Name: Local Hazard Mitigation Planning Committee Meeting DATE: 2/12/2024 Time: 1:00pm

NAME	DEPT/AGENCY	PHONE	EMAIL	TIME IN/OUT
Ariel Mallett	iParametrics			
Jeff Stevens	iParametrics			
Christopher Harwood	Brown University			
Maris Albanese	RI Energy			
Bruce Lofgren	CEMC			
Dave Ancain	NBC			
Jeff Enidy	RIHPHC			
John Arzoomanian	PUD Public Property			
Peter Kazanan	PPSD			
Stephen Houle	Prov Fire			

A.1.4 May 28, 2024





A.2 Public Meetings

A.2.1 Flyers

City of Providence
Multi-Hazard Mitigation Plan Update

About the Hazard Mitigation Plan Update

The City of Providence is currently updating the 2019 Hazard Mitigation Plan. This plan is important because it helps the City plan and receive funding for projects that reduce the risk of injury or damage to property from future natural hazard events such as flooding and hurricanes.

Public Workshops

April 29
Vincent Brown
Recreation Center
438 Hope Street

April 30
PEMA
591 Charles Street

May 1
Rollins Recreation Center
674 Prairie Ave

May 2
Olneyville Resilience Hub
at Joslin Recreation Center
17 Hyatt Street

All workshops are from 5:30-7:00pm and include a formal presentation and informal discussion. Please join us to share your concerns and insights regarding hazards facing our community and opportunities to make our City more resilient.

Contacts
Clara Decerbo—Director
Providence Emergency
Management Agency
591 Charles Street
Providence, RI 02904
cdecerbo@providenceri.gov
Phone: (401) 680-8000

2019 Hazard Mitigation Plan

To review a copy of the 2019 Hazard Mitigation Plan, scan the QR code.

Ciudad de Providence
Actualización del Plan de Mitigación de Riesgos Múltiples

Acerca de la Actualización del Plan de Mitigación de Riesgos

La Ciudad de Providence está actualizando el Plan de Mitigación de Riesgos 2019. Este plan es importante porque ayuda a la Ciudad a planificar y recibir fondos para proyectos que reducen el riesgo de heridas o daños a la propiedad a causa de futuros eventos de peligros naturales como inundaciones y huracanes.

Talleres públicos

29 de abril
Vincent Brown
Recreation Center
438 Hope Street

30 de abril
PEMA
591 Charles Street

1 de mayo
Rollins Recreation Center
674 Prairie Ave

2 de mayo
Olneyville Resilience Hub
at Joslin Recreation Center
17 Hyatt Street

Todos los talleres son de 5:30-7:00 p.m. e incluyen una presentación formal y una conversación informal. Por favor, acompáñenos para compartir sus preocupaciones y puntos de vista sobre los riesgos a los que se enfrenta nuestra comunidad y las oportunidades para hacer que nuestra ciudad tenga más capacidad de recuperación.

Para más información, diríjase a

Clara Decerbo—Directora
Providence Emergency
Management Agency
591 Charles Street
Providence, RI 02904
cdecerbo@providenceri.gov
Teléfono: (401) 680-80900

Plan de Mitigación de Riesgo 2019

Para revisar una copia del Plan de Mitigación de Peligros 2019, escanee el código QR.

A.2.2 Sign-In Sheets

CLARA DECERBO
DIRECTOR

BRETT P. SMILEY
MAYOR

PROVIDENCE EMERGENCY MANAGEMENT AGENCY

Meeting Name: Providence Hazard Mitigation Planning - Public Meeting #1 DATE: 4/29/2024 Time: 5:30pm

NAME	DEPT/AGENCY	PHONE	EMAIL	TIME IN/OUT
Sue AndersBois	Council	400-1014	AndersBois.ward3@gmail.com	
CARLA DOUGHTY	Zero waste Providence	(510) 940 6103	carla@zerowasteprovidence.com	
Linda Lassiter		401-280-6217	llassiter@providenceri.gov	
margaret johnson		401-282-0287		

CLARA DECERBO
DIRECTOR

BRETT P. SMILEY
MAYOR

PROVIDENCE EMERGENCY MANAGEMENT AGENCY

Meeting Name: Providence Hazard Mitigation Planning - Public Meeting #2 DATE: 4/30/2024 Time: 5:30pm

NAME	DEPT/AGENCY	PHONE	EMAIL	TIME IN/OUT
Juan M. Pichardo	City Council		JPichardo@ProvidenceRI.gov.	

CLARA DECERBO
DIRECTOR

BRETT P. SMILEY
MAYOR

PROVIDENCE EMERGENCY MANAGEMENT AGENCY

Meeting Name: Providence Hazard Mitigation Planning - Public Meeting #3 DATE: 5/1/2024 Time: 5:30pm

NAME	DEPT/AGENCY	PHONE	EMAIL	TIME IN/OUT
CARLA DOUGHTY	zero waste providence		carla@zerowasteprovidence.com	
Jimmy Peguero	Recreation	401 639-37X	Jimmy.Peg@Gmail.com	
Alexandra morales	Resident	401- 559-2832	morales.alexa@gweil.com	
Nasha Bailey	R2C / Resident	401-$261-2302	nbailey@providenceri.gov	

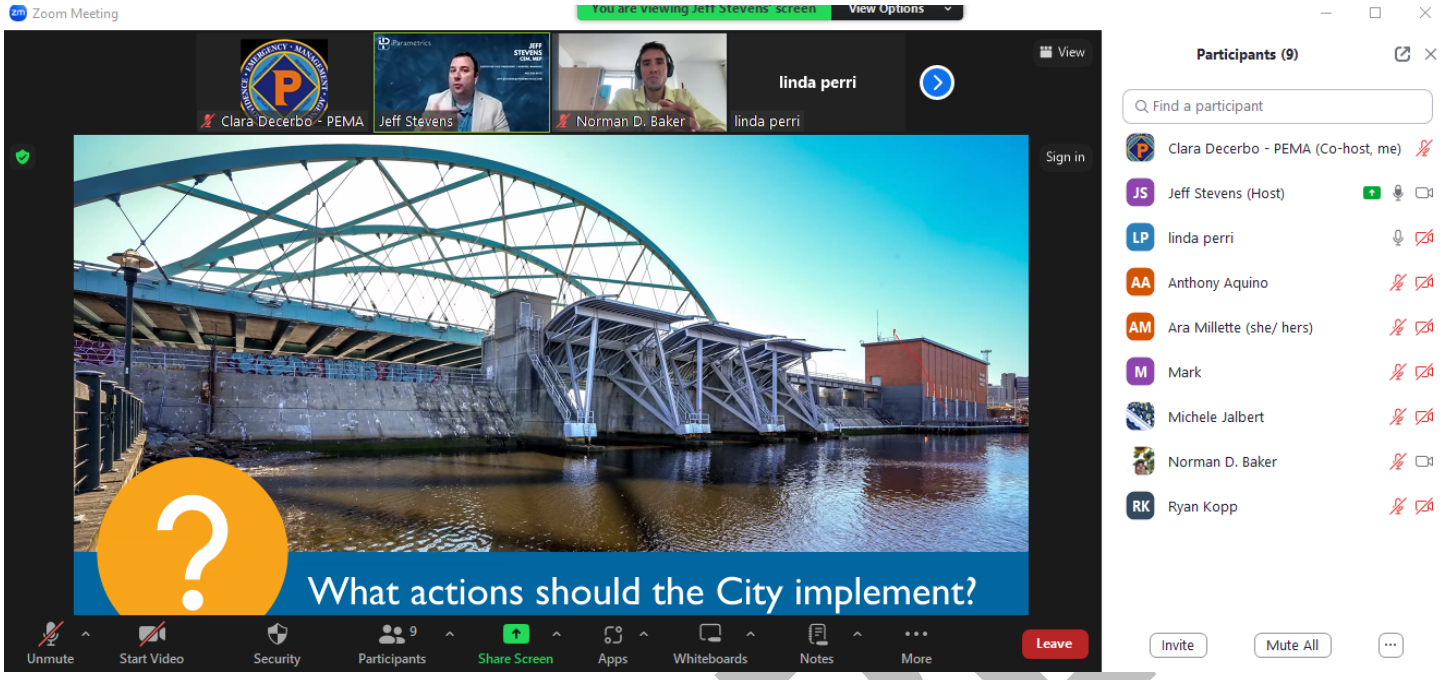
Clara Decerbo
DIRECTOR

Brett P. Smiley
MAYOR

PROVIDENCE EMERGENCY MANAGEMENT AGENCY

Meeting Name: Providence Hazard Mitigation Planning – Public Meeting #4 Date: 5/2/2024 Time 5:30pm

NAME	AGENCY/DEPT.	PHONE	EMAIL
Elmer Stanley Resident	City Recreation Dept	401-338-3954	estanley@providenceri.gov
Cecil Gonzalez Resident	City Recreation Dept	401-323-7248	cvega@providenceri.gov
XANDER MONGE RESIDENT	CITY OF PROVIDENCE REC / COMM'S	401-580-3811	XMONGE@PROVIDENCERI.GOV
Anthony Aquino	providence		


Zoom Meeting
You are viewing Jeff Stevens' screen
View Options
View
Clara Decerbo - PEMA
Jeff Stevens
Norman D. Baker
linda perri
linda perri
Sign in
What actions should the City implement?
Unmute
Start Video
Security
Participants
9
Share Screen
Apps
Whiteboards
Notes
More
Leave
Participants (9)
Find a participant
Clara Decerbo - PEMA (Co-host, me)
Jeff Stevens (Host)
linda perri
Anthony Aquino
Ara Millette (she/ hers)
Mark
Michele Jalbert
Norman D. Baker
Ryan Kopp
Invite
Mute All