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The City of Revere, Massachusetts Hazard Mitigation Plan – 2022 Update

The City of Revere

Prepared for:

City of Revere, Massachusetts

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Acronyms

SHMCAP	State Hazard Mitigation and Climate Adaptation Plan
ACOE	Army Corps of Engineers.
BRIC	Building Resilient Infrastructure and Communities
CDBG	Community Development Block Grant
CDBG-DR	Community Development Block Grant -Disaster Recovery
CEMP	Comprehensive Emergency Management Plan
CRS	Community Rating System
CTP	Cooperating Technical Partnership
DAP	Disaster Assistance Policy
DCR	Department of Conservation and Recreation
DHSES	Department of Homeland Security Emergency Services
DMA 2000	Disaster Mitigation Act of 2000
DPW	Department of Public Works
EF	Enhanced Fujita
FEMA	Federal Emergency Management Agency
FIRMs	Flood Insurance Rate Maps
FLP	Forest Legacy Program
FMA	Flood Mitigation Assistance
FPA	Floodplain Administrator
ft	feet
GIS	Geographic information system
HMA	Hazard Mitigation Assistance
HMGP	Hazard Mitigation Grant Program
HMP	Hazard Mitigation Plan
LiMWA	Limit of Moderate Wave Action
MAPC	Metropolitan Area Planning Council
MassDOT	Massachusetts Department of Transportation
MBTA	Massachusetts Bay Transportation Authority
MEMA	Massachusetts Emergency Management Agency
MHD	Massachusetts Highway Department
mph	miles per hour
MVP	Revere Municipal Vulnerability Preparedness
NCDC	National Climate Data Center
NCEI	National Center for Environmental Information
NDSP	National Dam Safety Program

NESIS	Northeast Snowfall Impact Scale
NFIP	National Flood Insurance Program
NOAA	National Oceanic and Atmospheric Administration
NRI	National Risk Index
NSORS	North Suffolk Office of Resiliency and Sustainability
NWS	National Weather Service
PA	Public Assistance
PDM	Pre-Disaster Mitigation
RiskMAP	Risk Mapping, Assessment and Planning
RL	repetitive loss
RSI	Regional Snowfall Index
SFHA	Special Flood Hazard Area
SRL	severe repetitive loss
TTF	Transportation Trust Fund
WPA	Wetlands Protection Act

Executive Summary

Hazard mitigation is defined as any sustained action taken to reduce or eliminate the long-term risk to life and property from natural hazard events. Hazard mitigation breaks the repetitive cycle of disaster damage, recovery, and repeated disaster damage.

Hazard mitigation planning reduces the loss of life and property by minimizing the impacts of disasters. It is a proactive effort to identify actions that communities can take to reduce the dangers to life and property from natural hazard events. Mitigation plans are critical to breaking the cycle of disaster damage and reconstruction by developing long-term strategies to protect life, property, and the environment from natural disasters. The Disaster Mitigation Act of 2000 (DMA 2000) requires all municipalities to adopt a Federal Emergency Management Agency (FEMA)-approved local multi-hazard mitigation plan to be eligible for Hazard Mitigation Assistance (HMA) funding. Pursuant to the Code of Federal Regulations (CFR) – 44 § 201.6 (d) (3), a local jurisdiction must review and revise its plan to reflect changes in development, progress in local mitigation efforts, and changes in priorities and resubmit every five years in order to continue to be eligible for mitigation project grant funding.

The City of Revere Hazard Mitigation Plan – 2022 Update (hereafter, 2022 Update) was completed in accordance with 44 CFR § 201.6 (d) (3).

Planning Process

Planning for the 2022 Update was led by the Revere Local Hazard Mitigation Planning Committee (hereafter, Planning Committee), composed of staff from several different City Departments. The Planning Committee discussed where the impacts of natural hazards most affect the City, goals for addressing these impacts, and hazard mitigation measures that would benefit the City.

The following two Local Hazard Planning Committee Meetings were held to support the 2022 Update:

- Local Hazard Planning Committee Meeting #1, January 20, 2021.
- Local Hazard Planning Committee Meeting #2, April 27, 2021.

The following two Public Stakeholder Meetings were held to support the 2022 Update:

- Public Stakeholder Meeting #1, March 3, 2021.
- Public Stakeholder Meeting #2, October 7, 2021.

Risk Assessment

The Risk Assessment includes a description of the type, location, and extent of all-natural hazards that can affect Revere. New to the 2022 Update is the organization of natural hazards through the following climate change interactions: changes in precipitation, sea level rise, rising temperatures, and extreme weather, in addition to non-climate influenced hazards.

The 2022 Update provides risk assessment for the following natural hazards in Revere, outlined by climate change interaction:

Changes in Precipitation

- Inland Flooding
- Drought
- Landslides

Sea Level Rise

- Coastal Flooding
- Coastal Erosion
- Tsunamis

Rising Temperatures

- Hurricanes/Tropical Storms
- Severe Winter Storms
- Tornadoes

In addition, the Risk Assessment profiles earthquakes, which are considered a non-climate influenced hazard.

Hazard Mitigation Strategy

The Hazard Mitigation Strategy provides the City's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs, and resources, and its ability to expand on and improve existing tools. Hazard Mitigation Goals and Actions, listed below, form the basis of the mitigation strategy.

Hazard Mitigation Goals

1) Ensure that critical infrastructure sites are protected from natural hazards.
2) Protect existing residential and business areas from flooding.
3) Make efficient use of public funds for hazard mitigation.
4) Continue to enforce existing zoning and building regulations.
5) Educate the public about zoning and building regulations, particularly about changes in regulations that may affect tear downs and new construction.
6) Encourage future development in areas that are not prone to natural hazards.
7) Educate the public about natural hazards and mitigation measures.
8) Protect the City's ability to respond to various natural hazard events.

Plan Adoption and Maintenance

The process for reviewing and updating Revere's Hazard Mitigation Plan is summarized in Table ES-1.

Table ES-1: Plan Review and Update

Chapter	Reviews and Updates
2 Planning Process	An active stakeholder engagement and public involvement process is critical to developing or updating a hazard mitigation plan. The Local Hazard Mitigation Planning Committee was established to lead the planning process for the 2022 Update. The Local Hazard Mitigation Planning Committee encompasses an interdisciplinary group of stakeholders from the City, and includes representation from first responders and emergency managers, planning and development, engineers and infrastructure operators, and the City's school department.
3 Risk Assessment	The Planning Committee gathered the most recently available hazard and land use data and met with City staff to identify changes in local hazard areas and development trends. City staff reviewed critical infrastructure to create an up-to-date list.
4 Hazard Mitigation Strategy	The Hazard Mitigation Strategy, comprised of goals and actions, were reviewed during the planning process, and endorsed by the Planning Committee. Mitigation measures from the 2015 Update were reviewed and assessed as to whether they were completed, on-going, or deferred. The Planning Committee determined whether to carry forward measures into the 2015 Update or delete them. The Hazard Mitigation Strategy for the 2022 Update reflects both new measures and measures carried forward from the 2015 Update. The Planning Committee re-prioritized all these measures based on current conditions
5 Plan Adoption and Maintenance	This section of the plan was updated with a new on-going plan implementation review and five-year update process that will assist the City in incorporating hazard mitigation issues into other City planning and regulatory review processes and better prepare the City to update the plan in 2021.

Moving forward into the next five-year plan implementation period there will be many more opportunities to incorporate hazard mitigation measures into the City's decision-making processes. The City will document any actions taken within this iteration of the Natural Hazard Mitigation on challenges met and actions successfully adopted as part of the ongoing work of the biannual survey and four-year update to be conducted by the Hazard Mitigation Implementation Team, as described in Chapter 6 Plan Adoption and Maintenance. The Hazard Implementation Team did not meet regularly, conduct a bi-annual survey or four-year update as described in Chapter 6 perhaps due to the absence of any one City department having been designated to follow up and implement the plan and coordinate plan review and updating. This plan update includes a revised plan implementation process in Chapter 6 that addresses these issues from the previous update.

1. Introduction

1.1 Planning Requirements under the Federal Disaster Mitigation Act

The Disaster Mitigation Act of 2000 (DMA 2000) requires that after November 1, 2004, all municipalities that wish to continue to be eligible to for Federal Emergency Management Agency (FEMA) Hazard Mitigation Assistance (HMA) funding to adopt a local multi-hazard mitigation plan, which must be updated in five-year intervals. This planning requirement does not affect post-disaster Public Assistance (PA) funding. Revere completed its Hazard Mitigation Plan (HMP) in 2005, and previously updated it in 2015.

1.1.1 Previous Federal and State Disasters

The City of Revere has experienced 23 natural hazards that triggered federal or state disaster declarations since 1991. These are listed in Table 1-1 below.[1] Most of these events involved severe storms.

Table 1-1: Previous Federal and State Disaster Declarations

Disaster Name (Date of Event)	Type of Assistance	Declared Areas
Hurricane Bob (August 1991)	FEMA Public Assistance Project Grants	Counties of Barnstable, Bristol, Dukes, Essex, Hampden, Middlesex, Plymouth, Nantucket, Norfolk, Suffolk
	Hazard Mitigation Grant Program	Counties of Barnstable, Bristol, Dukes, Essex, Hampden, Middlesex, Plymouth, Nantucket, Norfolk, Suffolk (16 projects)
No-Name Storm (October 1991)	FEMA Public Assistance Project Grants	Counties of Barnstable, Bristol, Dukes, Essex, Middlesex, Plymouth, Nantucket, Norfolk
	FEMA Individual Household Program	Counties of Barnstable, Bristol, Dukes, Essex, Middlesex, Plymouth, Nantucket, Norfolk
	Hazard Mitigation Grant Program	Counties of Barnstable, Bristol, Dukes, Essex, Middlesex, Plymouth, Nantucket, Norfolk. Suffolk (10 projects)
December Blizzard (December 1992)	FEMA Public Assistance Project Grants	Counties of Barnstable, Dukes, Essex, Plymouth, Suffolk
	Hazard Mitigation Grant Program	Counties of Barnstable, Dukes, Essex, Plymouth, Suffolk (7 projects)
March Blizzard (March 1993)	FEMA Public Assistance Project Grants	All 14 Counties
January Blizzard (January 1996)	FEMA Public Assistance Project Grants	All 14 Counties
May Windstorm (May 1996)	State Public Assistance Project Grants	Counties of Plymouth, Norfolk, Bristol (27 communities)
October Flood (October 1996)	FEMA Public Assistance Project Grants	Counties of Essex, Middlesex, Norfolk, Plymouth, Suffolk
	FEMA Individual Household Program	Counties of Essex, Middlesex, Norfolk, Plymouth, Suffolk

[1] Federal Emergency Management Agency, Declared Disasters, 2021. Retrieved https://www.fema.gov/disaster/declarations?field_dv2_state_territory_tribal_value=MA&field_year_value=All&field_dv2_declaration_type_value=All&field_dv2_incident_type_target_id_selective=All

Disaster Name (Date of Event)	Type of Assistance	Declared Areas
	Hazard Mitigation Grant Program	Counties of Essex, Middlesex, Norfolk, Plymouth, Suffolk (36 projects)
1997	Community Development Block Grant-HUD	Counties of Essex, Middlesex, Norfolk, Plymouth, Suffolk
June Flood (June 1998)	FEMA Individual Household Program	Counties of Bristol, Essex, Middlesex, Norfolk, Suffolk, Plymouth, Worcester
	Hazard Mitigation Grant Program	Counties of Bristol, Essex, Middlesex, Norfolk, Suffolk, Plymouth, Worcester (19 projects)
1998	Community Development Block Grant-HUD	Counties of Bristol, Essex, Middlesex, Norfolk, Suffolk, Plymouth, Worcester
March Flood (March 2001)	FEMA Individual Household Program	Counties of Bristol, Essex, Middlesex, Norfolk, Suffolk, Plymouth, Worcester
	Hazard Mitigation Grant Program	Counties of Bristol, Essex, Middlesex, Norfolk, Suffolk, Plymouth, Worcester (16 projects)
February Snowstorm (Feb 17-18, 2003)	FEMA Public Assistance Project Grants	All 14 Counties
January Blizzard (January 22-23, 2005)	FEMA Public Assistance Project Grants	All 14 Counties
Hurricane Katrina (August 29, 2005)	FEMA Public Assistance Project Grants	All 14 Counties
May Rainstorm/Flood (May 12-23, 2006)	Hazard Mitigation Grant Program	Statewide
April Nor'easter (April 15-27, 2007)	FEMA Public Assistance Project Grants	Counties of Barnstable, Berkshire, Dukes, Essex, Franklin, Hampden, Hampshire, Plymouth
	Hazard Mitigation Grant Program	Statewide
Flooding (March 2010)	FEMA Public Assistance FEMA Individuals Households Program SBA Loan	Counties of Bristol, Essex, Middlesex, Suffolk, Norfolk, Plymouth, Worcester
	Hazard Mitigation Grant Program	Statewide
Tropical Storm Irene (August 27-28, 2011)	FEMA Public Assistance	Statewide
Hurricane Sandy (October 27-30, 2012)	FEMA Public Assistance	Counties of Barnstable, Bristol, Dukes, Nantucket, Plymouth, Suffolk
Severe Winter Storm (February 8 - 9, 2013)	FEMA Public Assistance	Statewide
Severe Winter Storm (January 26 - 28, 2015)	FEMA Public Assistance	Counties of Barnstable, Dukes, Nantucket, Bristol, Suffolk, Norfolk, Middlesex, Essex, Plymouth, and Worcester
Severe Winter Storm (March 2 - 3, 2018)	FEMA Public Assistance	Counties of Bristol, Essex, Norfolk, Plymouth, Barnstable, and Nantucket
Severe Winter Storm (March 13 - 14, 2018)	FEMA Public Assistance	Counties of Worcester, Middlesex, Norfolk, Essex, and Suffolk

1.1.2 FEMA Funded Mitigation Projects

Over the last 20 years, the City has received HMA funding for one mitigation project, under the Hazard Mitigation Grant Program (HMGP). This project totaled $485,000, with $360,000 covered by HMA funding and $125,000 covered by local match, as summarized in Table 1-2.

Table 1-2: FEMA Funded Mitigation Projects (Utilizing HMGP)

Project Title	Scope of Work	Total Cost	Federal Funding	Local Funding
Oak Island Drainage Improvements	Installation of new tide gate; upgrade of existing culvert and tide gate.	$485,000	$360,000	$125,000

1.2 Changes since 2015 Update

D3. Was the plan revised to reflect changes in priorities? (Requirement §201.6(d)(3))

A significant revision to the City of Revere Hazard Mitigation Plan (2022 Update) includes the reorganization of natural hazards through the context of climate change to reflect the increasing urgency of climate change. This is consistent with the approach taken in the Massachusetts State Hazard Mitigation and Climate Adaptation Plan – 2018 (2018 SHMCAP).

Furthermore, FEMA's National Risk Index (NRI) was leveraged to update the risk analysis and loss estimation. While there are some limitations with regards to analyzing NRI data at the local scale, it serves as a useful starting point to estimate damages from the following natural hazards for which loss estimates were not provided in the 2015 Update of the City of Revere Hazard Mitigation Plan (2015 Update): drought, landslides, hurricanes (beyond wind), severe winter storms, and tornadoes. The 2022 Update also reflects changes in flood risk from the 2017 update to the FEMA-delineated Special Flood Hazard Area (SFHA).

Lastly, the mitigation goals and actions identified in the Hazard Mitigation Strategy were revised in accordance with the needs of the community. The City's Revere Municipal Vulnerability Preparedness (MVP) planning process identified seven new mitigation actions to include in the 2022 Update, and 14 new actions were identified by the Local Hazard Mitigation Planning Committee and feedback from Stakeholder Meeting #1.

2. Planning Process

An active stakeholder engagement and public involvement process is critical to developing or updating a hazard mitigation plan. This section describes the planning process taken with the Local Hazard Mitigation Planning Committee, which was established to lead the 2022 Update. Furthermore, the City recognizes that resilience planning is not limited to the hazard mitigation planning process. Resultantly, this section summarizes planning activities the City has taken to improve resilience that have occurred in addition to the efforts taken in accordance with CFR requirements.

A review of how existing studies were incorporated into the 2022 Update is followed by a summary of public outreach activities taken to support the 2022 Update.

2.1.1 Local Hazard Mitigation Planning Committee and Stakeholders

A1. Does the Plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction? (Requirement §201.6 (C) (1))

The Local Hazard Mitigation Planning Committee was led by Elle Baker, Open Space and Environmental Planner within the Revere Office of Planning and Development. Because the Office of Planning and Development has regulatory authority in the City, it was deemed appropriate to lead the 2022 Update. The Planning Committee was established to lead the planning process for the 2022 Update. Because the 2022 Update is for a single jurisdiction, every member of the Planning Committee represents the City of Revere. Some members of the Planning Committee are displayed in Table 2-1. A full stakeholder list representing the Planning Committee can be found in Appendix A.

Table 2-1: Local Hazard Mitigation Planning Committee

Name	Position
Elle Baker	Open Space and Environmental Planner
Frank Stringi	City Planner
Paul Argenzio	Superintendent, Department of Public Works
Don Ciaramella	Chief of Infrastructure
Joe Maglione	Water, Sewer, and Drainage
Nick Rystrom	City Engineer
Chief Bright	Chief, Fire Department
Captain Robert Fortuna	Fire Department
Chief Callahan	Chief, Police Department
Nick Moulaison	Former Chair, Conservation Commission
Dr. Diane Kelly	Superintendent, Revere Public Schools
Robert O'Brien	Former Director, Revere Planning and Development
Mike Hinojosa	Director, Parks and Recreation
Ralph Harris	Revere Housing Authority
Ralph Decicco	Chair, Commission on Disabilities

As shown in Table 2-1 and Appendix A, the Planning Committee encompasses an interdisciplinary group of stakeholders from the City, and includes representation from first responders and emergency managers, planning and development, engineers and infrastructure operators, and the City's school department. In addition, the Planning Committee includes stakeholder who represent community members with access and functional needs.

2.1.2 Local Hazard Mitigation Planning Committee Meeting #1

Local Hazard Mitigation Planning Committee Meeting #1 was held on January 20, 2021. The Planning Committee was provided an overview on the importance of updating hazard mitigation plans, benefits of updating hazard mitigation plans, and requirements of plan updates. Meeting #1 resulted in the identification of 14 new mitigation actions to be incorporated into the Hazard Mitigation Strategy. In addition, the Planning Committee discussed the following:

- Opportunities to engage the public and other stakeholders.
- Need for stakeholder engagement to be multi-lingual and accessible to English language learners.
- Recent changes in development.
- Updating priority projects for the mitigation strategy.

Meeting minutes from Planning Committee Meeting #1 can be found in Appendix A.

2.1.3 Local Hazard Mitigation Planning Committee Meeting #2

Local Hazard Mitigation Planning Committee #2 was held on April 27, 2021. The Planning Committee was provided an overview of and an opportunity to comment on the findings of the Risk Assessment. Furthermore, the Planning Committee reviewed 2015 Goal Statements, providing comments as necessary, and reviewed possible mitigation actions. In addition, the Planning Committee discussed and highlighted the following:

- With so much private development going on in the City, some mitigation measures will be funded by developers while others will be funded by the City.
- The City is collaborating on a joint project at Suffolk Downs.
- Importance of identifying or clarifying the method of prioritizing mitigation actions.
- Whether to incorporate data sourced from FEMA's National Risk Index into the findings of the Rusk Assessment.

Meeting minutes from Planning Committee Meeting #2 can be found in Appendix A.

2.2 Planning Activities Beyond the 2022 Update

Hazard mitigation planning should not occur independent of other community planning activities. The City has held stakeholder workshops to support the Revere Municipal Vulnerability Preparedness (MVP) Program and workshops specific to the Coastal Resilience Feasibility Study for the Point of Pines Riverside Area. Stakeholder engagement activities taken to support these efforts are summarized in the following sections.

2.2.1 Revere Municipal Vulnerability Preparedness Program

The Commonwealth of Massachusetts' Municipal Vulnerability Preparedness (MVP) Program is designed to increase resiliency to natural hazards that are exacerbated by climate change at the municipal level. The planning process included 69 stakeholders representing municipal departments and decision-makers from the City of Revere, neighborhoods, business associations, and regional and state entities were invited to the workshops. A summary of each public information and listening session is included below.

2.2.1.1 Workshop 1

A total of 38 stakeholders attended Workshop 1 on January 10, 2019. Workshop 1 included an overview of the MVP Program and an introduction to climate change projections and natural hazards. A group discussion was held to identify the top hazards in Revere before participants separated into breakout groups representing five distinct geographic areas of the City. An expanded summary of Workshop 1 can be found in Appendix A.

2.2.1.2 Workshop 2

A total of 28 stakeholders attended Workshop 2 on January 31, 2019. Workshop 2 discussed the City's objectives for the MVP Program, local natural and climate-related hazards of concern, and existing and future infrastructural, societal, and environmental strengths and weaknesses. Mitigation measures identified in the 2015 Update were also reviewed during Workshop 2, demonstrating the City's interdisciplinary and holistic approach to mitigation and resilience planning. Participants brainstormed actions to reduce vulnerability and reinforce strengths for each of the City's strengths and vulnerabilities. An expanded summary of Workshop 2 can be found in Appendix A.

2.2.1.3 Climate Change & Revere: A Community Listening Session

Lastly, the City hosted the climate change listening session on April 4, 2019, attended by a total of 27 participants. The listening session offered participants the opportunity to ask questions and provide written comments. A summary of the listening section can be found in Appendix A.

2.2.2 Coastal Resilience Feasibility Study for the Point of Pines/Riverside Area

The Coastal Resilience Feasibility Study for the Point of Pines/Riverside Area was identified as a top priority action from the MVP planning process, as the neighborhood is vulnerable to flooding and coastal erosion. The City has hosted two stakeholder workshops as of the time of the 2022 Update to support the feasibility study, which are summarized in the paragraphs below.

2.2.2.1 Stakeholder Workshop #1

A total of 18 attendees were present for the first workshop, held on December 15, 2020 in which current and future conditions were discussed. Stakeholders discussed existing concerns in addition to opportunities to collaborate with partners. A summary of the workshop can be found in Appendix A.

2.2.2.2 Stakeholder Workshop #2

A total of nine attendees were present for the second workshop, held on January 26, 2021. The purpose of the workshop was to provide an update on the feasibility study and discuss the assessment of current and future conditions in addition to the identification of potential short-term resilience measures. A summary of the workshop can be found in Appendix A.

2.3 Review and Incorporation of Existing Studies

A4. Does the Plan review and incorporate existing plans, studies, reports, and technical information? (Requirement §201.6(b)(3))

Planning is an iterative and interdisciplinary process. Hazard mitigation plans should not be updated in isolation without consideration of stakeholder feedback sought for existing planning activities or the findings of such plans. As such, a variety of plans, studies, and reports were leveraged and incorporated into this Update. These sources are cited throughout this Update. Notable sources used throughout this Update are outlined below.

2.3.1 City of Revere Hazard Mitigation Plan – 2015 Update

Because this is an update to Revere's existing plan, the 2015 Update was leveraged as the bases for the 2022 Update. Details regarding major changes are included in Section 1.2 Changes since 2015 Update.

2.3.2 Massachusetts State Hazard Mitigation and Climate Adaptation Plan – 2018 (2018 SHMCAP)

As with previous Updates, the 2018 SHMCAP was leveraged as a starting point to identify potential hazards and the risk they present to the Commonwealth. A significant change in the 2018 SHMCAP compared to prior versions is the framing of potential hazards through lens of climate change interactions, which include changes in precipitation, sea level rise, rising temperatures, and extreme weather. The effects of climate change on each hazard, as identified in the 2018 SHMCAP, were incorporated into the Risk Assessment.

2.3.3 City of Revere Municipal Vulnerability Preparedness Summary of Findings Report – 2019 (Revere MVP Report, 2019)

The 2019 Revere MVP Report identifies existing and future vulnerabilities and strengths and identifies opportunities to take action to reduce risk and build resilience, as well as implement key actions identified through the planning process. Specifically, seven new mitigation actions identified in the Hazard Mitigation Strategy were identified through the City's MVP planning process. The MVP Report, 2019 is referenced throughout this Update.

2.3.4 Next Stop Revere – 2020

Next Stop Revere is the City's Master Plan, the City's first comprehensive master plan developed in more than four decades. Among other objectives, the plan aims to promote resiliency of the City in the face of increasing climate challenges through comprehensive climate mitigation and resiliency strategies and energy efficiency programs and to position City government at the forefront of regional collaboration, climate resiliency, and mitigation programs. In addition, Next Stop Revere was used to identify current and anticipated changes in development and to update Section 3.1 Community Profile.

2.3.5 National Risk Index

The National Risk Index was used to update the Risk Analysis and Loss Estimation. While several limitations were identified with regards to applying the findings to a municipal scale, it provided a useful high-level summary of the community's risk and vulnerability.

2.4 Public Outreach

A3. Does the Plan document how the public was involved in the planning process during the drafting stage? (Requirement §201.6(b)(1))

The City of Revere has performed stakeholder engagement and sought public input on several planning initiatives to improve the City's resilience to natural hazards during the current planning cycle. The City hosted two public stakeholder meetings that empower the community to participate in the 2022 Update.

In addition to the Planning Committee, stakeholders representing state agencies, service and emergency service providers, developers, hospitals, neighborhood associations, and environmental organizations were targeted and engaged in the planning process. Stakeholders contacted are listed in Table 2-2.

Table 2-2: Local Hazard Mitigation Planning Stakeholders

State and Federal Agencies

Department of Conservation and Recreation
Department of Transportation

Massachusetts Bay Transportation Authority
Massachusetts Water Resources Authority
Municipal Planning Organizations
Service Providers
National Grid
RCN
Comcast
Emergency Service Providers
Action
Cataldo Ambulance
Developers
HYM
Redgate
Gansett Ventures
Post Road
Hospitals
East Boston Neighborhood Health
Cambridge Health Alliance
Mass General Hospital
Neighborhood Associations
Revere Community Council (Shirley Ave Area)
Beachmont Improvement Committee
North Revere Neighborhood Group
Oak Island Neighborhood Group
Point of Pines Beach Association
Riverside Association
Point of Pines Yacht Club
Environmental Organizations
Conservation Commission
Saugus River Watershed Council
Resilient Mystic Collaborative
Friends of Belle Isle Marsh
Alliance for Health and the Environment
MVP - EOEEA

Public Stakeholder Meetings are summarized below.

2.4.1 Public Stakeholder Meeting #1

The first public stakeholder meeting was held on March 3, 2021. The importance of hazard mitigation, hazard mitigation planning, and plan updates was discussed. The status of the 2022 Update and existing mitigation actions included in the Hazard Mitigation Strategy were discussed. Items discussed at Public Stakeholder Meeting #1 included the new Point of Pines Fire Station, the new Department of Public Works facility, and ongoing resiliency work at Suffolk Downs. A summary of Public Stakeholder Meeting #1 can be found in Appendix A.

2.4.2 Public Stakeholder Meeting #2

The second public stakeholder meeting was held on October 7, 2021. The meeting included a review on the importance of hazard mitigation, an overview of hazard mitigation planning and plan updates, and a summary of the findings of the 2022 Update, and an opportunity for comment and discussion. The meeting also provided the community the opportunity to review and comment on the 2022 Update, which wis posted on the City's website, and community members were provided the opportunity to comment on the plan between October 1 and October 15. It was noted that the 2022 Update is a lengthy document for the general public to read, and as such, the Strategy section was excerpted for more accessible public viewing. A summary of Public Stakeholder Meeting #2 can be found in Appendix A.

2.5 Opportunity for Neighboring Communities and Regional Agencies

A2. Does the Plan document an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development as well as other interests to be involved in the planning process? (Requirement §201.6(b)(2))

The City provided the following communities the opportunity to participate in the planning process:

- Chelsea
- Winthrop
- Saugus
- Malden
- Lynn
- Everett

These neighboring communities were invited to review and provide comments on the draft update, which was posted on the City's website for public viewing. As previously stated, the City recognizes hazard mitigation planning should not occur independent of other community and resilience planning activities. The City is engaged with the neighboring communities of Chelsea and Winthrop through the North Suffolk Office of Resiliency and Sustainability (NSORS). The City has also been coordinating with the neighboring communities to progress regional flood mitigation efforts. Funding has been secured for a regional flood mitigation working group that will be advanced this fiscal year.

In addition, the City has been coordinating regularly with the City of Boston to improve coastal flood resilience at Suffolk Downs, which encompasses portions of both cities. The cities are collaborating to identify opportunities for flood protection alignments based on existing physical conditions, the location of flood pathways, and the extent of flooding.

3. Risk Assessment

The City's climate, geography, and demography significantly determine its risk and vulnerability to impacts from natural hazards. Because risk is at the nexus of natural hazards and human infrastructure, this Risk Assessment begins with a review of Revere's community profile. The community profile includes a review of the City's social and economic profile, followed by the land use profile and a review of development trends. Finally, the community profile includes a review of the City's climate, which affect many hazards the City may be vulnerable to and summarizes how the City's climate has changed in recent decades.

The Risk Assessment continues with a description of future climate projections in the city followed by a review all potential natural hazard events that may occur in the City, leveraging work completed as part of the 2018 2018 SHMCAP and the 2019 Revere Municipal Vulnerability Preparedness (Revere MVP, 2019) Summary of Findings Report to identify potential hazards.

In compliance with the requirements outlined in 44 CFR § 201.6 (c) (2), the Risk Assessment provides the factual basis for activities proposed in the mitigation strategy to reduce losses from identified natural hazards, which are defined as environmental phenomena that have the potential to impact societies and the human environment.[2] The Risk Assessment consists of the following components:

- A description of the type, location, and extent of all-natural hazards that can affect the City, including previous occurrences and probability of future events, pursuant to 44 CFR § 201.6 (c) (2) (i).
- A description of the City's vulnerability to the hazards pursuant to 44 CFR § 201.6 (c) (2) (ii).

The Risk Assessment is organized into the following sections:

3.1 Community Profile

The Community Profile includes a summary of the City's social and economic profile, land use profile and development trends, as well as an overview of the City's climate profile, including current and future conditions.

3.1.1 Social and Economic Profile

Revere is a developed city in Suffolk County, located between the North Shore and Boston. Data on social and economic conditions was compiled for comparative purposes and social and economic conditions are presented for Revere and the Commonwealth of Massachusetts using 2015-2019 American Community Survey 5-year estimates, the most recent data available. To assess how the social and economic conditions of the City have changed in recent years, 2006-2010 American Community Survey 5-year estimates are also provided.

The population of Revere has grown by approximately 7 percent since 2010, and currently has an approximate population of 53,700. According to Next Stop Revere, Revere's Master Plan, the population will reach 66,700 by 2030 and 73,700 by 2040, an increase of 42 percent above the City's 2010

[2] Federal Emergency Management Agency, National Risk Index Primer, December 2020. Retrieved https://www.fema.gov/sites/default/files/documents/fema_national-risk-index_primer.pdf

population. Comparatively, the population of Massachusetts at large has grown by 6 percent since 2010. Population characteristics of Revere and Massachusetts are summarized in Table 3-1.[3]

Table 3-1: Population Characteristics

Characteristic	2010 Revere	2019 Revere	2019 Massachusetts
Total population	50,008	53,692	6,850,663
Under 18	10,654 (21.3%)	10,815 (20.1%)	1,371,260 (20.0%)
18 & over	39,354 (78.7%)	42,877 (79.9%)	5,479,293 (80.0%)
65 & over	7,289 (14.6%)	7,722 (14.4%)	1,107,089 (16.2%)
Median Age	37.8	39.2	39.5

As shown in Table 3-2, the population of Revere is 78.1 percent white, comparable to Massachusetts at large. While the share of residents identifying as African American, some other race, or two or more races has increased since 2010, the percent of residents identifying as American Indian and Alaska Native or Asian has decreased since 2010.[4]

Table 3-2: Population by Race

Race	2010 Revere	2019 Revere	2019 Massachusetts
White	37,748 (75.5%)	41,933 (78.1%)	5,348,538 (78.1%)
African American	2,010 (4.0%)	2,942 (5.5%)	522,357 (7.6%)
American Indian and Alaska Native	310 (0.6%)	140 (0.3%)	14,764 (0.2%)
Asian	3,147 (6.3%)	2,609 (4.9%	452,436 (6.6%)
Native Hawaiian and other Pacific Islander	0 (0.0%)	0 (0.0%)	2,804 (<0.1%)
Some other race	4,447 (8.9%)	3,209 (6.0%)	286,619 (4.2%)
Two or more races	2,346 (4.7%)	2,859 (5.3%)	223,035 (3.3%)

As shown in Table 3-3, the percent of Revere residents who identify as Hispanic or Latino has increased by over 50 percent since 2010. The percent of Revere residents who identify as Hispanic or Latino is nearly three times that of Massachusetts at large.[5]

Table 3-3: Population by Ethnicity

Ethnicity	2010 Revere	2019 Revere	2019 Massachusetts
Hispanic or Latino	11,859 (23.7%)	18,042 (33.6%)	809,179 (11.8%)
Not Hispanic or Latino	38,149 (76.3%)	35,650 (66.4%)	6,041,374 (88.2%)

[3] U.S. Census Bureau, American Community Survey 5-year estimates. 2021. Retrieved https://data.census.gov/cedsci/
[4] U.S. Census Bureau, American Community Survey 5-year estimates. 2021. Retrieved https://data.census.gov/cedsci/
[5] U.S. Census Bureau, American Community Survey 5-year estimates. 2021. Retrieved https://data.census.gov/cedsci/

As shown in Table 3-4, the total number of housing units decreased slightly between 2010 and 2019 but the average household size increased by 8 percent in that time period.[6]

Table 3-4: Household Breakdown

Population	2010 Revere	2019 Revere
Total Housing Units	20,592	20,559
Average Household Size	2.6	2.8
Occupied Household Units	19,025	19,223
Vacant Household Units	1,567	1,336

As shown in Table 3-5, the unemployment rate in Revere has dropped significantly since the years following the Great Recession. [7] However, the unemployment rate in Revere is higher than in Massachusetts at large. It is too early to understand the effects of the ongoing pandemic-related recession and the impact it will have on the economies of Revere and Massachusetts.

Table 3-5: Labor Force

Employment Status	2010 Revere	2019 Revere	2019 Massachusetts
Population 16 years and over	40,471	43,947	5,648,105
In Civilian Labor Force	26,497 (65.5%)	29,481 (67.1%)	3,795,730 (67.2%)
Employed	24,332 (91.8%)	27,892 (94.6%)	3,612,375 (95.2%)
Unemployment Rate	8.2%	5.4%	4.8%

As shown in Table 3-6, the median household income, mean household income, and per capita income in Revere are 30 percent, 38 percent, and 43 percent below those of Massachusetts at large, respectively.[8]

Table 3-6: Income Statistics

Characteristic	2010 Revere	2019 Revere	2019 Massachusetts
Median Household Income	$49,759	$62,568	$81,215
Mean Household Income	$60,326	$81,075	$111,498
Per Capita Income	$23,928	$30,587	$43,761

The social and economic conditions of Revere demonstrate the City is growing faster than that of Massachusetts at large, has significantly more ethnic diversity than Commonwealth at large, and has greater unemployment and lower household and per capita incomes than the Commonwealth at large.

[6] U.S. Census Bureau, American Community Survey 5-year estimates. 2021. Retrieved https://data.census.gov/cedsci/
[7] U.S. Census Bureau, American Community Survey 5-year estimates. 2021. Retrieved https://data.census.gov/cedsci/
[8] U.S. Census Bureau, American Community Survey 5-year estimates. 2021. Retrieved https://data.census.gov/cedsci/

3.1.2 Land Use Profile and Development Trends

D1. Was the plan revised to reflect changes in development? (Requirement §201.6(d)(3))

The City of Revere is largely developed, with limited developable land available. Resultantly, new development is largely limited to infill. As new development and redevelopment occurs, it will be subject to the latest building code requirements and zoning regulations. According to the Mass Builds database, 34 development projects were completed in Revere between 2015 and 2020 and another 21 are scheduled for completion in future years. Development projects are dispersed around the City and are not expected to significantly change the City's vulnerability to natural hazards. While a sizable portion of the City is vulnerable to flooding and coastal hazards, the community's participation in the National Flood Insurance Program (NFIP) mitigates the community's vulnerability to such hazards.

Aside from tax exempt land (which includes public right of ways, easements, and municipal property), single-family and multi-family residential properties account for most of the City's developable land. A breakdown of land use in Revere is provided in Table 3-7. [9]

Table 3-7: Land Use Breakdown

Land Use	Percent
Other exempt properties	9.3%
Single family properties	18.0%
Duplex/triplex	20.3%
Small apartments (8 units or less)	1.2%
Large apartments (more than 8 units)	4.6%
Mixed use	0.7%
Agriculture and outdoor recreation	1.1%
Commercial - low density	11.1%
Commercial - high density	0.5%
Educational uses	0.0%
Industrial properties, warehouses, and utilities	5.8%
Tax exempt	27.3%

A map visualizing the City's land use using the most recent data available can be found in Appendix B.

Next Stop Revere identified the following opportunity development sites, which provide opportunities for urban infill:

- Caddy Farm (Revere/Saugus)
- Former Necco Site
- G/J Towing & Recovery
- MBTA Parking Lot Beachmont

[9] Commonwealth of Massachusetts, Massachusetts Land Parcel Database, May 2019. Retrieved https://www.mass.gov/info-details/massgis-data-2016-land-coverland-use

- MBTA Parking Lot Wonderland
- Riverside Boat Works
- Waterfront Parcel (Lasden)
- Wonderland Race Track
- Suffolk Downs

In addition, the list of critical facilities was revised from the 2015 Update to reflect changes in development. Table 3-8 lists critical facilities in Revere.

Table 3-8: Critical Facilities in Revere

Facility ID	Critical Facility Type	Description
1	Wastewater Pumping Station	Bennington St. Pump Station
2	Water Pumping	Fennos Hill Reservation (T Carroll Way)
3	Stormwater Pump Station	Johnny Road Pump Station SWPS6197
4	Stormwater Pump Station	Sargent Street Pump Station SWPS6166
5	Stormwater Pump Station	Rice Avenue Pump Station SWPS0426
6	Stormwater Pump Station	Diner Road Pump Station SWPS4441
7	Stormwater Pump Station	Milano Ave Pump Station SWPS4443
8	Stormwater Pump Station	Franklin Street Pump Station SWPS4646
9	Stormwater Pump Station	Jackson Street Pump Station SWPS4648
10	Stormwater Pump Station	Festa Road Pump Station SWPS5503
11	Stormwater Pump Station	Undine Avenue Pump Station SWPS6171
12	Stormwater Pump Station	Rumney Marsh Academy (1) SWPS6289
13	Stormwater Pump Station	Rumney Marsh Academy (2) SWPS6298
14	Stormwater Pump Station	Revere Beach Parkway Pump Station SWPS0001
15	Stormwater Pump Station	Noble Street Pump Station SWPS6171
16	Stormwater Pump Station	Richie Road Pump Station
17	Stormwater Pump Station	Dunn Road
18	Stormwater Pump Station	Festa Road (2)
19	Stormwater Pump Station	Garfield Avenue (at Garfield School)
20	Wastewater Pump Station	S2983
21	Wastewater Pump Station	S3501
22	Wastewater Pump Station	S1945
23	Wastewater Pump Station	S2472
24	Wastewater Pump Station	S2478
25	Wastewater Pump Station	S2505
26	Wastewater Pump Station	S2543
27	Wastewater Pump Station	S2872
28	Wastewater Pump Station	S2992
29	Wastewater Pump Station	S2995
30	Wastewater Pump Station	S4002
31	Wastewater Pump Station	S4000
32	Wastewater Pump Station	WWPS1138
33	Wastewater Pump Station	WWPS5001
34	Wastewater Pump Station	WWPS5002
35	Wastewater Pump Station	Linehurst Road

Facility ID	Critical Facility Type	Description
36	Wastewater Pump Station	Atwood Street
37	Wastewater Pump Station	Marshview Terrace
38	Wastewater Pump Station	Beachmont (Jones Road)
39	Fire Station	Freeman Street Fire Station
40	Fire Station	Point Of Pines Fire Station
41	Fire Station	Beachmont Fire Station
42	Fire Station	Walden Street Fire Station
43	Fire Station	Revere Fire Dept
44	Police Station	State Police Dept
45	Police Station	Revere Police Dept
46	School	Garfield Community Magnet School
47	School	Augustine C Whelan Memorial
48	School	Paul Revere
49	School	Abraham Lincoln
50	School	Revere High
51	School	Seacoast School
52	School	Immaculate Conception Elementary
53	School	Eagle Heights Academy
54	School	Beachmont School
55	School	Rumney Marsh Academy
56	School	Staff Sargent James J. Hill Elementary School
57	School	Susan B Anthony Middle School
58	Medical Facility	North Suffolk Mental Health 1 of 8
59	Medical Facility	North Suffolk Mental Health 2 of 8
63	Medical Facility	North Suffolk Mental Health 3 of 8
64	Medical Facility	North Suffolk Mental Health 4 of 8
65	Medical Facility	North Suffolk Mental Health 5 of 8
66	Medical Facility	North Suffolk Mental 6 of 8
67	Medical Facility	North Suffolk Mental 7 of 8
68	Medical Facility	North Suffolk Mental 8 of 8
60	Medical Facility	Baycove
61	Medical Facility	Baycove
62	Medical Facility	Baycove
69	Health	MGH Community
70	Health	MGH/Revere High School
71	Health	Revere Care Center
72	Health	MGH Revere HealthCare Center Broadway
73	Health	East Boston Neighborhood Health Center/Pace Home Health Care
74	Power Station	MBTA Substation

Facility ID	Critical Facility Type	Description
75	Municipal Facility	DPW Headquarters/DPW Yard
76	Municipal Facility	City Hall
77	Office	Revere City Hall Annex
78	Multi	Revere Historical Society
79	Municipal Senior Center	Rossetti-Cowan Senior Center
80	Fire Station	360 Revere Beach Parkway
81	Power Substation	Electric Subsation#35
82	Child Care	Happy Day Nursery
83	Child Care	Kids and The Learning Center
84	Child Care	For Kids Only After School
85	Child Care	Capic Head Start
86	Child Care	Capic Head Start
87	Child Care	Baptist Church Head Start
88	Child Care	First Congregational Day Care
89	Child Care	Kiddie Koop Revere
90	Place of Assembly	Prospect House
91	Water Related Facility	Reservoir
92	Hazardous Materials	Boston Gas/Oil Farms Area
93	Human Services	May Institute
94	Elderly Housing	Proctor & Cushman Ave Elderly
95	Elderly Housing	J. Ward Howe (elderly housing)
96	Elderly Housing	Mary T. Rownan (elderly Housing)
97	Elderly Housing	Cushman Elderly Housing
98	Nursing Home	Alfred C Liston Towers
99	Nursing Home	Annemark Nursing
100	Nursing Home	Lighthouse Nursing Home
101	Club/Lounge	Park Departments

Critical facilities are displayed on hazard maps provided in Appendix B. Lastly, the Hazard Mitigation Strategy outlined in Section 4 reflects findings from Local Hazard Mitigation Planning Committee #1, in which the Planning Committee discussed recent changes in development, as noted in Section 0. Because Revere is largely developed, changes in development are primarily limited to infill development. At the Local Hazard Mitigation Planning Committee #1, it was noted there are approximately 3,500 more housing units in Revere than there were in 2014.

3.1.3 Climate Profile and Climate Change

Prior to reviewing the climate profile of Revere, it is important to highlight the difference between climate, weather, and climate change.

Climate: describes the typical weather conditions over a long period of time in a specific area. Typical indices of climate include temperature, precipitation, humidity, sun, and wind speed and direction. Climate refers to average indices, such as temperature and precipitation, over a long period of time. NOAA uses a time-period of 30 years to determine climate normal.

Weather: refers to short-term changes in the atmosphere in the short-term. Natural hazards are frequently a result of hazardous weather events.

Climate change: The climate at any location is not typically a steady state. Observations of factors such as temperature and precipitation, for example, regularly differ from long-term averages, and considerable variability over time is typical. However, when trends in these climate factors are observed to increase or decrease over extended periods of time (several decades or longer), this is referred to as “climate change”.

3.1.3.1 Climate Profile

Using the Koppen-Geiger climate classification, Revere has a humid subtropical climate. This means the City has a temperate climate defined by hot summers and the lack of a dry season.

The mean annual temperature in Revere is 50.1º F, based on 30-year climate data provided by the National Center for Environmental Information (NCEI). However, mean temperatures vary based on seasonal variations. Mean monthly and annual temperatures of Revere between 1991 and 2020 are displayed in Table 3-9.[10]

Table 3-9: Mean Monthly and Annual Temperatures in Revere

Time Period	Temperature (ºF)
Annual	50.7
January	28.6
April	47.8
July	73.1
October	52.9

Revere receives 48.3 inches of precipitation annually, on average, based on 30-year climate data provided by the NCEI. However, precipitation in Revere is not distributed uniformly throughout the year. Summer and winter months can be characterized as drier while months in the spring and autumn seasons are generally wetter. Average annual and monthly precipitation is displayed in Table 3-10.[11]

Table 3-10: Average Annual and Monthly Precipitation in Revere

Time Period	Precipitation (inches)
Annual	48.3
January	3.8
April	4.2
July	3.5
October	4.7

[10] National Oceanic and Atmospheric Administration National Centers for Environmental information, Climate at a Glance: County Time Series, February 2021.
[11] National Oceanic and Atmospheric Administration National Centers for Environmental information, Climate at a Glance: County Time Series, February 2021.

3.1.3.2 Changing Climate Conditions

The mean temperature has experienced observable increases since weather data began being recorded in 1895. The mean annual temperature increased approximately 3.7 ºF since 1895. As shown in Table 3-11, the temperature in Revere has not increased uniformly throughout the year.[12] For instance, the mean temperatures in April and July have increased more than those of January and October.

Table 3-11: Temperature Increase Since 1895

Time Period	Temperature Increase
Annual	3.7
January	2.8
April	3.7
July	3.6
October	1.9

Revere has experienced an observable increase in annual precipitation since 1895. Average annual precipitation has increased approximately 6.4 inches since 1895. However, precipitation has not increased uniformly throughout the year. For instance, Revere has experienced an approximate reduction of 0.1 inches of precipitation in the month of January since 1895 while average precipitation has not changed in the month of July since 1895. Change in precipitation is displayed in Table 3-12[13].

Table 3-12: Changes in Precipitation Since 1895

Time Period	Change in Precipitation (inches)
Annual	6.4
January	-0.1
April	0.4
July	0.0
October	1.9

In addition to temperature and precipitation increases resulting from climate change, the sea level of Boston Harbor has increased by 0.9 feet since 1920, according to National Oceanic and Atmospheric Administration (NOAA) records, exacerbating potential damages from future hazard events.

3.2 Future Climate Change Projections in Revere

A review of the City's climate, geography, and demography is necessary to understand its current risk and vulnerability to natural hazards. Furthermore, this section includes an assessment of how climate change may exacerbate the City's risk to natural hazards, with a focus on changes in precipitation, sea level rise, rising temperature, and extreme weather.

[12] National Oceanic and Atmospheric Administration National Centers for Environmental information, Climate at a Glance: County Time Series, February 2021.
[13] AECOM analysis of data provided by the National Center for Environmental Information. National Oceanic and Atmospheric Administration National Centers for Environmental information, Climate at a Glance: County Time Series, February 2021.

3.2.1 Changes in Precipitation

As stated in the 2018 SHMCAP, changes in precipitation include changes in the amount, frequency, and timing of precipitation – including both rainfall and snowfall – are occurring across the globe as temperatures rise and other climate patterns shift in response.

It is expected that precipitation will increase over this century. It is anticipated that total annual precipitation will increase by 1.0 to 6.0 inches by mid-century and by 1.2 to 7.3 inches by end of century. It is anticipated that precipitation will increase during the winter and spring months and decrease during the fall and summer months over this century. It is expected that climate change will result in more frequent, intense precipitation events in addition to more frequent extended periods of dry days.

Precipitation changes are likely to exacerbate the following natural hazards:

- Inland Flooding
- Drought
- Landslides

3.2.2 Sea Level Rise

As stated in the 2018 SHMCAP, climate change will drive rising sea levels, and rising seas will have wide-ranging impacts on communities, natural resources, and infrastructure.

Sea level rise is the rising water of levels resulting from meltwater of glaciers and ice sheets coupled with thermal expansion of seawater as it warms.[14]

The rise in relative mean sea level is projected to range from approximately 1 to 3 feet in the near term between 2000 and 2050), and from 4 to 10 feet by the end of this century (between 2000 and 2100) across the Commonwealth's coastline (2018 SHMCAP).

Sea level rise is expected to exacerbate the following natural hazards:

- Coastal flooding
- Coastal erosion
- Tsunamis

Sea level around Boston has risen by eight inches since 1950, rose by six inches between 1980 and 2016 and it is estimated the sea level around Boston will rise by another six inches in the next 15 years.[15]

3.2.3 Rising Temperatures

As stated in the 2018 SHMCAP, average temperatures have risen steadily in the past 50 years, a trend that is expected to continue.

Temperature: It is anticipated the average, maximum, and minimum temperatures will increase significantly over this century. It is anticipated the average annual temperature will increase by 2.8°F to 6.2°F by mid-century and by 3.8°F to 10.8°F by the end of this century (2018 SHMCAP). It is expected that temperatures will increase at a greater rate in winter months than in summer months. The long-term average minimum winter temperature is expected to increase by 4.6°F to 11.4°F by end of century.[16]

[14] National Oceanic and Atmospheric Administration, Climate Change: Global Sea Level, January 2021. Retrieved https://www.climate.gov/news-features/understanding-climate/climate-change-global-sea-level
[15] SeaLevelRise.org, Massachusetts' Sea Level Is Rising, no date. Retrieved https://sealevelrise.org/states/massachusetts/#:~:text=In%20the%20last%20decade%2C%20the,to%20rise%20around%206%20inches.&text=Scientists%20now%20forecast%20that%20in,rise%20by%20another%206%20inches.
[16] Commonwealth of Massachusetts, Massachusetts State Hazard Mitigation and Climate Adaptation Plan, 2018.

Temperature changes are likely to exacerbate the following natural hazards:

- Extreme temperatures
- Wildfires
- Invasive species

3.2.4 Extreme Weather

As stated in the 2018 SHMCAP, climate change is expected to increase extreme weather events across Massachusetts. There is strong evidence that storms, from heavy downpours and blizzards to tropical cyclones and hurricanes, are becoming more intense and damaging, and can lead to devastating impacts for residents.

In addition, precipitation and temperature changes are expected to exacerbate extreme weather events, affecting the following natural hazards:

- Hurricanes/tropical storms
- Severe winter storms
- Tornadoes

3.3 Natural Hazard Identification and Profile of Natural Hazards

This sub-section on natural hazard identification and profile of natural hazards includes a review of natural hazards identified in the 2018 SHMCAP. The review of natural hazards is followed by a profile of each hazard deemed applicable to the City.

3.3.1 Review of Natural Hazards

The 2018 SHMCAP was leveraged as the basis to identify natural hazards that have the potential to affect the City. The 2018 SHMCAP identified 14 natural hazards that have the potential to affect Massachusetts, which are organized by climate change impacts and projections, as described in Section 3.2. By framing natural hazards through the context of climate change, this Update aligns with the 2018 SHMCAP and the Commonwealth's resilient MA Climate Change Clearinghouse website, labeled as "Primary Climate Change Interaction." These hazards and justification for inclusion/exclusion from this Update are summarized in Table 3-13.

Table 3-13: Hazard Identification

Primary Climate Change Interaction	Hazard	Frequency in State	Severity in State	Hazard Risk in Revere
Changes in Precipitation	Inland Flooding	High	Serious	Same as state
	Drought	Low	Minor	Same as state
	Landslide	Low	Minor	Same as state
Sea Level Rise	Coastal Flooding	High	Serious	Same as state
	Coastal Erosion	High	Serious	Same as state
	Tsunami	Very Low	Extensive	Catastrophic
Rising Temperatures	Average/Extreme Temperature	High	Serious	Same as state
	Wildfires	Medium	Minor	Same as state
	Invasive Species	High	Serious	Same as state

Primary Climate Change Interaction	Hazard	Frequency in State	Severity in State	Hazard Risk in Revere
Extreme Weather	Hurricanes/Tropical Storms	High	Serious	Same as state
	Severe Winter Storm/Nor'easter	High	Serious	Same as state
	Tornadoes	Medium	Serious	Same as state
	Other Severe Weather	High	Serious	Same as state
Non-Climate Influenced Hazards	Earthquake	Very Low	Serious	Same as state

While no longer included in the 2018 SHMCAP, the frequency categorizations and severity categorizations have been carried over from the 2013 Massachusetts State Hazard Mitigation Plan and are summarized in Table 3-14 below.

Table 3-14: Definitions Used in the Commonwealth of Massachusetts 2013 State Hazard Mitigation Plan

Frequency Categorization	
Very low:	Events that occur less frequently than once in 1,000 years (Less than 0.1% per year).
Low:	Events that occur from once in 100 years to once in 1,000 years (0.1% to 1.0% per year).
Medium:	Events that occur from once in 10 years to once in 100 years (10% to 100% per year).
High:	Events that occur more frequently than once in 10 years (Greater than 10% per year).
Severity Categorization	
Minor:	Limited and scattered property damage; limited damage to public infrastructure and
	essential services not interrupted, limited injuries or fatalities.
Serious:	Scattered major property damage; some minor infrastructure damage; essential services are briefly interrupted; some injuries and/or fatalities.
Extensive:	Widespread major property damage; major public infrastructure damage (up to several days for repairs); essential services are interrupted from several hours to several days; many injuries and/or fatalities.
Catastrophic:	Property and public infrastructure destroyed; essential services stopped; numerous injuries and fatalities.

3.3.2 Previous Disaster Declarations in Suffolk County

FEMA disaster declarations are made at the county level. Suffolk County has been involved in 29 Federal Emergency or Disaster Declarations dating back to 1953; natural hazards resulting in declarations include hurricanes, flooding, and severe snow and ice storms. Historic declarations are summarized in Table 3-15.[17]

[17]Federal Emergency Management Agency, Disaster Declarations for States and Counties, February 2021. Retrieved https://www.fema.gov/data-visualization/disaster-declarations-states-and-counties

Table 3-15: Disaster Declarations in Suffolk County

Hazard	Year of Declaration	Disaster Number
Tornado*	1953	DR-7
Hurricanes*	1954	DR-22
Hurricanes*	1955	DR-43
Severe Storms and Flooding	1972	DR-325
Blizzard and Snowstorms	1978	EM-3059
Coastal Storms, Flood, Ice, Snow	1978	DR-546
Hurricane Gloria	1985	DR-751
Hurricane Bob*	1991	DR-914
Severe Coastal Storm	1991	DR-920
Winter Coastal Storm	1992	DR-975
Blizzards, High Winds, and Record Snow Fall	1993	EM-3103
Massachusetts Blizzard	1996	DR-1090
Extreme Weather/Flooding	1996	EM-3119
Severe Storms/Flooding	1996	DR-1142
Heavy Rains and Flooding	1998	DR-1224
Severe Storms	2001	DR-1364
Snow	2003	EM-3175
Snow	2004	EM-3191
Flooding	2004	DR-1512
Record and/or Near Record Snow	2005	EM-3201
Severe Storms	2006	DR-1642
Severe Winter Storm	2008	EM-3296
Severe Storm and Flooding	2010	DR-1895
Hurricane Earl	2010	EM-3315
Severe Winter Storm and Snowstorm	2011	DR-1959
Hurricane Sandy	2012	DR-4097
Severe Winter Storm, Snowstorm, and Flooding	2013	DR-4110
Severe Winter Storm, Snowstorm, and Flooding	2015	DR-4214
Severe Winter Storm and Snowstorm	2018	DR-4379

**Data regarding counties declared was not provided.*

3.3.3 Natural Hazard Profiles

B1. Does the Plan include a description of the type, location, and extent of all-natural hazards that can affect each jurisdiction(s)? (Requirement §201.6(c)(2)(i))

B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? (Requirement §201.6(c)(2)(i))

This section of the Risk Assessment describes the type, location, and extent for each natural hazard profiled. It also assesses vulnerability, provides an overview of previous occurrences and the probability of future occurrences. While a comprehensive assessment of possible natural hazards was performed, the Risk Assessment prioritized the natural hazards with consequences that pose the greatest threat to life, property, and the environment in Revere. Resultantly, some natural hazards that are possible in Revere, such as thunderstorms, lightning, hail, and extreme precipitation, were not profiled separately. However, the consequences of these events, namely forest fires and flooding, are included in the Risk Assessment. Furthermore, hazardous weather and geologic events that pose a threat to people and the environment do not always occur independently of each other. Resultantly, some hazardous events, such as storm surge and tornadoes, are referenced under multiple natural hazard profiles. An overview of natural hazards considered is provided in Table 3-16. Natural hazard profiles are grouped by climate change interactions as outlined in Table 3-13.

Table 3-16: Hazards Considered

Hazardous Event	Natural Hazard Profiles													
	Changes in Precipitation			Sea Level Rise			Rising Temperatures			Extreme Weather			Non-Climate	
	Inland Flooding	Drought	Landslide	Coastal Flooding	Coastal Erosion	Tsunami	Extreme Temperatures	Wildfires	Invasive Species	Hurricanes/ Tropical Storms	Severe Winter Storms	Tornadoes	Earthquake	Not profiled
Avalanche														X
Blight/ Infestation									X					
Blizzard											X			
Coastal Erosion					X									
Coastal Flooding				X										
Dam Failure														X
Drought		X												
Earthquake													X	
Erosion					X									
Extreme Heat							X							
Flash Flood	X													
Hail														X
Hurricane														
Ice Jam	X													

Hazardous Event	Natural Hazard Profiles													
	Changes in Precipitation			Sea Level Rise			Rising Temperatures			Extreme Weather			Non-Climate	
	Inland Flooding	Drought	Landslide	Coastal Flooding	Coastal Erosion	Tsunami	Extreme Temperatures	Wildfires	Invasive Species	Hurricanes/ Tropical Storms	Severe Winter Storms	Tornadoes	Earthquake	Not profiled
Ice Storm											X			
Inland Flooding	X													
Landslide			X											
Lightning														X
Nor'easter											X			
Precipitation (Extreme)														X
Riverine/ Riparian flooding	X													
Sleet Storm											X			
Storm Surge				X		X				X				
Subsidence														X
Thunderstorm														X
Tornado										X		X		
Tropical Cyclone										X				
Tsunami						X								
Urban flood	X													
Wildfire								X						
Wind										X	X	X		

3.3.3.1 Changes in Precipitation

Changes in precipitation will affect the risk from inland flooding, drought, and landslides.

3.3.3.2 Inland Flooding

General Definition

Flooding is a general and temporary condition of partial or complete inundation of normally dry land because of the following:

- The overflow of inland waters or tidal waters, or
- The unusual and rapid accumulation of runoff or surface waters from any source.[18]

[18] Federal Emergency Management Agency, National Flood Insurance Program Terminology Index, June 2021. Retrieved https://www.fema.gov/flood-insurance/terminology-index

Inland flooding is generally caused by hurricanes, nor'easters, severe rainstorms, melting snowpack, and thunderstorms.

Types of Flooding Events

Coastal Flooding: The temporary inundation of beaches and other coastal land area, either resulting from coastal storms, hurricanes, or geologic events. Coastal flooding is profiled under Section 3.3.3.5 under Sea Level Rise.

Flash Flood: Flooding that occurs with limited warning time, usually following extensive rainfall.[19]

Ice Jam: Flooding that results following the accumulation and build-up of floating ice fragments that block the normal flow of a river.[20]

Riverine/Riparian: When excessive runoff from longer-lasting rainstorms and snow melt causes a rise in the water level over a larger area.[21]

Storm Surge: The abnormal rise in seawater level during a storm, measured as the height of the water above the normal predicted astronomical tide. Storm surge is predominately caused by a storm's winds pushing water onshore.[22] Storm surge is captured under *Hurricanes/Tropical Storms*.

Urban: The accumulation of floodwaters that result when the inflow of storm water exceeds the capacity of a drainage system to infiltrate water into the soil or carry it away.[23]

Location of Flooding

Locations vulnerable to flooding in the City were determined using information from FEMA's Flood Insurance Rate Maps (FIRMs) and from discussions with local officials. The FIRM flood zones, effective March 16, 2016, are provided in Appendix B.

In addition, discussions with local officials identified the following flood-prone areas of the City:

- Asti Avenue Neighborhood: floods consistently during combined high tide/precipitation events of greater than 1 inch. There is very limited flood storage capacity in this low-lying coastal area.
- Elliot Circle: This site, adjacent to Revere Beach, experiences overtopping during combined high tide and storm events.
- Point of Pines: Rock revetment and seawall along Mills Avenue is overtopped during storm events. Needs repairs from North Shore Road to River Avenue.
- Cary Circle to Alden Avenue: Storm surge during high tide/storm events.
- Rice Avenue near Yacht Club: Flooding due to storm surge/high tide events.
- Revere Beach: The beach, from Cary Circle to Eliot Circle is overtopped by waves during high tide and coastal storm surge events.
- Winthrop Parkway Neighborhood: Failing floodgate allows overtopping by storm surge and high tide during coastal storm events.

[19] National Oceanic and Atmospheric Administration, Flash Flood Definition, no date. Retrieved https://www.weather.gov/phi/FlashFloodingDefinition
[20] Northeast States Emergency Consortium, Ice Jams, no date. Retrieved http://nesec.org/ice-jams/
[21] United States Geological Survey, What are the two types of floods? No date. Retrieved https://www.usgs.gov/faqs/what-are-two-types-floods?qt-news_science_products=0#qt-news_science_products
[22] National Oceanic and Atmospheric Administration, what is storm surge? No date. Retrieved https://oceanservice.noaa.gov/facts/stormsurge-stormtide.html
[23] National Academy of Sciences, Framing the Challenge of Urban Flooding in the United States, March 2019. Retrieved https://www.ncbi.nlm.nih.gov/books/NBK541185/#:~:text=Urban%20flooding%20is%20the%20accumulation,or%20to%20carry%20it%20away

- Washburn Avenue Drainage Outfall: Backs up and causes localized flooding during high precipitation and storm events.
- Belle Isle Avenue Neighborhood: Flooding of neighborhood occurs when storm surge from Belle Isle Inlet overtops Belle Isle Avenue.
- Pearl Avenue: Backup of existing 24-inch storm drain causes localized flooding along lower elevation stretches of Pearl Avenue.

Extent/Severity of Flooding

Suffolk County receives 43.8 inches of rain annually, on average, determined based on data from NOAA's National Center for Environmental Information. This is above the national average annual precipitation of 31.3 inches.[24]

The National Weather Service classifies the severity of inland flooding as minor, moderate, or severe based on the types of impacts that occur, outlined as follows (2018 SHMCAP):

- Minor: "nuisance only" degree of flooding that causes impacts such as road closures, flooding of recreational areas, and farmland.
- Moderate: results in land with structures being inundated.
- Major: widespread and life-threatening event.

Previous Occurrences

There have been several significant flood events that have affected the City and North Shore region of Massachusetts over the last 50 years. Flood events of historic significance include the following:

- March 1968
- The Blizzard of 1978
- January 1979
- April 1987
- October 1991 ("The Perfect Storm")
- October 1996
- June 1998
- March 2001
- April 2004
- May 2006
- April 2007
- March 2010

Notable flood events affecting the City are summarized in Table 3-17.[25]

[24] National Oceanic and Atmospheric Administration, National Centers for Environmental Information – Climate at a Glance: Climate Time Series, May 2021, Retrieved https://www.ncdc.noaa.gov/cag/county/time-series/MA-025/pcp/12/12/1990-2021?base_prd=true&begbaseyear=1901&endbaseyear=2000.

[25] National Oceanic and Atmospheric Administration, National Centers for Environmental Information, Storm Event Database, May 2021. Retrieved https://www.ncdc.noaa.gov/stormevents/

Table 3-17: Summary of Notable Flood Events

Date	Type	Deaths	Injuries	Property Damage
9/18/1996	Flood	0	0	0
3/5/2001	Flood	0	0	15.000 M
5/13/2006	Flood	0	0	0
10/28/2006	Flood	0	0	8k
2/13/2008	Flood	0	0	5.00 M
3/14/2010	Flood	0	0	10.700 M
8/25/2010	Flood	0	0	0
10/29/2012	Flood	0	0	15k
6/7/2013	Flood	0	0	0
9/1/2013	Flood	0	0	5k
10/23/2014	Flood	0	0	30 K
7/23/2016	Flood	0	0	0
7/12/2017	Flood	0	0	0
7/18/2017	Flood	0	0	0
8/2/2017	Flood	0	0	0
8/2/2017	Flood	0	0	0
9/14/2017	Flood	0	0	25 K
9/30/2017	Flood	0	0	25 K
9/30/2017	Flood	0	0	25 K
9/30/2017	Flood	0	0	0
9/30/2017	Flood	0	0	40 K
10/30/2017	Flood	0	0	15 K
5/15/2018	Flood	0	0	15 K
6/25/2018	Flood	0	0	0
6/25/2018	Flood	0	0	0
6/25/2018	Flood	0	0	0
8/12/2018	Flood	0	0	10 K
9/25/2018	Flood	0	0	3 K
11/3/2018	Flood	0	0	0
6/29/2019	Flood	0	0	20 K
7/6/2019	Flood	0	0	0
7/31/2019	Flood	0	0	2K
7/31/2019	Flood	0	0	2K
8/7/2019	Flood	0	0	0

Date	Type	Deaths	Injuries	Property Damage
6/28/2020	Flood	0	0	0
6/28/2020	Flood	0	0	0
Total	**36**	**0**	**0**	**25.945M**

While all listed flood events were regionally significant, their impacts varied across communities. The Army Corps of Engineers estimated that the Blizzard of 1978 damaged over 1,200 homes in Revere, resulting in $16 million (1978$) in damages and 289 flood insurance claims resulting in $2.5 (1978$) million in pay-outs. The October 1991 storm resulted in 421 flood insurance claims totally $5.1 million (1991$) in pay-outs.

County-level data on previous flooding occurrences was used as city-specific data summarizing previous flood events was not available. There were 10 non-coastal or non-urban small stream flood events between January 1950 and 2020; six of which resulted in property damage. No injuries or deaths were reported from the previous flood events, and the six flood events associated with property damage resulted in losses of $25.7 million. The most severe recent flooding occurred during the major storm of March 2010, when Suffolk County broke the record of 11 inches of rain set in 1953. During the month of March of 2010, a new total of 14.83 inches of rainfall accumulation was officially recorded by the National Weather Service (NWS).

Probability of Future Events and Changes from Previous Update

Inland Flooding in Revere is considered a “High Frequency” event that has a recurrence interval of less than 10 years. Alternatively stated, the annual probability of inland flooding occurring in the City is greater than 10-percent.

Repetitive Loss Structures

As defined by the Community Rating System (CRS) of the NFIP, a repetitive loss property is any property which the NFIP has paid two or more flood claims of $1,000 or more in any given 10-year period since 1978. More information on repetitive loss structures can be found in Section 3.4.

Impacts on the Community and Vulnerability

Severe flooding can cause damage to buildings and infrastructure. The locations susceptible to flooding, listed under Location of Flooding, cover approximately 397 acres, or 6.2 percent of the City’s land area. Assuming all structures are evenly distributed throughout the City, approximately 940 of the 15,100 structures are vulnerable to flooding. Low-lying areas and land in the FEMA-delineated SFHA are also vulnerable to flooding. In addition, the Revere MVP Summary of Findings Report identified the following areas as vulnerable to inland flooding:

West/North Revere:
The West / North Revere area has frontage on both the east and west sides of the Pine River and lies to the southwest of Rumney Marsh. The west side of this region of the city along the Malden border is within the FEMA 100-year floodplain. The drainage system is of particular concern in this area. Storm drainage systems on Washington Avenue and Amelia Place and catch basins on Asti Avenue and Tuscano Avenue are insufficient to manage stormwater. This results in pooling of water in these areas. Along Route 1, tide gates that are not adequately maintained exacerbate flooding within the Town Line Brook watershed. Area-wide challenges include illegal sewer hookups, downed trees, groundwater infiltration, and expansion of flood zones. Additionally, backfill on properties has reduced the area available for collecting and storing water during precipitation events.

Sales Creek:
The Sales Creek area lies almost entirely within the FEMA 100-year floodplain and is flanked by the Chelsea River, Belle Isle Marsh, and Broad Sound. This is a densely developed portion of Revere’s

waterfront with multiple schools, subway stations, local and State police, a transit-oriented development economic development area, and ongoing construction. Factors that increase vulnerability in this region of the city include the poor condition of water and sewer infrastructure, evacuation and emergency routes that are susceptible to flooding, and characteristics of the population that resides here — including low-income populations, non-native English speakers, renters, and newcomers — which can be more challenging to reach through the City's conventional communication methods. Topography in this area makes low-lying areas vulnerable to flooding. The fire and police departments off Revere Beach Parkway and the police department on Ocean Avenue are identified as vulnerable locations.

Impacts of Climate Change

Climate change is expected to increase the frequency of inland flooding. Changes in precipitation patterns, including more intense and frequent downpours, increase the likelihood of inland flooding as soils become saturated. Climate change is also likely to increase the frequency and intensity of severe storm events, further increasing the likelihood of inland flooding.

3.3.3.3 Drought

General Definition

Drought is a period of below-average precipitation in a given region, resulting in prolonged shortages in its water supply. This can include atmospheric, surface water, or groundwater.

Types of Drought Events:

Meteorological Drought: When dry weather patterns dominate an area.

Hydrologic Drought: When low water supply becomes evident in steams, reservoirs, and groundwater levels. Hydrological drought indicators lag significantly behind meteorological drought indicators.

Agricultural Drought: When precipitation deficits, soil water deficits, reduced ground water, or reduced reservoirs levels impact agricultural yields.

Socioeconomic Drought: When physical drought conditions impact the supply and demand of economic goods and services.

Location of Drought

Because drought classifications are relative to the average local precipitation, surface, and groundwater levels, the entire City is susceptible to drought.

Extent/Severity of Drought

The U.S. Drought Monitor categorizes the severity of drought on scale of D0 to D4, which is outlined in Table 3-18.[26]

Table 3-18: USDM Drought Classification

Category	Description	Possible Impacts
D0	Abnormally Dry	Going into drought: - Short-term dryness slowing planting, growth of crops, or pastures. Coming out of drought: - Some lingering water deficits. - Pastures or crops not fully recovered.
D1	Moderate Drought	- Some damage to crops or pastures. - Streams, reservoirs, or well low, some water shortages developing or imminent. - Voluntary water-use restrictions requested.

[26] University of Nebraska-Lincoln, United States Drought Monitor, 2021. Retrieved https://droughtmonitor.unl.edu/About/AbouttheData/DroughtClassification.aspx

D2	Severe Drought	- Crop or pasture losses likely. - Water shortages common. - Water restrictions imposed.
D3	Extreme Drought	- Major crop/pasture losses. - Widespread water shortages or restrictions.
D4	Exceptional Drought	- Exceptional and widespread crop/pasture losses. - Shortages of water in reservoirs, streams, and wells creating water emergencies.

Massachusetts uses several indices to determine regional drought status, including the Standard Precipitation Index, crop moisture index, groundwater levels, stream flow, and reservoir levels to classify drought. Such indices were combined to develop five regional drought classifications in Massachusetts, outlined in Table 3-19.

Table 3-19: Massachusetts Drought Levels

Level	Description
Level 0	Normal
Level 1	Mild Drought
Level 2	Significant Drought
Level 3	Critical Drought
Level 4	Emergency Drought

Previous Occurrences

Previous drought events affecting Revere and Suffolk County are summarized in Table 3-20.

Table 3-20: Previous Drought Events

Date	Area Affected	Recurrence Interval (years)	Remarks
1879-83	- -	- -	
1908-12	- -	- -	
1929-32	Statewide	10 to >50	Water-supply sources altered in 13 communities. Multistate.
1939-44	Statewide	15 to >50	Most severe in eastern and extreme western Massachusetts. Multistate.
1957-59	Statewide	5 to 25	Record low water levels in observation wells, northeastern Massachusetts.
1961-69	Statewide	35 to >50	Water-supply shortages common. Record drought. Multistate.
1980-83	Statewide	10 to 30	Most severe in Ipswich and Taunton River basins; minimal effect in Nashua River basin. Multistate.
1995	- -	- -	Based on statewide average precipitation
1998-1999	- -	- -	Based on statewide average precipitation

Dec 2001-Jan 2003	Statewide	- -	Level 2 drought (out of 4 levels) was reached statewide for several months.
Oct 2007-Mar 2008	Statewide except West and Cape and Island regions	- -	Level 1 drought (out of 4 levels)
Aug 2010-Nov 2010	Connecticut River Valley, Central and Northeast regions	- -	Level 1 drought (out of 4 levels)
Oct 2014-Nov 2014	Southeast and Cape and Island regions	- -	Level 1 drought (out of 4 levels)
Jul 2016-Apr 2017	Statewide	- -	Level 3 drought (out of 4 levels)

Probability of Future Events and Changes since Previous Update

Historical records in Massachusetts indicate there is a 1-percent chance of being in a drought emergency classification each month (2018 SHMCAP). Drought in Revere is considered a "Low Frequency" event that have a recurrence interval of between 100 and 1,000 years. Alternatively stated, the annual probability of a drought occurring in the City is between 1.0 and 0.1-percent. The probability of future events has not changed since the 2015 Update.

Impacts on the Community and Vulnerability

While drought does not pose a significant risk to the City, it can impact agricultural production and water access to residents on private water supplies. Residents on private water supply are the most vulnerable to drought events. The City's connection to a regional, public water supply limits the vulnerability of the community to drought events.

Impacts of Climate Change

Climate change is expected to result in precipitation anomalies, including prolonged dry spells and droughts. Furthermore, the likelihood of drought will increase resulting from climate change because it is anticipated that less precipitation will be in the form of snow, lessening the opportunity for groundwater recharge.

3.3.3.4 Landslides

General Definition

The term landslide includes a wide range of ground movements, such as rock falls, deep failure of slopes, and shallow debris flows (2018 SHMCAP). The most common types of landslides in Massachusetts include translational debris slides, rotational slides, and debris flows. Most of these events are caused by a combination of unfavorable geologic conditions (silty clay or clay layers contained in glaciomarine, glaciolacustrine, or thick till deposits), steep slopes, and/or excessive wetness leading to excess pore pressures in the subsurface.

Location of Landsides

Landslides have the potential to occur anywhere in the City. However, landslides are more likely to occur in locations with the following characteristics or under the following circumstances[27]:

- Steep slopes with thick deposits of unconsolidated earth materials.
- River cut banks and coastal bluff areas that have been undermined by high flow/tides or storm events.

[27] Maine Emergency Management Agency, State Hazard Mitigation Plan – 2019 Update. Retrieved https://www.maine.gov/mema/sites/maine.gov.mema/files/inline-files/State%20Hazard%20Mitigation%20Plan%202019%20Update_10.8.2019.pdf

- Prolonged wet periods that add water weight and reduce slope strength.

According to the Slope Stability Map of Massachusetts, produced by the Massachusetts Geological Survey, most of the land in Revere is rated as stable.[28] However, the Slope Stability Map identified a stretch of land adjacent to Chelsea Creek, near the Chelsea and Revere border as moderately stable. Stretches of land alongside Massachusetts 145 were also rated moderately stable while some patches of land in the northwest portion of Revere, just north of Rumney March, are rated unstable.

Extent/Severity of Landslides
While there is not currently an accepted standardized scale to classify land slide events, the extent of landslides can be characterized by the area of ground disturbed.

Previous Occurrences
While the City does not record data on landslide occurrences, there have been no known landslides in Revere. The best available data is for Suffolk County. Suffolk County has not experienced landslide events since 1950.

Probability of Future Events and Changes since Previous Update
Landslides in Revere are considered “Very Low Frequency” events that have a recurrence interval of greater than 1,000 years. Alternatively stated, the annual probability of a landslide occurring in the City is less than 0.1-percent. The probability of future events has not changed since the 2015 Update.

Impacts on the Community and Vulnerability
A landslide in Revere could destroy buildings and infrastructure. While the probability of a landslide occurring in Revere is unlikely, the entire City is susceptible to damage resulting from landslides.

Impacts of Climate Change
Climate change could indirectly increase the frequency of landslides. Increased precipitation resulting from climate change and reduced soil stability from climate-induced drought events could trigger landslides.

Sea Level Rise
Sea level rise will affect risk of coastal flooding, coastal erosion, and tsunamis.

3.3.3.5 Coastal Flooding

General Definition
Coastal flooding is the inundation of normally dry land along the ocean coast and other inland waters from the movement of ocean water above the normal present-day tidal range. Coastal flooding is influenced by meteorological events, such as severe weather events resulting in storm surge, as well as geologic events, such as earthquake-induced tsunamis. Please note, storm surge is profiled under *Hurricanes/Tropical Storms* and tsunamis are profiled under *Tsunamis*.

Locations of Coastal Flooding
Coastal flooding is associated with severe coastal storms that, through the combination of winds and tides, drive tidal waters to higher levels than normally experienced, leading to the inundation of low-lying land areas and the overtopping of sea walls.

Extent/Severity of Coastal Flooding
The most severe storm event in Revere was the “Blizzard of ‘78” on February 6-7, 1978, which had a peak surge coinciding with a spring tide to create a 100-year water level of 14.9 feet mean low water at the National Ocean Survey Boston Harbor gauge.

[28] Massachusetts Geological Survey, Slope Stability Map of Massachusetts, 2013. Retrieved http://www.geo.umass.edu/stategeologist/Products/Landslide_Map/SSIM_Sheet2v2_print.pdf?_gl=1*1d1nwk4*_ga*MjA3Mjk1NTg2MS4xNjI5ODA2NzIw*_ga_21RLS0L7EB*MTYzMjE0NDU2Mi40LjEuMTYzMjE0NDU3MS4w&_ga=2.125254153.2036013224.1632144562-2072955861.1629806720

Previous Occurrences

A summary of coastal flooding events is provided in Table 3-21. [29]

Table 3-21: Previous Coastal Flooding Events

Date	Type	Deaths	Injuries	Property Damage
1/31/2006	Coastal Flood	0	0	10 K
4/15/2007	Coastal Flood	0	0	5 K
4/16/2007	Coastal Flood	0	0	5 K
4/17/2007	Coastal Flood	0	0	10 K
10/18/2009	Coastal Flood	0	0	0
1/2/2010	Coastal Flood	0	0	0
3/14/2010	Coastal Flood	0	0	0
12/27/2010	Coastal Flood	0	0	56 K
11/23/2011	Coastal Flood	0	0	0
6/3/2012	Coastal Flood	0	0	0
6/4/2012	Coastal Flood	0	0	0
10/29/2012	Coastal Flood	0	0	3.00 M
2/9/2013	Coastal Flood	0	0	30 K
3/7/2013	Coastal Flood	0	0	0
1/2/2014	Coastal Flood	0	0	0
1/3/2014	Coastal Flood	0	0	0
8/13/2014	Coastal Flood	0	0	0
10/23/2014	Coastal Flood	0	0	0
1/27/2015	Coastal Flood	0	0	0
10/28/2015	Coastal Flood	0	0	0
1/24/2016	Coastal Flood	0	0	0
2/8/2016	Coastal Flood	0	0	0
1/4/2018	Coastal Flood	0	0	500 K
1/30/2018	Coastal Flood	0	0	20 K
3/2/2018	Coastal Flood	0	0	0
10/27/2018	Coastal Flood	0	0	0
11/25/2018	Coastal Flood	0	0	0
1/20/2019	Coastal Flood	0	0	0
10/28/2019	Coastal Flood	0	0	0

[29] National Oceanic and Atmospheric Administration, National Centers for Environmental Information, Storm Event Database, May 2021. Retrieved https://www.ncdc.noaa.gov/stormevents/

Date	Type	Deaths	Injuries	Property Damage
4/3/2020	Coastal Flood	0	0	0
4/9/2020	Coastal Flood	0	0	0
9/22/2020	Coastal Flood	0	0	0
Total	**32**	**0**	**0**	**3.630 M**

Probability of Future Events and Changes from Previous Update

Coastal flooding in Revere is considered a “High Frequency” event that has a recurrence interval of less than 10 years. Alternatively stated, the annual probability of coastal flooding occurring in the City is greater than 10-percent. The probability of future events has not changed since the 2015 Update.

Impacts on Community and Vulnerability

Coastal flooding can damage buildings and infrastructure. Residents directly adjacent to the coast are most vulnerable to coastal flooding. The Revere MVP Summary of Findings Report identified the following areas as vulnerable to flooding:

Beachmont:
Several areas are susceptible to flooding in the southeast corner of Revere. Areas along Winthrop Parkway from the Elliot Circle to the Revere-Winthrop border and within the Winthrop Parkway Neighborhood are vulnerable to flooding. Portions of this area lie within the FEMA 100-year and 500-year floodplains. The beaches and shoreline of coastal areas and streets — such as Broad Sound Avenue — within the Beachmont area are vulnerable to sea level rise and storm surge. Streets to the north and northwest of Belle Isle Marsh Reservation, including Pearl Avenue, Belle Isle Avenue, Winthrop Avenue, and Bennington Street have experienced flooding. This region is home to schools, pump stations, a tide gate, and areas designated as Areas of Critical Environmental Concern by the State.

Point of Pines/Riverside:
Except for elevated areas around the Route 1A on-ramp, all the Point of Pines / Riverside area is located within the FEMA 100-year floodplain. This region of the City has widespread vulnerability to flooding. Route 1A, Mills Avenue, Rice Avenue, and Revere Beach Boulevard have experienced localized flooding and drainage issues. Residences in the neighborhoods of this area have experienced flooding and increased flood insurance rates. There are several vulnerable tide gates located along Route 1A. The Point of Pines Yacht Club, Point of Pines Beach, and associated piers, docks, and water access points are exposed to wind and storm surge. The Point of Pines Yacht Club is identified as an emergency gathering space.

Oak Island/Revere Beach:
Like the Beachmont and Point of Pines / Riverside areas, the Oak Island / Revere Beach area is characterized by low-lying areas within the FEMA 100-year floodplain, coastal frontage, and marshes. Non-functional flood gates and an antiquated drainage system contribute to flood vulnerability in this part of the City. Within this area, the high density of traffic along Roosevelt Avenue, Revere Street, and Broadway combined with flood vulnerability impact emergency access. Additional hazards in this area include risk of fire due to the prevalence of Phragmites in the marsh near the Wonderland Greyhound Park and coastal erosion. Populations in low-income and senior housing and schools in the Oak Island / Revere Beach area are among the vulnerable social features in this area.

Impacts of Climate Change

Climate change is expected to increase the frequency and severity of routine tidal flooding and storm-related flooding in the City. Climate change is also expected to increase the frequency and severity of severe storm events, such as hurricanes and nor’easters, that would result in more coastal flooding from storm surge. Severe storm events coupled with sea level rise could exacerbate the extent of coastal flooding.

3.3.3.6 Coastal Erosion

General Definition

The process by which local sea level rise, strong wave action, and coastal flooding wear down or carry away rocks, soils, and sands along the cost; all coastlines are affected by storms and other natural events that cause erosion.[30]

Location of Coastal Erosion

Storm surges accelerate erosion along beaches and undermine sea walls, some of which are decades old. Failure of seawalls and shoreline erosion increase the vulnerability of nearby structures.

Located on Broad Sound, the east facing shoreline of Revere is exposed to coastal erosion. Approximately five miles of shoreline is directly exposed, with the remaining shoreline semi-protected by offshore structures or landforms. The city is protected from coastal storms by both natural and human-made shoreline structures. There are 15 structures including 11 bulkheads/seawalls, 3 revetments, and one breakwater. Nine of these structures are owned by the Commonwealth of Massachusetts and six are owned by the City of Revere. The Massachusetts Coastal Infrastructure Assessment Project rated the condition of 10 of these structures "B" (structures requiring limited or no repair) and the remaining five were rated "C" (structures requiring moderate to limited repair). The inventory is summarized in Table 3-22.[31]

Table 3-22: Inventory of Coastal Structures in Revere

Primary Structure	A	B	C	D	F	Total	Length (ft)
Seawall/Bulkhead		9	2			11	21,585
Revetment		1	2			3	2,600
Breakwater			1			1	2.725
Total		10	5			15	26,890

Key
A: Excellent - Like new condition.
B: Good – Minor problems, superficial in nature
C: Fair – Structure is sound but may have minor deterioration
D: Poor – Advanced levels of deterioration; risk of damage and possible failure
F: Critical – Conditions may warrant emergency stabilization

According to a US Army Corps of Engineers study of Revere Beach, the coastal reach from Revere Beach to Point of Pines forms a littoral cell bordered to the southwest by Roughans Point headland and by the Saugus River estuary to the northeast. Exposure to waves from the southeast via Broad Sound and partial sheltering by Nahant Peninsula to the east combine to create a general southwest-to-northeast direction of sediment transport. Wave energy tends to focus at two locations: between Revere and Beach Streets, and at Carey Circle.

In addition to flood hazards, coastal shorelines change constantly in response to wind, waves, tides, sea level fluctuation, seasonal and climatic variations, human alteration, and other factors that influence the movement of sand and material within a shoreline system. The loss (erosion) and gain (accretion) of

[30] National Oceanic and Atmospheric Administration, U.S. Climate Resilience Toolkit, 2021. Retrieved https://toolkit.climate.gov/topics/coastal-flood-risk/coastal-erosion
[31] Massachusetts Coastal Infrastructure Inventory and Assessment Project, July 2009. Retrieved https://www.mass.gov/files/documents/2016/08/pa/marblehead-revere.pdf

coastal land is a visible result of the way shorelines are reshaped in the face of these dynamic conditions. Shorelines tend to change seasonally, accreting slowly during the summer months when sediments are deposited by relatively low energy waves and eroding dramatically during the winter when sediments are moved offshore by high-energy storm waves, such as those generated by nor'easters. Regardless of the season, coastal storms typically cause erosion. With the anticipated change in climate an increase in intensity and frequency of storms is expected.

Extent/Severity of Coastal Erosion

A study of shoreline change in Massachusetts by the U.S. Geological Survey, Woods Hole Oceanographic Institution Sea Grant Program, and Cape Cod Cooperative Extension reveals that approximately 68 percent, or 513 miles, of Massachusetts' ocean- facing shore exhibits a long-term erosion trend, 30 percent, or 226 miles, shows long-term accretion, and two percent, or 15 miles, shows no net change.

For the entire ocean-facing Massachusetts shore, from the mid -1800's to 1994, the long- term average annual shoreline change rate ranges between -0.58 and 0.75 feet per year. Approximately 46 percent of the Massachusetts shore is eroding at one foot or less per year, while 22 percent of the shore is accreting at one foot or less per year. Eighty-one percent of the shore fluctuates +/-2 feet per year.

Previous Occurrences

Historic coastal erosion is difficult to quantify due to the extent of human interventions have altered the coast of Revere. Furthermore, Coastal shorelines change constantly in response to wind, waves, tides, sea level fluctuation, seasonal and climatic variations, human alteration, and other factors that influence the movement of sand and material within a shoreline system. While discrete storm events can accelerate coastal erosion, it is generally a continuous event resulting from earth's processes. However, it is estimated the shoreline within the vicinity of Boston is fluctuating 0.3 feet annually.[32]

Probability of Future Events and Changes from Previous Update

Coastal erosion in Revere is considered a "High Frequency" event that has a recurrence interval of less than 10 years. Alternatively stated, the annual probability of coastal erosion occurring in the City is greater than 10-percent. The probability of future events has not changed since the 2015 Update.

Impacts on the Community and Vulnerability

Coupled with sea level rise, coastal erosion can increase the vulnerability of residents further from the coast to coastal flooding, exacerbating the impacts of coastal flooding. Residents adjacent to the coastline are most vulnerable to coastal erosion.

Impacts of Climate Change

It is anticipated that sea level rise resulting from climate change will exacerbate the rate and extent of coastal erosion in Massachusetts. In general, sandy shoreline retreats landward approximately 100 feet for every foot of sea level rise (2018 SHMCAP).

3.3.3.7 Tsunamis

General Definition

FEMA defines tsunami as a series of enormous seismic sea waves created by an underwater disturbance caused by geologic activity in the form of earthquakes, volcanic eruptions, underwater landslides, or meteorites striking the Earth.

[32] Massachusetts Coastal Erosion Commission, Report of the Massachusetts Coastal Erosion Commission, December 2015. Retrieved https://www.mass.gov/files/documents/2016/12/sd/cec-final-report-dec2015-complete.pdf

Locations of Atlantic Based Tsunamis
Tsunamis are a potential city-wide hazard in Revere. While the probability of a tsunami striking Revere is unlikely, it is assumed in the 2018 SHMCAP that a tsunami could inundate portions of the City within a mile of the coastline.

Extent/Severity of Atlantic Based Tsunamis
Tsunamis are typically measured by their height at the shore and the maximum run-up of the tsunami waves on the land (2018 SHMCAP).

Previous Occurrences
There is no historical record of tsunami events occurring in the City.

Probability of Future Events and Changes from Previous Update
Tsunami events in Revere are considered “Very Low Frequency” events that have a recurrence interval of greater than 1,000 years. Alternatively stated, the annual probability of a landslide occurring in the City is less than 0.1-percent. The probability of future events has not changed since the 2015 Update.

Impacts on the Community and Vulnerability
Like other forms of coastal flooding, tsunamis can damage buildings and infrastructure, and can also result in loss of life. While the likelihood of a tsunami is low, those most adjacent to the coastline are most susceptible to tsunamis.

Impacts of Climate Change
Climate change will increase the likelihood of tsunamis in the future. As ice melts because of climate change, the likelihood of earthquakes and submarine landslides will increase, potentially triggering tsunamis. Furthermore, the impact of collapsing glaciers may trigger tsunamis as a secondary threat following landslides.

Rising Temperatures
Rising temperatures will affect risk of extreme temperatures, wildfires, and invasive species.

3.3.3.8 Extreme Temperatures

General Definition
There is no universal definition for extreme temperatures. The term is relative to the usual weather in the region based on climatic averages. Revere has four well-defined seasons. The seasons have several defining factors, with temperature one of the most significant. Extreme temperatures can be defined as those, which are far outside of the normal seasonal ranges for Massachusetts. The average temperatures for Massachusetts are as follows:

- Winter (Dec-Feb) Average: 31.8°F
- Summer (Jun-Aug) Average: 71°F

Extreme temperatures include extreme heat and extreme cold.

Extreme Heat: Extreme heat, for this climatic region, is usually defined as a period of 3 or more consecutive days above 90 °F, but more generally a prolonged period of excessively hot weather, which may be accompanied by high humidity. Extreme cold, again, is relative to the normal climatic lows in a region.

Extreme Cold: Extreme cold is more difficult to define but is relative to normal climatic lows in the region.

Location of Extreme Temperatures
The entire City of Revere is susceptible to extreme temperatures.

Extent/Severity of Extreme Temperatures

The National Weather Service uses Wind Chill Advisories/Warnings and Heat Advisories/Warnings to measure the extent of extreme temperatures.

Heat Parameters:

- Heat Advisory: temperatures between 100°F and 104°F for at least two hours
- Heat Warning: temperatures at or above 105°F for at least two hours

Wind Chill Parameters:

- Wind Chill Advisory: temperatures between - 15°F and 24°F for at least three hours
- Wind Chill Warning: temperatures at or below -25°F for at least three hours

Previous Occurrences

Previous occurrences of excessive heat events in Suffolk County are summarized in Table 3-23.

Table 3-23: Excessive Heat Occurrences in Suffolk County since 1950[33]

Date	Type	Deaths	Injuries	Property Damage
12/17/2000	Excessive Heat	0	0	0.00K
5/3/2001	Excessive Heat	0	0	0.00K
5/4/2001	Excessive Heat	0	0	0.00K
5/12/2001	Excessive Heat	0	0	0.00K
7/22/2011	Excessive Heat	0	0	0.00K
Total	**5**	**0**	**0**	**0.00K**

Previous occurrences of extreme cold and wind chill occurrences in Suffolk County are summarized in Table 3-24.[34]

Table 3-24: Extreme Cold and Wind Chill Occurrences in Suffolk County since 1950

Date	Type	Deaths	Injuries	Property Damage
1/6/2018	Cold/wind Chill	0	0	0.00K
2/3/2007	Extreme Cold/wind Chill	1	0	0.00K
7/14/1999	Cold/wind Chill	0	0	0.00K
7/8/2000	Cold/wind Chill	0	0	0.00K
10/9/2000	Cold/wind Chill	0	0	0.00K
10/30/2000	Cold/wind Chill	0	0	0.00K
Total	**6**	**1**	**0**	**0.00K**

[33] National Oceanic and Atmospheric Administration, National Centers for Environmental Information, Storm Event Database, May 2021. Retrieved https://www.ncdc.noaa.gov/stormevents/

[34] National Oceanic and Atmospheric Administration, National Centers for Environmental Information, Storm Event Database, May 2021. Retrieved https://www.ncdc.noaa.gov/stormevents/

Probability of Future Events and Changes from Previous Update
Extreme temperatures in Revere are considered a “High Frequency” event that have a recurrence interval of less than 10 years. Alternatively stated, the annual probability of an extreme weather event occurring in the City is greater than 10-percent. The probability of future events has not changed since the 2015 Update.

Impacts on the Community and Vulnerability
Extreme temperatures threaten public health and can limit access to lifeline utilities such as electricity and potable water. Residents without access to sufficient heat sources in the winter months and air conditioning in the summer months are most likely to suffer adverse effects from extreme temperatures. Vulnerable populations include low-income residents, those with limited access to climate control mechanisms, and elderly populations that are most susceptible to extreme temperatures.

Impacts of Climate Change
Annual extreme heat events are expected to increase up to seven-fold by 2050 because of climate change.

3.3.3.9 Wildfires

General Definition
A wildfire is any non-structure fire that occurs in vegetative wildland that contains grass, shrub, leaf litter, and forested tree fuels (2018 SHMCAP). Wildfires in Massachusetts are caused by natural events, human activity, or prescribed fire.

Location of Wildfire
Wildfires can occur throughout the City, though the following locations have been identified as having the highest potential for brush fires:

- Washburn Avenue area- sparks from Massachusetts Bay Transportation Authority (MBTA) Blue Line subway cause marsh grass fires.
- MBTA Blue Line subway tracks area between Wonderland Dog Track to Revere Street; sparks from vehicles’ wheels causes marsh grass fires.
- MBTA Blue Line subway tracks area between Revere Street and Oak Island; subway wheel sparks cause marsh grass fires.
- North Revere area: vandals.
- North Shore Road: North of Oak Island to Mills Avenue and east side of Route 1A: vandals.
- West of Washington Avenue from Amelia Place to Sherman Street: vandals.
- Revere Beach Parkway from Pratt Avenue to Suffolk Downs: vandals set fires in marsh grass.
- Bird Sanctuary at Tank Farm: vandal and lightening caused brush fires.

Extent/Severity of Wildfire
The severity of wildfires is measured by acres burned. Based on the locally identified known fire hazard areas, the maximum extent of potential fire damage in Revere is summarized in Table 3-25.

Table 3-25: Maximum Extent of Potential Fire Damage

Fire Hazard Area	Acres
Washburn Avenue area	18
MBTA Blue Line Wonderland Dog Track	15
MBTA Blue Line Revere Street and Oak Island	78

North Revere area	92
North Shore Road	74
West of Washington Avenue	81
Revere Beach Parkway	12
Bird Sanctuary at Tank Farm	7
Total Fire Hazard Area	**377**

Previous Occurrences

Over the ten-year period from 2004 to 2014 the Revere Fire Department logged a total of 271 wildfire incidences, of which 60 percent were brush or mixed brush/grass fires, and 30 percent were grass fires. The remaining 10 percent included fires categorized as forest, woods or wildland fires, natural vegetation fires, other, and special outside fires, other. Only seven of these fires over the ten-year period resulted in dollar losses; and the average of these was $7,300. The Fire Chief estimates that the area impacted averages four to five acres per year.

Probability of Future Events and Changes from Previous Update

Wildfire events in Revere are a “High” frequency event, indicating the estimated recurrence interval is less than 10 years. Alternatively stated, the annual probability of a tornado occurring in Revere is greater than 10-percent. The probability of future events has not changed since the 2015 Update.

Impacts on the Community and Vulnerability

Wildfires can destroy buildings and result in loss of life. Residents most living adjacent to the areas listed under Locations of Wildfires are most vulnerable to their impacts.

Impacts of Climate Change

Climate change is expected to increase the risk of wildfires as precipitation anomalies and prolonged drought events increase the risk of wildfire.

3.3.3.10 Invasive Species

General Definition

Invasive species are organisms that are not native to local ecosystems. Absent native predators and competitors are often disruptive and damaging to native ecosystems, displace native species.

Locations of Invasive Species

Due to the massive scope of the hazard of invasive species, the entire Commonwealth of Massachusetts experiences impacts of invasive species (2018 SHMCAP). Using the findings of the 2018 SHMCAP as a basis, the entire City of Revere is vulnerable to the impacts resulting from invasive species.

Extent/Severity of Invasive Species

Invasive species are a widespread problem throughout the City, though the geographic extent varies depending on the species in question (2018 SCHMAP).

Previous Occurrences

Following introduction, presence of invasive species is a continuous event that does not have discrete occurrences. Resultantly, it is difficult to measure the frequency of previous occurrences.

Probability of Future Events and Changes from the Previous Update

Invasive species are expected to be an increasing challenge throughout the City. Invasive species were not profiled in the previous Update.

Impacts on the Community and Vulnerability
It is rare for invasive species to directly impact humans. The entire City is vulnerable to adverse impacts from invasive species.

Impacts of Climate Change
Climate change is expected to facilitate the migration and introduction of invasive species to non-native ecosystems. Furthermore, it is anticipated that native ecosystems of Massachusetts will be further stressed by the impacts of climate change, including increased periods of heavy precipitation and extended drought, and increasing temperatures, making native ecosystems more vulnerable to displacement.

Extreme Weather
Extreme weather resulting from climate change will affect risk from the hurricanes and tropical storms, severe winter storms, and tornadoes.

3.3.3.11 Hurricanes/Tropical Storms

General Definition
Hurricanes are tropical cyclones with sustained winds of 74 miles per hour or greater. A tropical cyclone is a rotating low-pressure weather system. Tropical cyclones with maximum sustained surface winds of less than 39 miles per hour are classified as tropical cyclones, while tropical cyclones with maximum sustained winds of 39 miles per hour or greater are classified as tropical storms. Atlantic hurricane season runs from June 1 through November 30.[35]

Types of Hurricanes/Tropical Storms
Hurricanes and tropical storm events include a bundle of natural hazards. The primary hazards associated with tropical cyclones are outlined as follows:

- Storm surge
- Wind
- Inland freshwater flooding
- Tornadoes

Location of Hurricanes/Tropical Storms
The entire City is susceptible to strong winds, inland freshwater flooding, and tornadoes. As Revere is a coastal city, much of the land area is susceptible to storm surge.

Extent of Hurricanes/Tropical Storms
The strength of a hurricane is measured by the Saffir-Simpson Wind Scale, which is outlined in Table 3-26.[36]

Table 3-26: Saffir-Simpson Wind Scale

Category	Sustained Winds	Types of Damage Due to Hurricane Winds
Tropical Depression	Up to 38 mph	N/A
Tropical Storm	39-73 mph	N/A

[35] National Oceanic and Atmospheric Administration, What is a hurricane? June 2021. Retrieved https://oceanservice.noaa.gov/facts/hurricane.html.
[36] National Oceanic and Atmospheric Administration, Saffir-Simpson Hurricane Wind Scale, no date. Retrieved https://www.nhc.noaa.gov/aboutsshws.php

1	74-95 mph	Very dangerous winds will produce some damage: Well-constructed frame homes could have damage to roof, shingles, vinyl siding and gutters. Large branches of trees will snap, and shallowly rooted trees may be toppled. Extensive damage to power lines and poles likely will result in power outages that could last a few to several days.
2	96-110 mph	Extremely dangerous winds will cause extensive damage: Well-constructed frame homes could sustain major roof and siding damage. Many shallowly rooted trees will be snapped or uprooted and block numerous roads. Near-total power loss is expected with outages that could last from several days to weeks.
3	111-129 mph	Devastating damage will occur: Well-built framed homes may incur major damage or removal of roof decking and gable ends. Many trees will be snapped or uprooted, blocking numerous roads. Electricity and water will be unavailable for several days to weeks after the storm passes.
4	130-156 mph	Catastrophic damage will occur: Well-built framed homes can sustain severe damage with loss of most of the roof structure and/or some exterior walls. Most trees will be snapped or uprooted, and power poles downed. Fallen trees and power poles will isolate residential areas. Power outages will last weeks to possibly months. Most of the area will be uninhabitable for weeks or months.
5	157 mph or higher	Catastrophic damage will occur: A high percentage of framed homes will be destroyed, with total roof failure and wall collapse. Fallen trees and power poles will isolate residential areas. Power outages will last for weeks to possibly months. Most of the area will be uninhabitable for weeks or months.

mph – miles per hour

Previous Occurrences

The region has been impacted by hurricanes throughout its history, starting with the Great Colonial Hurricane of 1635. Table 3-27 provides a summary of tropical cyclones that have affected eastern Massachusetts since 1861.

Table 3-27: Hurricane Records for Eastern Massachusetts

Hurricane Name	Date
Hurricane Sandy	October 29-30, 2012
Tropical Storm Irene	August 28, 2011
Hurricane Earl	September 4, 2010
Hurricane Hanna	August 28, 2008 to September 8, 2008
Tropical Storm Barry	May 31, 2007 to June 5, 2007
Tropical Storm Hermine	August 27 - 31, 2004
Hurricane Bertha	July 3 -17, 1996
Hurricane Bob	August 16 - 29, 1991
Hurricane Gloria	September 27,1985
Hurricane Donna	12-Sep-60
Hurricane Diane	August 17-19, 1955
Hurricane Edna*	September 11, 1954
Hurricane Carol*	August 31, 1954
Hurricane Doug	September 11-12, 1950
Great Atlantic Hurricane of 1944*	September 9 - 16, 1944

Great New England Hurricane*	September 21, 1938
Tropical Storm of 1923	October 15 – 19, 1923
Extratropical Storm of 1916	May 13 – 18, 1916
Hurricane of 1916	July 10 - 22, 1916
Hurricane of 1915	July 31, 1915 to August 5, 1915
Hurricane of 1908	May 24 - 31, 1908
Tropical Storm of 1902	June 12 - 17, 1902
Hurricane of 1897	September 20 - 25, 1897
Hurricane of 1888	August 14 - 24, 1888
Tropical Storm of 1888	September 6 -13, 1888
Hurricane of 1876	September 12 - 19, 1876
Hurricane of 1869	September 7 – 9, 1869
Hurricane of 1861	November 1 – 3, 1869

Probability of Future Events and Changes from Previous Update

Data was pulled from the 2018 SHMCAP to estimate probability of future events. As stated in the 2018 SHMCAP, 65 hurricane or tropical storm events occurred in Massachusetts between 1842 and 2017. On average, storms severe enough to receive a FEMA disaster declaration have occurred every nine years. NOAA estimates there is an average annual probability of 1-2 percent of a major hurricane making landfall in Massachusetts.[37] The probability of future events has not changed since the 2015 Update.

Impacts on the Community and Vulnerability

Hurricanes can destroy structures and infrastructure, and result in loss of life. The entire City is susceptible to damage from hurricane winds while those in low-lying coastal areas are most susceptible to damage from hurricane storm surge.

The Massachusetts Sea Level Rise and Coastal Flooding Viewer visualizes locations in Revere vulnerable to storm surge from hurricanes.

Impacts of Climate Change

Climate change is expected to increase the frequency and intensity of hurricanes and tropical storms, fueled by warming ocean temperatures. Furthermore, climate change is likely to increase the rate of rainfall during hurricanes, increasing the potential for inland flooding. Sea level rise will exacerbate storm surge during hurricanes.

3.3.3.12 Severe Winter Storms

General Definition

Severe winter storms are characterized by ice and snow accumulation, strong winds, and low temperatures.

Types of Winter Storms

Winter storms can include blizzards, heavy snowstorms, “nor’easters”, and sleet and ice storms.

Location of Winter Storms

The entire City is susceptible to winter storms.

[37] National Oceanic Administration, no title, no date. Retrieved https://www.nhc.noaa.gov/climo/images/return_mjrhurr.jpg

Extent/Severity of Winter Storms

The average annual snowfall for most of the City ranges from 36.1 to 48 inches, except for a small portion of northwest Revere where the average ranges from 48.1 inches to 72 inches of snowfall.

The Regional Snowfall Index (RSI) is used to measure the extent of winter storms. The RSI ranks snowstorm impacts on a scale from 1 to 5, and factors the spatial extent of the storm, the amount of snowfall, and the juxtaposition of these elements with population.[38] The RSI is summarized in Table 3-28.[39]

Table 3-28: Regional Snowfall Index

Category	RSI Value (inches of snowfall)	Description
1	1-3	Notable
2	3-6	Significant
3	6-10	Major
4	10-18	Crippling
5	18 and above	Extreme

The Northeast Snowfall Impact Scale (NESIS) was used to rank and characterize high-impact northeast snowstorms with large areas of 10-inch accumulation and greater prior to the RSI. The NESIS is summarized in Table 3-29.[40]

Table 3-29: Northeast Snowfall Impact Scale

Category	NESIS (inches of snowfall)	Value Description
1	1.0-2.49	Notable
2	2.5-3.99	Significant
3	4.0-5.99	Major
4	6.0-9.99	Crippling
5	10.0 and above	Extreme

Most of the City receives an average of 36.1 to 48 inches of snowfall annually, except for a small portion of northwest Revere, which receives an average of 48.1 to 72 inches of snowfall, annually.

Previous Occurrences

Notable severe winter storms are listed below:

- Blizzard of 1978, February 1978
- Blizzard, March 1993
- Severe Snowstorm, March 2001
- Severe Snowstorm, December 2003
- Severe Snowstorm, January 2005

[38] National Oceanic and Atmospheric Administration, Regional Snowfall Index, no date. Retrieved https://www.ncdc.noaa.gov/snow-and-ice/rsi/
[39] Department of Commerce, Regional Snowfall Index, no date. Retrieved https://www.ncdc.noaa.gov/snow-and-ice/rsi/
[40] U.S. Department of Commerce, The Northeast Snowfall Impact Scale, no date. Retrieved https://www.ncdc.noaa.gov/snow-and-ice/rsi/nesis

- Severe Snowstorm, April 2007
- Severe Snowstorm, December 2010
- Severe Snowstorm, January 2011
- Blizzard of 2013, February 2013
- Blizzard of 2015, January 2015

The City of Revere does not keep records of winter storms. Data for Suffolk County, which includes Revere, is the best available data to help understand previous occurrences and impacts of winter storm events. According to National Climate Data Center (NCDC) records, Suffolk County has only experienced one blizzard between 1950 and 2021, in February of 2013, which resulted in no deaths or property damage in Suffolk County. For the same time period, Suffolk County experienced 40 heavy snowfall events, resulting in no deaths, one injury and $9.582 million dollars in property damage. Using the NESIS scale for magnitude and the National Weather Service's definition of heavy snowfall, it can be deduced that Suffolk County has experienced a minimum of 40 NESIS Category 3 heavy snowfall events since 1950. See Table 3-30 below for and Heavy Snow events and impacts.[41]

Table 3-30: Heavy Snow Events and Impacts in Suffolk County 1950-2020

Date	Type	Deaths	Injuries	Property Damage
3/14/2017	Heavy Snow	0	0	0
2/8/2016	Heavy Snow	0	0	0
2/5/2016	Heavy Snow	0	0	10 K
1/23/2016	Heavy Snow	0	0	0
2/14/2015	Heavy Snow	0	0	0
2/8/2015	Heavy Snow	0	0	0
2/2/2015	Heavy Snow	0	0	0
1/24/2015	Heavy Snow	0	0	0
2/5/2014	Heavy Snow	0	0	0
1/2/2014	Heavy Snow	0	0	0
12/17/2013	Heavy Snow	0	0	0
3/18/2013	Heavy Snow	0	0	0
3/18/2013	Heavy Snow	0	0	0
3/7/2013	Heavy Snow	0	0	0
3/7/2013	Heavy Snow	0	0	0
2/8/2013	Heavy Snow	0	0	0
2/8/2013	Heavy Snow	0	0	0
1/26/2011	Heavy Snow	0	0	0
12/19/2009	Heavy Snow	0	0	0
3/1/2009	Heavy Snow	0	0	0
1/19/2009	Heavy Snow	0	0	0

[41] National Oceanic and Atmospheric Administration, National Centers for Environmental Information, Storm Event Database, May 2021. Retrieved https://www.ncdc.noaa.gov/stormevents/

Date	Type	Deaths	Injuries	Property Damage
1/18/2009	Heavy Snow	0	0	0
12/31/2008	Heavy Snow	0	0	0
12/19/2008	Heavy Snow	0	0	0
2/22/2008	Heavy Snow	0	0	0
1/14/2008	Heavy Snow	0	0	55 K
12/19/2007	Heavy Snow	0	0	0
12/16/2007	Heavy Snow	0	0	7.5 K
2/24/2005	Heavy Snow	0	0	0
2/21/2005	Heavy Snow	0	0	0
3/16/2004	Heavy Snow	0	0	0
3/5/2001	Heavy Snow	0	0	0
2/5/2001	Heavy Snow	0	0	0
1/20/2001	Heavy Snow	0	0	0
2/18/2000	Heavy Snow	0	0	0
1/13/2000	Heavy Snow	0	0	0
3/15/1999	Heavy Snow	0	0	0
3/6/1999	Heavy Snow	0	0	0
2/25/1999	Heavy Snow	0	0	0
1/14/1999	Heavy Snow	0	0	0
1/15/1998	Heavy Snow	0	0	0
12/23/1997	Heavy Snow	0	0	0
4/1/1997	Heavy Snow	1	0	2.5 M
3/31/1997	Heavy Snow	0	0	0
4/9/1996	Heavy Snow	0	0	0
4/7/1996	Heavy Snow	0	0	0
3/7/1996	Heavy Snow	0	0	0
3/2/1996	Heavy Snow	0	0	0
2/16/1996	Heavy Snow	0	0	0
1/7/1996	Heavy Snow	0	0	7 M
1/2/1996	Heavy Snow	0	0	0
Total	**51**	**1**	**0**	**9.582 M**

Since 1958 Massachusetts has experienced two Category 5 Extreme snowstorms, nine Category 4 (Crippling) storms, and 13 Category 3 (Major) snowstorms.

Probability of Future Events and Changes from Previous Update

In Massachusetts, winter storms happen multiple times each year. Winter storms are considered a "High" frequency event in Revere, indicating the estimated recurrence interval is less than 10 years. Alternatively stated, the annual probability of a tornado occurring in Revere is greater than 10-percent. The probability of future events has not changed since the 2015 Update.

Impacts on the Community and Vulnerability

Winter snowstorms and extended cold weather are frequent hazards in New England. The impact of heavy snowfall is to impair the flow of vehicles needed for day-to-day commuting, local businesses, and public safety response. In addition, infrastructure, including critical utilities, may be impacted by winter storms and power outages and hazards to navigation and aviation can occur. During winter storms, there is an increased risk of fire due to loss of electricity and the associated use of portable heaters, gas stoves, candles, and other flammable sources of heat and light. Fire during winter storms presents a great danger because water supplies may freeze, and it may be difficult for firefighting apparatus to get to a fire. The added impacts from heavy snow and ice can affect transportation infrastructure and negatively impact both the local and regional economies. The entire City is vulnerable to impacts from severe winter storms, though marginalized communities such as elderly and low-income populations are most vulnerable to adverse effects resulting from severe winter storms.

Impacts of Climate Change

It is expected that climate change will increase the frequency and severity of severe winter storms. Climate change may result in increased snow fall and increased intensity of winter storms.

3.3.3.13 Tornadoes

General Definition

A tornado is a violently rotating column of air that extends from the base of a cumulonimbus cloud to the ground.

Location of Tornadoes

The location of a tornado is generally unpredictable, though historical records indicate tornadoes are less likely to strike in coastal communities such as Revere than they are to strike in inland communities across the Commonwealth. The potential remains for tornadoes to strike anywhere in the City.

Extent of Tornadoes

The Enhanced Fujita (EF) Scale is used to measure the severity of tornadoes. The Fujita Tornado Damage Scale is summarized in Table 3-31.[42]

Table 3-31: Enhanced Fujita Scale

Scale	Wind Speed – 3 Second Gust (mph)	Typical Effects
F0	65-85	Gale tornado (weak); light damage to chimneys; breaks twigs and branches off trees; pushes over shallow-rooted trees; damages signboards; some windows broken.
F1	86-110	Moderate tornado (weak); Moderate damage: peels surface off roofs; mobile homes pushed off foundations or overturned; outbuildings demolished; moving autos pushed off roads; trees snapped or broken.
F2	111-135	Significant tornado (strong); considerable damage: roofs torn off frame houses; mobile homes demolished; frame houses with weak foundations lifted and

[42] U.S. Department of Commerce, The Enhanced Fujita Scale, no date. Retrieved https://www.weather.gov/oun/efscale; Maine Emergency Management Agency, State Hazard Mitigation Plan – 2019 Update, 2018. Retrieved https://www.maine.gov/mema/sites/maine.gov.mema/files/inlinefiles/State%20Hazard%20Mitigation%20Plan%202019%20Update_10.8.2019.pdf

		moved; boxcars pushed over; large trees snapped or uprooted; light-object missiles generated.
F3	136-165	Severe tornado (strong); severe damage: roofs and some walls torn off well-constructed houses; trains overturned; most trees in forests uprooted; heavy cars lifted off the ground and thrown; weak pavement blown off roads.
F4	166-200	Devastating tornado (violent); devastating damage: well-constructed homes leveled; structures with weak foundations blown off some distance; cars thrown and disintegrated; large missiles generated; trees in forest uprooted and carried some distance away.
F5	Over 200	Incredible tornado (violent); Strong-framed, well-built houses leveled; steel-reinforced concrete structures damaged, tall buildings collapse or have severe deformations; some vehicles can be thrown great distances.

Previous Occurrences

While the City does not have an extensive history of tornadoes, an F2 tornado struck the City on July 28, 2014. The tornado touched down at 9:32 am in Chelsea just south of Route 16 (Revere Beach Parkway) and moved north into Revere's business district along Broadway, past Revere City Hall, and ended at 9:36 AM near the intersection of Routes 1 and 60 (see Figure 3-1). The path was approximately two miles long and ⅜-mile-wide, with wind speeds up to 120 miles per hour.

According to Revere Fire Chief Gene Doherty 65 homes had "substantial damages" and 13 homes and businesses were uninhabitable. The city set up a shelter at a local school for displaced residents. National Grid reported that 3,000 homes were without power.

Figure 3-1: Path of Revere Tornado on July 28, 2014

Probability of Future Events and Changes from Previous Update

Based on the record of previous occurrences since 1950, Tornado events in Revere are a "Medium" frequency event, indicating the estimated recurrence interval ranges between 10 and 100-years. Alternatively stated, the annual probability of a tornado occurring in Revere ranges from 1-percent to 10-percent.

Impacts on the Community and Vulnerability
Tornadoes can damage buildings and infrastructure and result in loss of life. While the likelihood of a tornado striking Revere is low, the entire community is vulnerable to tornadoes.

Impacts of Climate Change
While climate change is expected to increase the frequency and severity of thunderstorms and hurricanes, which can both include tornadoes, the impacts of climate change on tornadoes are not certain.

3.3.4 Non-Climate Influenced Hazards

Earthquakes represent a non-climate influenced hazard that poses a risk to the City.

3.3.4.1 Earthquakes

General Definition
An earthquake is the vibration of the Earth's surface that follows a release of energy in the Earth's crust (2018 SHMCAP).

Location of Earthquakes
Earthquakes have the potential to affect the entire City of Revere. Massachusetts, like the other New England States, is located deep within the interior of the North American Plate; resultantly, Revere is most susceptible to intraplate earthquakes (2018 SHMCAP).

Extent/Severity of Earthquakes
The Richter Scale is used to measure the strength, or magnitude of an earthquake at its epicenter. While the magnitude of an earthquake measures the strength at its epicenter, intensity measures the strength of an earthquake at a given location, measured using the Mercalli Intensity Scale. The Richter Scale and Mercalli Intensity Scales are outlined in Table 3-32.[43]

Table 3-32: Richter Scale and Mercalli Intensity Scale

Magnitude	Mercalli Intensity	Average Effects
1	I	Microearthquakes not felt.
2	I	Minor earthquakes felt slightly by some people.
3	II to III	Minor earthquake often felt by people but rarely causes damage.
4	IV to V	Light earthquake with noticeable shaking of indoor objects but little damage.
5	VI to VII	Moderate earthquake felt by everyone and can damage poorly constructed buildings.
6	VII to IX	Strong earthquake that can cause damage to well-constructed buildings.
7	VIII or greater	Damages most buildings, some of which partially or completely collapse.
8	VIII or greater	Major damage to buildings. Structures likely to be destroyed.
9	VIII or greater	Permanent changes in ground topography. Severe damage or collapse to all buildings.

[43] Pacific Northwest Seismic Network, Magnitude/Intensity, no date. Retrieved https://pnsn.org/outreach/about-earthquakes/magnitude-intensity

Previous Occurrences

There was an earthquake recorded in the south-central portion of the City of Revere near the Boston line on August 6, 1978. This earthquake was recorded as having a magnitude of 1.8. Historical records of some of the more significant earthquakes in the region are shown in Table 3-33.

Table 3-33: Historical Earthquakes in Massachusetts or Surrounding Area, 1727-2012

Location	Date	Magnitude
MA - Cape Ann	November 10, 1727	5
MA - Cape Ann	December 29, 1727	NA
MA – Cape Ann	February 10, 1728	NA
MA – Cape Ann	March 30, 1729	NA
MA – Cape Ann	December 9, 1729	NA
MA – Cape Ann	February 20, 1730	NA
MA – Cape Ann	March 9, 1730	NA
MA - Boston	June 24, 1741	NA
MA - Cape Ann	June 14, 1744	4.7
MA - Salem	July 1, 1744	NA
MA - Off Cape Ann	November 18, 1755	6
MA – Off Cape Cod	November 23, 1755	NA
MA - Boston	March 12, 1761	4.6
MA - Off Cape Cod	February 2, 1766	NA
MA - Offshore	January 2, 1785	5.4
MA – Wareham/Taunton	December 25, 1800	NA
MA - Woburn	October 5, 1817	4.3
MA - Marblehead	August 25, 1846	4.3
MA - Brewster	August 8, 1847	4.2
MA - Boxford	May 12, 1880	NA
MA - Newbury	November 7, 1907	NA
MA - Wareham	April 25, 1924	NA
MA – Cape Ann	January 7, 1925	4
MA – Nantucket	October 25, 1965	NA
MA – Boston	December 27, 1974	2.3
VA –Mineral	August 23, 2011	5.8
MA - Nantucket	April 12, 2012	4.5
ME - Hollis	October 17, 2012	4

Probability of Future Events and Changes from Previous Update

According to the Boston College Weston Observatory, in most parts of New England, there is a one in ten chance that a potentially damaging earthquake will occur in a 50-year time-period. Significant earthquake

events in Revere are considered a “Very Low” frequency event that have a typical recurrence interval of greater than 100-years. Alternatively stated, the annual probability of an earthquake occurring in Revere is less than 1-percent. The probability of future events has not changed since the 2015 Update.

Impacts on the Community and Vulnerability

Earthquakes can cause damage to buildings and infrastructure. Non-reinforced masonry is particularly vulnerable to earthquakes. While the likelihood of a severe earthquake impacting Revere is low, the entire City is vulnerable to earthquakes.

3.3.5 Technological and Human-Caused Hazards

Dam failure is a common technological hazard that is relevant in hazard mitigation plans as the consequence of a dam failure is flooding. However, there are no dams in the City, so this hazard is not profiled.

3.3.5.1 Impacts of Climate Change

Climate change is not expected to impact the frequency or severity of earthquakes.

3.4 Community Assets and NFIP Insured Structures

B4. Does the Plan address NFIP insured structures within the jurisdiction that have been repetitively damaged by floods? (Requirement §201.6(c)(2)(ii))

Residents of Revere have received 1,002 NFIP payouts since 1978 from 303 flood damaged structures. NFIP payouts aggregate to $18.9 million in 2021 dollars, resulting in an average of $18,900 per payout. There are 301 repetitive loss properties in Revere. Of the 301 repetitive loss properties in Revere, 296 are residential (172 are single family residences) and five are non-residential properties.

In total, four flood-prone structures in Revere have been bought out using HMA funding.

3.5 Risk Analysis and Loss Estimation

The Risk Analysis and Loss Estimation describes each hazard’s impact on the community, as well as an overall summary of the community’s vulnerability pursuant to 44 CFR § 201.6 (c) (2) (ii).

The findings of the Risk Analysis and Loss Estimation conducted for this update, which utilized data from FEMA’s National Risk Index (NRI), suggest that the City is most vulnerable to extreme temperatures, hurricanes and tropical storms, severe winter storms, tornadoes, and earthquakes, based on the exposed population. However, the Risk Rating, which includes a qualitative assessment of the estimated annual losses, identified inland flooding as being the greatest risk to the City at large.

The NRI was leveraged to estimate the potential for negative impacts resulting from natural hazards profiled in this Risk and Vulnerability Assessment. The NRI represents the potential for negative impacts resulting from natural hazards, including estimated monetary damages.[44] Table 3-34 summarizes the Risk Analysis and Annual Loss Estimation, as summarized by the NRI with the following exceptions.[45]

- According to NRI data, population affected for hazards with city-wide population exposure varied between 45,000 and 52,000. These estimates were replaced with the latest population estimate of 54,000, as estimated by the U.S. Census Bureau.

[44] Federal Emergency Management Agency, National Risk Index Technical Documentation, July 2021. Retrieved https://www.fema.gov/sites/default/files/documents/fema_national-risk-index_technical-documentation.pdf

[45] Federal Emergency Management Agency, National Risk Index, no date. Retrieved https://hazards.geoplatform.gov/portal/apps/MapSeries/index.html?appid=ddf915a24fb24dc8863eed96bc3345f8. AECOM Analysis.

- NRI data estimated annual loss of $13.0 million from tornadoes in Revere. Because the 2014 tornado that caused $4.0 million in damages is the only recorded tornado event in 66 years of record keeping, the estimated annual loss of $13.0 million was re-estimated by assuming the 2014 tornado had a return period between 10 and 100 years (after adjusting previous damages to 2021 dollars).

The estimated annual loss and risk ratings reported in Table 3-34 were sourced from the NRI. However, community input received during the planning process indicated that the estimated annual loss and risk ratings may be under-estimated for some hazards. The Massachusetts Coastal Flood Risk Model and the FEMA-delineated SFHA suggest the NRI's estimated annual loss and risk ratings for coastal flooding and hurricanes/tropical storms under-estimate the risk they present to the City. The City's extensive record of winter storms and the New England region's reputation for nor'easters suggests that severe winter storms are a regular occurrence, and that the City's risk is also under-estimated by the NRI.

Table 3-34: Risk Analysis and Annual Loss Estimation Using FEMA's National Risk Index Data

Hazard (grouped by climate change interaction)	Exposed Population	Value Natural Hazard Exposure (in $M)	Estimated Annual Losses	Estimated Annual Loss Rating	Risk Rating
Changes in Precipitation					
Inland Flooding	10,000	$77,200	$321,000	Relatively Low to Relatively High	Relatively Low to Relatively High
Drought	0	$0	$100	Very Low	Very Low
Landslides	37,000	$280,000	$24,800	Very Low to Relatively Low	Very Low to Relatively Low
Sea Level Rise					
Coastal Flooding	29,000	$218,900	$29,800	Very Low to Relatively Low	Very Low to Relatively Low
Coastal Erosion	*Not quantified*				
Tsunamis	0	$0	$0	Insufficient Data	Insufficient Data
Rising Temperatures					
Extreme Temperatures	54,000	$381,700	$13,100	Very Low to Relatively Low	Relatively Low
Wildfires	0	$1,900	$900	None Expected to Relatively Low	Very Low to Relatively Low
Invasive Species	*Not quantified*				
Extreme Weather					
Hurricanes/Tropical Storms	54,000	$385,100	$6,700	Very Low	Very Low
Severe Winter Storms	54,000	$382,300	$5,900	Very Low to Relatively Low	Relatively Low
Tornadoes	54,000	$340,500	$80,000	Very Low to Relatively Low	Very Low to Relatively Low
Non-Climate Influenced Hazards					
Earthquakes	54,000	$388,000	$318,700	Relatively Low to Relatively Moderate	Relatively Low

Natural hazard exposure represents the monetary value of buildings, population (assuming a value of a statistical life of $7.4 million), or agricultural value exposed to a natural hazard event, based on the areas affected by historical events, hazard susceptibility, or probabilistic modeling.

3.6 Vulnerability Summary

B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? (Requirement §201.6(c)(2)(ii))

Pursuant to 44 CFR § 201.6 (c) (2) (ii), the Vulnerability Summary describes Revere's vulnerability to the hazards profiled in the Risk and Vulnerability Assessment. The Vulnerability Summary includes an overall summary of each hazard and its impact on the community. FEMA defines vulnerability as the susceptibility of people, property, industry, resources, ecosystems, or historical buildings and artefacts to the negative impact of a disaster.

The purpose of the vulnerability assessment is to estimate the extent of potential damages from natural hazards of varying types and intensities. The natural hazard exposure values provided in Table 3-34 monetize vulnerability to natural hazards at a high level.

A qualitative summary of impacts and vulnerability resulting from each hazard profiled is provided in Table 3-35, organized by climate change interactions.

Table 3-35: Summary of Impacts and Vulnerability

Hazard (grouped by climate change interaction)	Impacts	Vulnerability
Changes in Precipitation		
Inland Flooding	- Damage to buildings and infrastructure	- Low-lying areas Land in the SFHA - West/North Revere - Sales Creek area
Drought	- Agricultural production and water access	- Residents on private water supply (not a concern in Revere)
Landslides	Damage to buildings and infrastructure	- Entire City
Sea Level Rise		
Coastal Flooding	- Damage to buildings and infrastructure	- Low-lying coastal areas - Beachmont - Point of Pines/Riverside - Oak Island/Revere Beach
Coastal Erosion	- Increases vulnerability of residents further from to coast to coastal flooding	- Residents adjacent to coastline
Tsunamis	- Damage to buildings and infrastructure	- Residents adjacent to coastline
Rising Temperatures		
Extreme Temperatures	- Public health - Access to lifeline utilities such as electricity and potable water	- Entire city - Emphasis on low-income and elderly residents
Wildfires	- Damage to buildings	- Residents most adjacent to shrubland and MBTA lands

Hazard (grouped by climate change interaction)	Impacts	Vulnerability
Invasive Species	- Rarely impact humans directly	- Entire City
Extreme Weather		
Hurricanes/Tropical Storms	- Damage to buildings and infrastructure	- Entire City is vulnerable to hurricane winds - Low-lying coastal areas are most vulnerable to storm surge
Severe Winter Storms	- Inhibit travel - Power outages - Structure fires	- Entire city - Emphasis on low-income and elderly residents
Tornadoes	- Damage to buildings and infrastructure	- Entire City
Non-Climate Influenced Hazards		
Earthquakes	- Damage to buildings and infrastructure	- Entire City

In the 2015 Update, a vulnerability assessment and estimation of damages was performed for hurricanes, earthquakes, and flooding. HAZUS-MH (multiple hazards) software was used to estimate damages from hurricane winds and earthquakes, using the current version at the time of the latest analysis in April 2011, using 2000 Census Data. The methodology for flooding was developed specifically to address the issue in many of the communities where flooding was not solely related to location within the FEMA-delineated Special Flood Hazard Area.

3.6.1.1 Introduction to HAZUS-MH

HAZUS-MH is a computer program developed by FEMA to estimate losses resulting from a variety of natural hazards. The following overview of HAZUS-MH is taken from the FEMA website. For more information on the HAZUS-MH software, go to FEMA's HAZUS-MH website.

- "HAZUS-MH is a nationally standardized risk modeling methodology. It is distributed as free Geographic information system (GIS)-based desktop software with a collection of inventory databases for every U.S. state and territory. HAZUS-MH identifies areas with high risk for natural hazards and estimates physical, economic, and social impacts of earthquakes, hurricanes, floods, and tsunamis. The HAZUS-MH Program, managed by FEMA's Natural Hazards Risk Assessment Program, partners with other federal agencies, research institutions, and regional planning authorities to ensure HAZUS-MH resources incorporate the latest scientific and technological approaches and meet the needs of the emergency management community.
- HAZUS-MH is used for mitigation, recovery, preparedness, and response. Mitigation planners, GIS specialists, and emergency managers use HAZUS-MH to determine potential losses from disasters and to identify the most effective mitigation actions for minimizing those losses. HAZUS-MH supports the risk assessment requirement in the mitigation planning process. Response planners use HAZUS-MH to map potential impacts from catastrophic events and identify effective strategies for response and preparedness. HAZUS-MH is also used during real-time response efforts to estimate impacts from incoming storms or ongoing earthquake sequences."

There are three modules included with the HAZUS-MH software: hurricane wind, flooding, and earthquakes. There are also three levels at which HAZUS-MH can be run. Level 1 uses national baseline data and is the quickest way to begin the risk assessment process. The analysis that follows was completed using Level 1 data.

Level 1 relies upon default data on building types, utilities, transportation, etc. from national databases as well as census data. While the databases include a wealth of information on the City of Revere, it does not capture all relevant information. In fact, the HAZUS-MH training manual notes that the default data is "subject to a great deal of uncertainty."

However, for the purposes of this plan, the analysis is useful. This plan is attempting to indicate the possible extent of damages due only generally to certain types of natural disasters and to allow for a comparison between different types of disasters. Therefore, this analysis should be a starting point for understanding potential damages from the hazards.

3.6.1.2 Revisions Since 2015 Update

While an additional HAZUS-MH analysis was not completed for this update, the results of the 2011 HAZUS-MH analysis were adjusted to reflect population growth and inflation. Methods used to update damage estimates are described under each respective hazard. It was assumed the 2011 HAZUS-MH analysis used 2000 US Census data and that all monetized damages were in 2002 dollars.

3.6.2 Estimated Damages from Hurricane Wind

The HAZUS-MH software was used to model potential damages to the community from a 100 -year and 500-year hurricane event; storms that are 1.0% and 0.2% likely to happen each year and roughly equivalent to a Category 2 and Category 4 hurricane. The damages caused by these hypothetical storms were modeled as if the storm track passed directly through the City, resulting in the strongest winds and greatest damage potential from hurricane winds.

Though there are no recorded instances of a hurricane equivalent to a 500-year storm passing through Massachusetts, this model was included to present a reasonable "worst case scenario" that would help planners and emergency personnel evaluate the impacts of storms that might be more likely in the future, as we enter a period of more intense and frequent storms.

3.6.2.1 Methods to Update Damage Estimates

The estimated number of buildings damaged was escalated by 14 percent proportionate to the City's population growth since 2000. The estimated total building replacement value was escalated by 14 percent commensurate with the increase in estimated total number buildings; this dollar value was then adjusted to 2021 dollars using the White House Office of Management and Budget Gross Domestic Product and Deflators. Similarly, the tonnage of building debris generated and number of truckloads to clear building debris were escalated by 14 percent; tree debris generated was not adjusted under the assumption that tree canopy coverage is independent of population growth. Total property damage and total losses due to business interruption were escalated by 14 percent and then adjusted to 2021 dollars.

A summary of estimated damages from hurricane winds is provided in Table 3-36.

Table 3-36: Estimated Damages from Hurricane Winds

	100-Year (Category 2)	500-Year (Category 4)
Building Characteristics		
Estimated total number of buildings	15,142	15,142
Estimated total building replacement value (in $M)	$5,616.2	$7,131.6
Building Damages		
# of buildings sustaining minor damage	1,858	5,202
# of buildings sustaining moderate damage	425	2,962

	100-Year (Category 2)	500-Year (Category 4)
# of buildings sustaining severe damage	25	629
# of buildings destroyed	7	252
# of households displaced	185	1,783
# of people seeking public shelter	50	476
Debris		
Building debris generated (tons)	14,303	67,271
Tree debris generated (tons)	3,275	10,663
# of truckloads to clear building debris	424	2,221
Value of Damages (in $M)		
Total property damage	$97.6	$765.0
Total losses due to business interruption	$11.6	$109.2

3.6.3 Estimated Damages from Earthquakes

The HAZUS-MH earthquake module allows users to define an earthquake magnitude and model the potential damages caused by that earthquake as if its epicenter had been at the geographic center of the City. For the purposes of this plan, two earthquakes were selected: magnitude 5.0 and a magnitude 7.0. Historically, major earthquakes are rare in New England, though a magnitude 5 event occurred in 1963.

The estimated total number of buildings, buildings sustaining damage, households displaced, number of people seeking shelter, building debris generated, and number of truckloads to clear building debris were escalated by 14 percent, proportionate to population growth. Estimated building replacement value, property damage, and losses due to business interruption were escalated by 14 percent commensurate with population growth and then adjusted to 2021 dollars. Tree debris generated was not adjusted under the assumption that tree canopy coverage is independent of population growth.

A summary of estimated damages from earthquakes is provided in Table 3-37.

Table 3-37: Estimated Damages from Earthquakes

	100-Year (5.0 magnitude)	500-Year (7.0 magnitude)
Building Characteristics		
Estimated total number of buildings	15,142	15,142
Estimated total building replacement value (in $M)	$5,616	$5,616
Building Damages		
# of buildings sustaining slight damage	2,550	1,180
# of buildings sustaining moderate damage	915	4,385
# of buildings sustaining extensive damage	156	4,304
# of buildings completely damaged	20	5,121
Population Needs		

	100-Year (5.0 magnitude)	500-Year (7.0 magnitude)
# of households displaced	245	11,220
# of people seeking public shelter	162	7,415
Debris		
Building debris generated	34,066	1,044,702
Tree debris generated	18,000	543,000
# of truckloads to clear building debris	1,363	41,743
Value of Damages (millions of dollars)		
Total property damage	$324.0	$4,810.1
Total losses due to business interruption	$31.8	$836.0

3.6.4 Estimated Damages from Flooding

HAZUS-MH was not used to estimate damages from flooding in Revere. In addition to technical difficulties with the software, the riverine module is not a reliable indicator of flooding in areas where inadequate drainage systems contribute to flooding even when those structures are not within a mapped flood zone. In lieu of using HAZUS-MH, a separate methodology was developed to give a rough approximation of flood damages.

Revere covers 10 square miles or 6,400 acres. Local officials have identified approximately 397 acres in Revere as vulnerable to flooding, amounting to approximately 6.2 percent of the land area in Revere. The number of structures in each flood area was estimated by applying the percentage of the total land area to the number of structures (previously assumed to be 13,335, this number was escalated to 15,142 proportionate to population growth between 2000 and 2021) in Revere; the same number of structures used by HAZUS-MH for the hurricane and earthquake calculations. The HAZUS-MH analysis described in the previous update used a value of $257,200 (2002 dollars) which was adjusted to 2021 dollars, resulting in an updated building replacement value of $370,900. This was used to calculate the total building replacement value in each of the flood areas. Low damage estimates were assumed to be 10 percent of the building replacement value while high damage estimates were assumed to be 50 percent of the building replacement values, as suggested in the FEMA September 2002 publication, “State and Local Mitigation Planning how-to guides” (Page 4-13). These calculations are not based solely on location within the floodplain or a particular type of storm.

A summary of estimated damages from flooding is provided in Table 3-38.

Table 3-38: Estimated Damages from Flooding

ID Flood Hazard Area	Approximate Area (acres)	% of Total Land Area	Number of Structures	Replacement Value ($M)	Low Damage Estimate ($M)	High Damage Estimate
Asti Avenue Neighborhood	93.05	1.5%	220	$81.7	$8.2	$40.8
Elliot Circle	7.04	0.1%	17	$6.2	$0.6	$3.1
Martin Street Tide Gate	2.06	0.0%	5	$1.8	$0.2	$0.9
Oak Island Tide Gate	2.11	0.0%	5	$1.9	$0.2	$0.9
Point of Pines - Seawall	12.91	0.2%	31	$11.3	$1.1	$5.7

ID Flood Hazard Area	Approximate Area (acres)	% of Total Land Area	Number of Structures	Replacement Value ($M)	Low Damage Estimate ($M)	High Damage Estimate
Cary Circle to Alden Avenue	5.04	0.1%	12	$4.4	$0.4	$2.2
Rice Avenue near Yacht Club	10.02	0.2%	24	$8.8	$0.9	$4.4
Revere Beach	236.96	3.7%	561	$207.9	$20.8	$104.0
Winthrop Parkway Neighborhood	7.69	0.1%	18	$6.7	$0.7	$3.4
Washburn Avenue Drainage Outfall	4.79	0.1%	11	$4.2	$0.4	$2.1
Belle Isle Avenue Neighborhood	9.99	0.2%	24	$8.8	$0.9	$4.4
Pearl Avenue	5.4	0.1%	13	$4.7	$0.5	$2.4
Totals	397.06	6.2%	939	$348.4	$34.8	$174.2

4. Hazard Mitigation Strategy

This chapter provides Revere's blueprint for reducing the potential losses identified in the Risk Assessment, based on existing authorities, policies, programs, and resources, and its ability to expand on and improve these existing tools. This strategy was developed using the findings of the Planning Process and Risk Assessment.

The hazard mitigation strategy is made up of the following elements:

- Mitigation Goals: General guidelines that represent visions for reducing or avoiding losses from the identified hazards.
- Mitigation Actions: Specific projects and activities that work towards achieving mitigation goals.
- Action Plan: Explains how mitigation actions will be prioritized, administered, and incorporated into the community's existing planning mechanisms.

Hazard mitigation actions eliminate or reduce long-term risk to people and property from future disasters and differ from actions taken to prepare for or respond to hazard events. Potential long-term strategies include planning, policy changes, programs, projects, and other activities. FEMA currently has the following three HMA programs that provide funding for mitigation activities:

- Hazards Mitigation Grant Program (HMGP)
- Building Resilient Infrastructure and Communities (BRIC) – previously known as Pre-Disaster Mitigation (PDM)
- Flood Mitigation Assistance (FMA)

Hazard mitigation actions can generally be sorted into the following groups:

- Local Plans and Regulations: Include land-use policies or codes that influence the way land and buildings are developed and built.
- Structure and Infrastructure Projects: Involve modifying existing structures and infrastructure to lessen exposure to a hazard or remove them from a hazard area.
- Natural Systems Protection: Actions that minimize damage and losses and preserve or restore the functions of natural systems.
- Education and Awareness Programs: Actions inform and educate stakeholders about potential hazards and opportunities to mitigate their impacts.

The Hazard Mitigation Strategy begins with the City's Capability Assessment, which identifies existing authorities, policies, programs, and resources and its ability to expand on and improve existing policies and programs. Because natural disasters, particularly large-scale, are not typically limited to a single jurisdiction, the Capability Assessment continues with a review of Regional and Inter-Community Considerations. The Capability Assessment concludes with a summary of Revere's participation in the NFIP.

4.1 Capability Assessment

C1. Does the plan document each jurisdiction's existing authorities, policies, programs, and resources and its ability to expand on and improve these existing policies and programs? (Requirement §201.6(c)(3))

4.1.1 Overview of Existing Authorities, Policies, Programs, and Resources

Performing a Capability Assessment is one step of a successful hazard mitigation plan update process. A mitigation planning Capability Assessment consists of taking an in-depth look at existing community resources (such as plans, codes, ordinances, staffing, etc.) to assess which capabilities contribute to vulnerability by reducing or exacerbating disaster impacts. Understanding what capabilities need to be changed or enhanced to reduce disaster losses allows the planning team to address those shortfalls in the mitigation strategy. Performing the Capability Assessment helps communities identify the regulatory, administrative, technical, and fiscal capacities and capabilities of their jurisdiction and consider ways that these existing tools can be used to further their hazard mitigation and disaster resiliency goals.

The City of Revere completed its first Capability Assessment in 2021, guided by AECOM Technical Services, Inc. (AECOM) and the process outlined in FEMA's Local Mitigation Planning Handbook. A virtual meeting was held on April 8, 2021. Attendees included representatives from AECOM and City Planning. AECOM provided background information on the Capability Assessment process (its purpose and benefits), presented an overview of the worksheet content, and then began to assist the City with documenting its responses. Time did not allow for the assessment to be completed during the time allotted for the virtual meeting; therefore, City Planning coordinated the completion of the balance of the assessment. The worksheet used to conduct the Capability Assessment consisted of Worksheet 4.1 from FEMA's Local Mitigation Planning Handbook.

As part of this assessment and as recommended in the Handbook, the City also conducted a Safe Growth Audit and an assessment of its NFIP participation. Safe Growth Audits allow communities to further evaluate the ways that their existing policies, ordinances, and plans are driving growth and how risks may be increasing under these current conditions. The Safe Growth Audit completed by the City of Revere is documented on Worksheet 4.2 of FEMA's Local Mitigation Planning Handbook. As a participant in FEMA's NFIP since 1974, the City of Revere has inherently developed and enhanced its local capabilities in terms of flood mitigation. As part of its Capability Assessment the City evaluated its participation in the NFIP and ways that they will continue to comply with the program's requirements in the future. To facilitate this portion of the assessment, the City completed Worksheet 4.3 from FEMA's Local Mitigation Planning Handbook.

AECOM has summarized the City's worksheet responses in this plan section, describing local activities currently reported to be underway which contribute to, or can be utilized for, hazard mitigation. The City of Revere has used this assessment process as a tool for informing its mitigation strategy, to be sure that proposed projects, funding streams, and timeframes for completion align with local resources, abilities, and limitations.

State and Federal resources (such as technical assistance, funding streams, etc.) can also be used by local communities like Revere to supplement and enhance resources available at the local level. These outside resources, as related to hazard mitigation, are summarized at the end of this section.

4.1.2 Capabilities and Resources – City of Revere

4.1.2.1 Planning and Regulatory

The City of Revere has several policies, programs, and capabilities which help to prevent and minimize future damages resulting from hazards (Table 4-1). These tools are valuable instruments in pre- and post-disaster mitigation as they facilitate the implementation of mitigation activities through the City's current legal and regulatory framework.

Table 4-1: Policies, Programs, and Capabilities to Prevent and Minimize Future Damages

Plans	Yes/No Year	Does the plan address hazards? Does the plan identify projects to include in the mitigation strategy? Can the plan be used to implement mitigation actions?
Comprehensive/Master Plan	Yes 2020	The City's Master Plan does not address hazards. Resiliency is discussed in the plan, but the plan does not identify specific projects that could be included in the mitigation strategy. The City feels that the Master Plan could be used to advocate for project grants, but that it could not be used directly to implement mitigation actions. Additionally, the City's Riverfront Master Plan (2021) includes stormwater management and coastal resiliency. It addresses improvements for the Point of Pines area pump station, generator, and other electronic improvements. Check valves in the outfalls are also under contract for design (as of April 2021).
Capital Improvements Plan	No	
Economic Development Plan	Yes, this is included as a component of the Master Plan	The economic development component of the City's Master Plan does not address hazards. Resiliency is discussed, but the plan does not identify specific projects that could be included in the mitigation strategy. The City does not feel that the economic development component of the City's Master Plan could be used to implement mitigation actions.
Local Emergency Operations Plan	Yes May 2021	Yes, the City's Emergency Operations Plan addresses hazards. Local Comprehensive Emergency Management Plan (CEMP) Yes, it identifies projects that could be included in the mitigation strategy. Yes, the City feels that its Emergency Operations Plan could be used to implement mitigation actions.
Continuity of Operations Plan	No	
Transportation Plan	Yes 2018	Yes, the City has different plans for different areas within its municipal boundary. There is also some coverage of transportation issues in the City's Master Plan. Yes, the area transportation plans address hazards. Yes, the MPO's Route 1A Corridor Plan does identify relevant projects that are being incorporated into the City's HMP mitigation strategy. Yes, the City feels that its transportation plans could be used to implement mitigation actions.
Stormwater Management Plan	Yes 2016	The City has a Stormwater Management Plan and a Stormwater Management Ordinance. Yes, the Stormwater Management Plan and stormwater management ordinance addresses the flood hazard.
Community Wildfire Protection Plan	No	

Plans	Yes/No Year	Does the plan address hazards? Does the plan identify projects to include in the mitigation strategy? Can the plan be used to implement mitigation actions?
Other special plans (e.g., brownfields redevelopment, disaster recovery, coastal zonemanagement, climate change adaptation)	Yes	The City's MVP Plan: Addresses hazards Includes projects that could be incorporated into the HMP mitigation strategy. Could be used to implement mitigation actions Additionally, the City completed a coastal resiliency study for the Riverside/Point of Pines area. The City was also awarded another MVP Grant to prepare plans for shoreline restoration in the Riverside Area, and a subsurface water retention at Gibson Park study is currently ongoing. The City's Open Space and Recreation Plan: Addresses hazards? Minimal Includes projects that could be incorporated into the HMP mitigation strategy? Yes Could be used to implement mitigation actions? Yes Noted Pages 72-78

4.1.2.2 Administrative and Technical

The ability of a local government to develop and implement mitigation projects, policies, and programs is contingent upon its staff and resources. Administrative capability is determined by evaluating whether there are an adequate number of personnel to complete mitigation activities. Similarly, technical capability can be evaluated by assessing the level of knowledge and technical expertise of local government employees, such as personnel skilled in surveying and Geographic Information Systems. Table 4-2 provides a summary of the administrative and technical capabilities currently in place for Revere.

Table 4-2: Administrative and Technical Capabilities

Administration	Yes/No	Describe capability Is coordination effective?
Planning Commission	Yes- the City has a Planning Board	The City of Revere Planning Board consists of nine board members. The Planning Board works with the City Planning Department to provide advice on various matters before the City (such as zoning, subdivisions, master plans, etc.). Yes, the City feels that coordination between the Planning Department and Planning Board is effective.
Mitigation Planning Committee	Yes	The City has had a mitigation planning committee since the inception of its mitigation planning program in 2010. While there is always some staff turnover over time, many of the same people have served on the committee since its inception, offering great institutional knowledge. Yes, the City feels that coordination is effective.

Administration	Yes/No	Describe capability Is coordination effective?
Maintenance programs to reduce risk (e.g.,tree trimming, clearing drainage systems)	Yes	The City noted that its Department of Public Works (DPW) does undertake maintenance programs such as tree trimming, and clearing of drainage systems, which serve to reduce risk. The City's new Water/Sewer/Drain department provides increased capacity for the City to handle issues such as drainage system clearing. Yes, the City feels that coordination is effective.
Mutual aid agreements	Yes – re: Fire Department	The City of Revere Fire Department has entered into mutual aid agreements with neighboring municipalities for fire support. Yes, the City feels that coordination is effective.

Staff	Yes/No FT/ PT[1]	Is staffing adequate to enforce regulations?Is staff trained on hazards and mitigation? Is coordination between agencies and staff effective?
Chief Building Official	Yes FT	Yes, the City feels that staffing is presently adequate to enforce regulations. Yes, the City feels that its staff is adequately trained on hazards and mitigation. Yes, the City feels that coordination between agencies and staff is effective.
Floodplain Administrator	Yes FT	No, the City does not feel that staffing is presently adequate to enforce regulations. Yes, the City feels that its staff is adequately trained on hazards and mitigation. Yes, the City feels that coordination between agencies and staff is effective.
Emergency Manager	Yes FT	No, the City does not feel that staffing is presently adequate to enforce regulations. Yes, the City feels that its staff is adequately trained on hazards and mitigation. Yes, the City feels that coordination between agencies and staff is effective.
Community Planner	Yes FT	Yes, the feel that staffing is presently adequate to enforce regulations, but that additional staff would be beneficial. Yes, the City feels that its staff is adequately trained on hazards and mitigation. Yes, the City feels that coordination between agencies and staff is effective.
Civil Engineer	Yes FT	No, the City does not feel that staffing is presently adequate to enforce regulations. Yes, the City feels that its staff is adequately trained on hazards and mitigation. Yes, the City feels that coordination between agencies and staff is effective. The City Engineer is on the site plan review committee so there is good coordination on new developments.

Staff	Yes/No FT/ PT[1]	Is staffing adequate to enforce regulations? Is staff trained on hazards and mitigation? Is coordination between agencies and staff effective?
GIS Coordinator	Yes PT	N/A – GIS staff does not have a role in regulation enforcement. No, the City GIS Coordinator is not trained on hazards and mitigation. The City feels that coordination between GIS and other departments is something that could be improved.
Other	Yes DPW-new FT position	The City DPW has recently added a new full-time position, “Chief of Infrastructure”. This has improved coordination both within the City (i.e., site plan review) and externally (i.e., between the City and other outside agencies). The City of Revere does not have a conservation agent to enforce wetlands bylaws; this position would be very beneficial as most of the City’s new development is in the floodplain. The City also has created North Suffolk Office of Resiliency and Sustainability, a regional office between Revere, Chelsea, and Winthrop. Two new positions will be filled before the HMP is adopted. One person for resiliency, and one for sustainability. These two new positions are shared across all three member municipalities. Both of these positions are full-time, but each person is only 1/3 dedicated to Revere. The City Engineer completed Illicit Discharge & Detection Elimination training in 2021. The City recently added the position of Open Space and Environmental Planner / Resiliency Coordinator; this is a full-time position. Overall, regarding the other staff capabilities discussed here: No, staffing is still not deemed to be adequate to properly enforce existing regulations. Staff would benefit from additional hazards and mitigation training. Yes, coordination is deemed to be effective.

Additional technical capacities are summarized in Table 4-3.

Table 4-3: Additional Technical Capacities

Technical	Yes/No	Describe capability Has capability been used to assess/mitigate risk in the past?
Warning systems/services (Reverse 911, outdoor warning signals)	Yes	We have robo call via 311 system for emergency alerts. Digital sign boards are also used for emergencies
Hazard data and information	Yes	Gages for the water elevation at Oak Island Marsh. We do not have data captured for general storm or tide levels that cause floods. We need capacity for this data collection.
Grant writing	Yes	Limited capacity; only .5 staff dedicated to resiliency.
HAZUS-MH analysis	No	
Other		
How can these capabilities be expanded and improved to reduce risk?		

Technical	Yes/No	Describe capability Has capability been used to assess/mitigate risk in the past?
Additional staff is needed to supplement access to hazard data, support grant writing, and provide informational materials to residents regarding flood risk and flood proofing measures.		

4.1.2.3 Financial

The ability of a local government to implement mitigation activities is directly associated with the funding it has at its disposal. Funding for hazard mitigation initiatives is often locally based revenue and financing, supplemented by outside grants. Costs associated with mitigation activities range from staffing and administrative costs to the actual cost of the mitigation project. Table 4-4 provides a summary of the fiscal capabilities currently in place in the City of Revere.

Table 4-4: Fiscal Capacity for the City of Revere

Funding Resource	Access/ Eligibility (Yes/No)	Has the funding resource been used in past and for whattype of activities? Could the resource be used to fund future mitigationactions?
Capital improvements project funding	No	At this time Revere must complete the Hazard Mitigation plan to be eligible for federal funding. Yes, Revere is eligible for state funding via MVP since the MVP designation in 2019.
Authority to levy taxes for specific purposes	No	
Fees for water, sewer, gas, or electric services	Yes	Water and Sewer Enterprise fund is used for drainage improvements.
Impact fees for new development	Yes	Community Improvement Trust Fund
Storm water utility fee	No	
Incur debt through general obligation bonds and/or special tax bonds	Yes	Revere has an excellent bond rating
Incur debt through private activities	No	
Community Development Block Grant	Yes	The City has obtained $780,000
Other federal funding programs	Yes	ACOE, FEMA
State funding programs	Yes	Coastal Zone Management -coastal Resiliency program
Other		
How can these capabilities be expanded and improved to reduce risk?		
Additional staff to support for state/federal funding grant programs.		

Education and Outreach

Successful development and implementation of local mitigation initiatives involves significant education and outreach programs delivered to the public and other key stakeholders within the community. As part of its Capability Assessment, the City of Revere has evaluated education and outreach programs and

methods already in place that could be used to implement mitigation activities and communicate hazard-related information. Table 4-5 provides a summary of the City's education and outreach capabilities.

Table 4-5: City of Revere Education and Outreach Capabilities

Program/Organization	Yes/No	Describe program/organization and how relates to disaster resilience and mitigation. Could the program/organization help implement futuremitigation activities?
Local citizen groups or non-profit organizationsfocused on environmental protection, emergency preparedness, access, and functional needs populations, etc.	Yes	Alliance for Health and the Environment Beechmont Improvement Committee Point of Pines Beach Association Riverside Neighbourhood Group
Ongoing public education or information program (e.g., responsible water use, fire safety, household preparedness, environmentaleducation)	Yes	Stakeholder engagement process used for each hazard mitigation plan update as well as the City's participation in the MVP program.
Natural disaster or safety related school programs	Yes	The Revere Public Schools has emergency plans in place that are implemented during natural and human-caused hazard events. The emergency plans can be used to communicate hazard-related information.
Storm Ready certification	In progress	Scheduling certification requirements
Firewise Communities certification	No	
Public-private partnership initiatives addressingdisaster-related issues	No	
Other		
The city will seek certifications for Firewise community and storm ready certification. In addition, Revere, Chelsea and Winthrop are in collaboration as part of the North Suffolk Office of Resiliency and Sustainability and we have begun discussions regarding opportunities for educating the public about the risks of climate change and sea level rise via regional community forums.		

Safe Growth Audit

The FEMA Local Mitigation Planning Handbook indicates that one way to assess the impact of planning and regulatory capabilities is to complete a safe growth audit. The purpose of the safe growth audit is to analyze the impacts of current policies, ordinances, and plans on community safety from hazard risks due to growth. The City of Revere conducted its Safe Growth Audit using the Handbook's Worksheet 4.2. The City's assessments are summarized in Table 4-6.

Table 4-6: City of Revere Safe Growth Audit

Comprehensive Plan	Yes	No
Land Use		
1. Does the future land-use map clearly identify natural hazard areas?	X	
2. Do the land-use policies discourage development or redevelopment within natural hazard areas?		X

Comprehensive Plan	Yes	No
3. Does the plan provide adequate space for expected future growth in areas located outside natural hazard areas?		X
Transportation		
1. Does the transportation plan limit access to hazard areas?		X
2. Is transportation policy used to guide growth to safe locations?		X
3. Are movement systems designed to function under disaster conditions (e.g., evacuation)?	X	
Environmental Management		
1. Are environmental systems that protect development from hazards identified and mapped?	X	
2. Do environmental policies maintain and restore protective ecosystems?	X	
3. Do environmental policies provide incentives to development that is located outside protective ecosystems?		X
Public Safety		
1. Are the goals and policies of the comprehensive plan related to those of the FEMA Local Hazard Mitigation Plan?		X
2. Is safety explicitly included in the plan's growth and development policies?		X
3. Does the monitoring and implementation section of the plan cover safe growth objectives?		X
Zoning Ordinances		
1. Does the zoning ordinance conform to the comprehensive plan in terms of discouraging development or redevelopment within natural hazard areas?		X
2. Does the ordinance contain natural hazard overlay zones that set conditions for land use withinsuch zones?		X
Floodplain Overlay District	X	
3. Do rezoning procedures recognize natural hazard areas as limits on zoning changes that allow greater intensity or density of use?		X
4. Does the ordinance prohibit development within, or filling of, wetlands, floodways, and floodplains?		X
Sub-Division Regulations		
1. Do the subdivision regulations restrict the subdivision of land within or adjacent to natural hazard areas?		X
2. Do the regulations provide for conservation subdivisions or cluster subdivisions in order to conserveenvironmental resources?		X
3. Do the regulations allow density transfers where hazard areas exist?		X
Capital Improvement Program and Infrastructure Policies		
1. Does the capital improvement program limit expenditures on projects that would encourage development in areas vulnerable to natural hazards?		X
2. Do infrastructure policies limit extension of existing facilities and services that would encourage development in areas vulnerable to natural hazards?		X
3. Does the capital improvement program provide funding for hazard mitigation projects identified inthe FEMA Mitigation Plan?	X	

Comprehensive Plan	Yes	No
Other		
1. Do small area or corridor plans recognize the need to avoid or mitigation natural hazards?	X	
MPO Plan		
2. Does the building code contain provisions to strengthen or elevate construction to withstand hazard forces?	X	
Flood Plain ordinance requires structures to be elevated.		
3. Do economic development or redevelopment strategies include provisions for mitigation naturalhazards?	X	
Site Plan Review encourages mitigation for natural hazards for new development.		
4. Is there an adopted evacuation and shelter plan to deal with emergencies from natural hazards?	X	

Questions adapted from Godschalk, David R. Practice Safe Growth Audits, Zoning Practice, Issue Number 10,

Regulatory Capacity

Table 4-7 provides an overview of the City's regulatory capacity.

Table 4-7: Revere's Regulatory Capacity

Building Code, Permitting, and Inspections	Yes/No	Are codes adequately enforced?
Building Code	Yes	Version/ Year: The City of Revere enforces the (9th) edition of the Massachusetts State code 2015. Yes, the City feels that codes are adequately enforced through the site plan review process.
Building Code Effectiveness Grading Schedule (BCEGS) Score	Yes	Score: 31.08 Commercial and 28.84 Residential
Fire department ISO rating	Yes	ISO rating is class 4 according to Asst Chief Cullen
Site plan review requirements	Yes	Yes, the City feels that there is adequate enforcement of its site plan review requirements. These requirements include measures for hazard reduction.

Land Use Planning and Ordinances	Yes/No	Is the ordinance an effective measure for reducing hazard impacts? Is the ordinance adequately administered and enforced?
Zoning ordinance	Yes	Yes, the City feels that its zoning ordinance is an effective measure for reducing hazard impacts. Yes, the City feels that its zoning ordinance is adequately administered and enforced.
Subdivision ordinance	Yes	Yes, the City feels that its subdivision ordinance is an effective measure for reducing hazard impacts. Yes, the City feels that its subdivision ordinance is adequately administered and enforced.

Land Use Planning and Ordinances	Yes/No	Is the ordinance an effective measure for reducing hazard impacts? Is the ordinance adequately administered and enforced?
Floodplain ordinance	Yes	Yes, the City feels that its floodplain ordinance is an effective measure for reducing hazard impacts. Yes, the City feels that its floodplain ordinance is adequately administered and enforced.
Natural hazard specific ordinance (stormwater, steep slope, wildfire)	Yes	See above for information on the City's stormwater management ordinance. The City does not have a steep slope ordinance or a wildfire ordinance.
Flood insurance rate maps	Yes	The City participates in the NFIP and uses FEMA's Flood Insurance Rate Maps (FIRMs). Yes, the City feels that its FIRMs area an effective measure for reducing hazard impacts. Yes, the City feels that its FIRMs are adequately administered and enforced.
Acquisition of land for open space and public recreation uses	Yes	The City of Revere does not have a specific ordinance regarding acquisition of land for open space and public recreation uses; however, while not an ordinance, its Open Space and Recreation Plan does address this issue. Along the Route 1A corridor there is a plan to acquire land for marsh restoration, it's not specifically for open space and public recreation but it is for flood protection. This is in the MVP and in the MPL as well and referenced in the Riverfront Master Plan.
Other	None	
How can these capabilities be expanded and improved to reduce risk?		
The City's planning and regulatory capabilities could be expanded/improved to reduce risk in the following ways: The next update of the Master Plan could be expanded to incorporate natural hazards and mitigation principles.		

Continued Compliance with the NFIP

The City of Revere has participated in FEMA's NFIP since 1972. With direct participation from its Floodplain Administrator (Frank Stringi, Chief Planner and Zoning Coordinator, Office of Strategic Planning and Economic Development), the City has collected information on its participation in, and continued compliance with, the NFIP and has identified areas for improvement that could be potential mitigation actions. The City's assessments are summarized in Table 4-8.

Table 4-8: City of Revere NFIP Assessments

NFIP Topic	Source of Information	Comments
Insurance Summary		
How many NFIP policies are in the community? What is the total premium and coverage?	State NFIP Coordinator orFEMA NFIP Specialist	Revere has 2,239 Policies in Force. The total premium is $2,177,282 and the total coverage is $553,175,300. (Source: NFIP Policy Information by State (2/28/21) online at

NFIP Topic	Source of Information	Comments
		https://nfipservices.floodsmart.gov//reports-flood-insurance-data)
How many claims have been paid in thecommunity? What is the total amount of paid claims? How many of the claimswere for substantial damage?	FEMA NFIP or Insurance Specialist	Revere has experienced 2,547 total losses. Total net dollars paid are $15,060,979. (Source: NFIP HUDEX Policy and Loss Data by Geography (2/28/21) online at https://nfipservices.floodsmart.gov//reports-flood-insurance-data)
How many structures are exposed toflood risk within the community?	Community Floodplain Administrator (FPA)	939 (as estimated in the updated HMP)
Describe any areas of flood risk withlimited NFIP policy coverage	Community FPA and FEMAInsurance Specialist	All areas of flood risk are located within the FIRM boundaries which require NFIP policy coverage. There are no areas outside the FIRM that pose flood risk.
Staff Resources		
Is the Community FPA or NFIP Coordinator certified?	Community FPA	Frank Stringi; not a Certified Floodplain Manager
Is floodplain management an auxiliaryfunction?	Community FPA	Yes, the Community FPA wears many hats in the City outside of their floodplain administrator role (also Chief Planner and Zoning Coordinator, Office of Strategic Planning and Economic Development).
Provide an explanation of NFIP administration services (e.g., permitreview, GIS, education or outreach, inspections, engineering capability)	Community FPA	NFIP administrative services include permit reviews and review of elevation plans and the requirement that all new structures within the FIRM file elevation certificates prior to occupancy. Administration also includes educating local realters and homeowners regarding floodplain boundaries and base flood elevations.
What are the barriers to running an effective NFIP program in the community, if any?	Community FPA	Lack of staffing for adequate outreach
Compliance History		
Is the community in good standing withthe NFIP?	State NFIP Coordinator, FEMA NFIP Specialist, community records	Yes, Revere is participating and is in good standing. Source: 3/18/21 Community Status Book (https://www.fema.gov/cis/MA.html) and 2/18/21 NFIP Community Status Information (https://nfipservices.floodsmart.gov//reports-flood-insurance-data)
Are there any outstanding complianceissues (i.e., current violations)?	Community FPA	No
When was the most recent CommunityAssistance Visit (CAV) or Community Assistance Contact (CAC)?	Community FPA	September 2021

NFIP Topic	Source of Information	Comments
Is a CAV or CAC scheduled or needed?	Community FPA	Yes for amendments to floodplain ordinance with respect to recent FIRM revisions

Table 4-9 provides additional NFIP information.

Table 4-9: Additional NFIP Information

NFIP Topic	Source of Information	Comments
Regulation		
When did the community enter the NFIP?	Community Status Book http:/www.fema.gov/national-flood-insurance-program/national-flood-insurance-program-community-status-book	Revere entered the Emergency Program on 12/29/72 and entered the Regular Program on 10/16/84. The Community is still in the Regular Program. (Source: NFIP Community Status Information posted on https://nfipservices.floodsmart.gov//reports-flood-insurance-data)
Are the FIRMs digital or paper?	Community FPA	Revised maps FIRM Effective Date is 3/16/16. FIRMs are digital on GIS.
Do floodplain development regulations meet or exceed FEMA or State minimum requirements? If so, in what ways?	Community FPA	Floodplain development regulations meet all FEMA and State minimum requirements in terms of floodproofing measures and required first floor and mechanical system elevations at least 1-ft above the base flood elevation established by FEMA.
Provide an explanation of the permitting process.	Community FPA, State, FEMA NFIP Flood Insurance Manual http:/www.fema.gov/flood-insurance-manual Community FPA, FEMA CRS Coordinator, ISO representative CRS manual http://www.fema.gov/library/viewRecord.do?id=243 4	All new construction must go through a Site Plan Review process which reviews each project for compliance with all applicable federal, state, and local regulations and outlines the required permits which are necessary for each project prior to filing for a building permit. Once all the necessary environmental permits are obtained, the applicant can file for a building permit.
Community Rating System (CRS)		
Does the community participate in CRS?	Community FPA, State, FEMA NFIP	The City of Revere is in the process of pursuing participation in CRS.
What is the community's CRS Class Ranking?	Flood Insurance Manual http:/www.fema.gov/flood-insurance-manual	n/a – Revere does not currently participate in the CRS
What categories and activities provide CRS points and how can the class be improved?		n/a – Revere does not currently participate in the CRS
Does the plan include CRS planning requirements	Community FPA, FEMA CRS Coordinator, ISO representative CRS manual http://www.fema.gov/library/viewRecord.do?id=2434	n/a – Revere does not currently participate in the CRS

4.1.2.4 Conclusion

This Capability Assessment finds that the City of Revere has a significant level of planning and regulatory, technical, and administrative, financial, and education and outreach tools and resources at its disposal to implement hazard mitigation initiatives. Additionally, as part of this Capability Assessment, the City of Revere also considered ways of improving or enhancing their capabilities to achieve better alignment with the City's long-term mitigation goals.

Like many communities in Massachusetts and across the nation, the City of Revere generally finds its most significant resource constraints to be related to staffing and funding. Some intermunicipal agreements have allowed the City to supplement its core staff with shared services or shared staff members with its neighboring jurisdictions. While this approach has helped, City staff responsibilities still tend to exceed available time constraints. With regard to financial constraints, the City's funds are indeed limited, and its budget is tight; however, local officials actively pursue grant funding streams wherever possible to supplement project costs and stretch every tax dollar for the greatest benefit to the municipality.

4.1.3 Capabilities and Resources – Commonwealth of Massachusetts

The 2018 SHMCAP includes a detailed evaluation of the State's authorities, laws, policies, programs, staff, funding, and other resources available to the Commonwealth to support hazard mitigation and climate adaptation efforts. The Commonwealth has a long history of demonstrating its commitment to advancing risk reduction and resilience across the state. This encompasses a broad range of State-supported initiatives and activities that include a combination of outreach, training, technical assistance, funding, partnerships, regulatory codes and statutes, infrastructure projects, and other activities to increase statewide resilience. An overview of some key capabilities and resources are summarized in Table 4-10. For more details, interested persons should refer to the SHMCAP, Chapter 6, online at https://www.mass.gov/files/documents/2018/09/17/SHMCAP-September2018-Chapter6.pdf.

This capability assessment finds that the Commonwealth's various departments collectively have a significant level of legal, technical, and fiscal tools and resources necessary for implementation of hazard mitigation strategies, and that many of these programs and initiatives can be used to support the activities of local municipalities. Excerpts from examples included in the SHMCAP are provided below. The State Plan should be referred to directly for more specifics (on the web at https://www.mass.gov/service-details/massachusetts-integrated-state-hazard-mitigation-and-climate-adaptation-plan).

Table 4-10 provides an overview of key state capabilities and resources for mitigation.

Table 4-10: Overview of Key State Capabilities and Resources for Mitigation

Capability/Resource	Description
State Hazard Mitigation Team	Actively manages a statewide program of hazard mitigation and climate adaptation through the development of legislative initiatives, multi-agency committees or councils, public/private partnerships, and/or other executive actions that promote hazard risk reduction and resilience. The SHMT consists of staff members employed by the Department of Conservation and Recreation (DCR) and MEMA, who work full-time on hazard mitigation planning, grants management, and project management
State Hazard Mitigation Plan	The Commonwealth has maintained a FEMA- approved state hazard mitigation plan since 1986. The most recent update of the plan (the 2018 SHMCAP) incorporates climate adaptation.
Local Hazard Mitigation and Climate Adaptation Planning	The Commonwealth supports local hazard mitigation and climate adaptation planning by providing workshops and training, State planning grants, and other coordinated resource and capability development of local officials.

Capability/Resource	Description
Municipal Vulnerability Preparedness (MVP) Grant Program	The Commonwealth provides support for cities and towns in Massachusetts to begin or enhance the process of planning for resiliency to extreme weather and other natural or climate-related hazards. Under the MVP planning program, the Commonwealth awards funding to communities to complete vulnerability assessments and develop action-oriented resiliency plans.
Capital Investment Plan	This plan provides funding for the Commonwealth's capital needs, with a critical new component of climate change preparedness and resiliency.
Statewide Resilience Master Plan (SRMP)	The SRMP identifies and addresses potential climate impacts to State facility assets.
Coastal Resilience Grant Program	This program funds the non-Federal match for NOAA Regional Coastal Resilience Grants and provides 50% of the non-Federal share of the costs of major local flood control projects developed in conjunction with the U.S. Army Corps of Engineers (USACE).
FEMA HMGP Grant Cost Share Supplemental Funds	The State contributes funding toward FEMA HMGP grant cost share to offset local hazard mitigation project costs. From 1991 to 2018, the State contributed more than $27 million under this initiative.
State Building Code	The Commonwealth requires local governments to use a nationally applicable model building code that addresses natural hazards (including wind, flood, snow, seismic, and other hazards) as a basis for design and construction of new buildings and any State-sponsored mitigation projects. The 9th Edition of the State Building Code became effective October 20, 2017, and is based on modified versions of the 2015 International Codes (I-Codes), as published by the International Code Council (ICC). Under the 9th Edition, the design and construction of buildings and structures located in flood hazard areas must be in accordance with American Society of Civil Engineers (ASCE) standards, which are consistent with, and in some cases, exceed minimum NFIP requirements.
The Commonwealth routinely integrates risk reduction into its post-disaster response and recovery operations	The State's Disaster Recovery Manager at the Massachusetts Emergency Management Agency (MEMA) also oversees the Mitigation Unit, providing seamless coordination with the implementation of post-disaster mitigation and recovery programs, including FEMA's Hazard Mitigation Grant Program, PA program, and Individuals and Households Program. During Joint Field Office operations, the State Hazard Mitigation Officer is present for the duration of the recovery process.
State Agency Partnerships and Initiatives	Some state agencies and offices routinely conduct hazard mitigation and resilience building as part of their organizational missions.
Executive Order 569 – Establishing an Integrated Climate Change Strategy for the Commonwealth	This Executive Order, signed in September 2016, lays out a comprehensive approach to further reduce greenhouse gas emissions; safeguard residents, municipalities, and businesses from the impacts of climate change; and build a more resilient Commonwealth.
Silver Jackets	The goal of the Massachusetts Silver Jackets Team is to reduce the risk of flooding and other natural disasters by bringing together multiple federal and state agencies. The interagency team facilitates a collaborative process of strategic and integrated mitigation actions to reduce the threat, vulnerability, and consequences of flooding in the Commonwealth of Massachusetts.
Massachusetts Executive Order 149 (1978), State Coordination and Participation with the Federal Administration under the National Flood Insurance Act	Designates the Massachusetts Water Resources Commission as the state agency to implement floodplain management programs in Massachusetts. The Office of Water Resources in DCR provides technical and staff support, including scientists, hydrogeologists, and water policy specialists who undertake activities of the Commission.
Massachusetts Executive Order 181 (1980), Barrier Beaches	To mitigate future loss of life and property, Executive Order 181 prohibited new development in velocity zones or primary dunes, as well as seawalls and

Capability/Resource	Description
	revetments on barrier beaches. It constrains the use of state funds and federal grants for construction projects that could encourage growth and development in barrier beach areas.
The Wetlands Protection Act (WPA) (Massachusetts General Laws [MGL] Chapter 131, Section 40) was codified as 310 Code of Massachusetts Regulations (CMR) Section 10.00	These regulations protect wetlands functions and their public interests, including flood control, prevention of pollution and storm damage, and protection of water supplies and other natural resources and habitats.
Massachusetts Rivers Protection Act	Enacted in 1996, the Massachusetts Rivers Protection Act amends the WPA to provide protection to rivers and implements hazard mitigation by regulating activities within a 200-foot-wide resource area called the Riverfront Area.
StormSmart Coast	This national model developed by CZM is designed to help communities and homeowners address coastal erosion, storm damage, flooding, and related issues. The StormSmart Coasts website includes information on available grants and on assessing the vulnerability of coastal properties to erosion and flooding; tools for local officials to improve coastal floodplain management; options for coastal property owners to effectively reduce erosion and storm damage while minimizing impacts to shoreline systems; landscaping options for controlling erosion and storm damage; interactive maps of erosion along the Massachusetts coast; and more
Coastal Resilience Grant Program	Program to provide financial and technical support to the Commonwealth's Chapter 6: State Capability and Adaptive Capacity Analysis 6-10 Massachusetts 2018 SHMCAP September 2018 78 coastal communities and certified 501(c)(3) nonprofit organizations with vulnerable coastal property for local efforts to increase awareness and understanding of climate impacts, identify and map vulnerabilities, conduct adaptation planning, redesign vulnerable public facilities and infrastructure, and implement nonstructural (or green infrastructure) approaches that enhance natural resources and provide storm damage protection.
Sea Level Rise and Coastal Flooding Viewer	Online tool to support the assessment of coastal flooding vulnerability and risk for community facilities and infrastructure. This viewer includes interactive maps of flooding extents and water level elevations associated with sea level rise scenarios, current coastal flood zones, and hurricane storm surge. It also includes location data for a wide range of public facilities and infrastructure.
Coastal A Zone Mapping:	To improve coastal flood hazard mapping in Massachusetts, DCR and CZM recently partnered to map the delineation of Limit of Moderate Wave Action (LiMWA) for 15 coastal communities. LiMWA is the inland limit of the area expected to receive 1.5-foot or greater breaking waves during the 1 percent annual chance flood event. FEMA FIRMs that went into effect in 2009-2013 for Massachusetts coastal counties were based on studies initiated in 2005 and did not include LiMWA lines. The addition of the LiMWA to FIRMs allows communities and individuals to better understand the flood risks to their property. T
Increasing Resilience through Application of Nature-Based Infrastructure	Regional effort to increase resilience to sea level rise in New England that is focused on increasing the effective use of nature-based infrastructure for reduced erosion and enhanced wave attenuation
Energy Resilience Initiatives (various)	The Massachusetts Department of Energy Resources (DOER) develops and implements policies and programs aimed at ensuring the adequacy, security, diversity, and cost-effectiveness of the Commonwealth's energy supply to create a clean, affordable, and resilient energy future for all residents, businesses, communities, and institutions.(See https://www.mass.gov/files/documents/2018/09/17/SHMCAP-September2018-Chapter6.pdf for more information)

Capability/Resource	Description
Transportation Resiliency Initiatives (various)	Various initiatives to enhance Massachusetts Department of Transportation's (MassDOT's) climate preparedness and mitigation efforts to identify and adapt to climate-related threats to the State's key transportation assets and infrastructure.
Recovery Planning Initiative	MEMA staff attends semi-annual Recovery and Mitigation meetings to discuss important aspects of the programs, changes in priorities, and lessons learned from disaster events. In addition, Mitigation staff provide support to the Recovery Unit during immediate post-disaster operations, such as attending applicants' briefings for PA and other administrative duties. In 2018, the Commonwealth initiated the development of a new State Disaster Recovery Plan.

4.1.4 Capabilities and Resources – Federal

The Federal government offers a wide range of funding and technical assistance programs that can be accessed by municipalities to foster local hazard mitigation initiatives and support community resiliency. Some of these programs are geared to disaster preparedness and mitigation planning, while the focus of others is the long-term vitality of the communities. Table 4-11 presents a summary of Federal funding sources available for mitigation activities.

It should be emphasized that the capabilities and resources summarized in Table 4-11 present a high-level overview of some key resources that are most relevant to hazard mitigation and mitigation planning; it is not a comprehensive list. Further information on these and other Federal programs can be found in the Assistance Listings online at www.beta.sam.gov. This site allows users to browse federal assistance listings across all government agencies and download a copy of the latest Catalog of Federal Domestic Assistance.

This capability assessment finds that the various Federal agencies collectively have a significant level of resources that support local implementation of hazard mitigation strategies and that can be accessed to support the activities of local municipalities.

Table 4-11: Federal Funds Available for Mitigation Activities

Funding Source	Description
Funding that Requires an Approved Hazard Mitigation Plan:	
Flood Mitigation Assistance Program (FMA)	*Availability*: Pre-disaster, annually *Description*: FMA provides funds for planning and projects to reduce or eliminate long-term risk of flood damage to repetitive loss (RL) properties and severe repetitive loss (SRL) properties, including residential and non-residential structures insured under the NFIP.
Hazard Mitigation Grant Program (HMGP)	*Availability*: Post-Disaster; After FEMA disaster and emergency declarations *Description*: Following a Presidential major disaster declaration, the state receives 15% of the total federal share of the declared disaster damage amount to fund hazard mitigation plans and projects under the HMGP. HMGP funds projects in accordance with priorities identified in State, Tribal or local hazard mitigation plans, and enables mitigation measures to be implemented during the recovery from a disaster. The Federal government may fund up to 75 percent of total eligible project costs, with a 25 percent non-Federal match.
Public Assistance Program (PA) Mitigation	*Availability*: Post-Disaster; After FEMA disaster and emergency declarations

Funding Source	Description
	Description: Section 406 of the Stafford Act, provides funding for mitigation measures in conjunction with the repair of disaster-damaged public facilities. This allows the opportunity to maximize recovery dollars by building back stronger and more resilient, thus reducing potential damage in the future.
Building Resilient Infrastructure and Communities (BRIC)	*Availability*: Pre-disaster, annually *Description*: Support for states, local communities, tribes, and territories as they undertake hazard mitigation projects, reducing the risks they face from disasters and natural hazards. BRIC is a new FEMA pre-disaster hazard mitigation program that replaces the existing PDM program.
Other Available Federal Funds for Mitigation Planning and Implementation:	
RiskMAP	*Availability*: Pre-disaster *Description*: FEMA's Risk Mapping, Assessment and Planning (RiskMAP) program provides high quality flood maps and information, tools to better assess the risk from flooding and planning and outreach support to communities to help them take action to reduce (or mitigate) flood risk. Each Risk MAP flood risk project is tailored to the needs of each community and may involve different products and services.
National Flood Insurance Program (NFIP)	*Availability*: Pre- or post-disaster *Description*: New York State Department of Environmental Conservation administers the National Flood Insurance Program (NFIP) within the State of New York. The office of the State NFIP Coordinator facilitates municipal participation in the NFIP; provides technical assistance, training, and support to local Floodplain Administrators on the minimum NFIP design standards; and encourages participation in the CRS program.
FEMA Cooperating Federal Partners (CTP)	*Availability*: Pre-disaster *Description*: FEMA's Cooperating Technical Partnership (CTP) Program was created to partner with communities, state or regional agencies, universities or Tribal nations to enhance hazard data in the creation of FIRMs and Digital FIRMs. DHSES intends to pursue this partnership in the future and enhance our awareness of and involvement in the RiskMAP process.
Fire Management Assistance Grant Program	*Availability*: Post-disaster *Description*: Assistance for the mitigation, management, and control of fires on publicly or privately-owned forests or grasslands, which threaten such destruction as would constitute a major disaster.
Community Development Block Grant (CDBG) and Community Development Block Grant – Disaster Recovery (CDBG-DR)	*Availability*: Pre- or post-disaster *Description*: Federal grant provided to Community Development Block Grant (CDBG "entitlement communities" (typically, municipalities with populations over 50,000 and urban counties with populations over 200,000) and to all states. The CDBG and Community Development Block Grant- Disaster Recovery (CDBG-DR) funds are some of the limited number of federal grant funds that lose federal identity when it is allocated to the state and therefore can be used to assist with meeting the non-federal match for HMA grant programs. The 2019 New York State HMP notes that the State is using Hurricane Sandy CDBG-DR to assist with meeting non-federal match for several disasters, including Hurricane Sandy (DR-4085) HMGP projects.
Reimbursement for Firefighting on Federal Property	*Availability*: Post-disaster *Description*: Provides reimbursement only for direct costs and losses over and above normal operating costs
National Dam Safety Program	*Availability*: Pre-disaster *Description*: The National Dam Safety Program (NDSP) was formally established by the Water Resources and Development Act of 1996. Led by FEMA, the

Funding Source	Description
	NDSP is a partnership of the states, federal agencies, and other stakeholders to encourage individual and community responsibility for dam safety. Provides vital support for the improvement of the state dam safety programs that regulate most of the 79,500 dams in the United States.
Land and Water Conservation Fund (LWCF)	*Availability*: To States, local and conservation organizations *Description*: Funding for outdoor recreational development, renovation, land acquisition, and planning. The program is divided into two distinct funding pots: State grants, and Federal acquisition funds.
The Forest Legacy Program (FLP)	*Availability*: Participation in Forest Legacy is limited to private forest landowners. *Description*: Federal program in partnership with States, supports State efforts to protect environmentally sensitive forest lands. Designed to encourage the protection of privately-owned forest lands, FLP is an entirely voluntary program. To maximize the public benefits it achieves, the program focuses on the acquisition of partial interests in privately owned forest lands. FLP helps the States develop and carry out their forest conservation plans. It encourages and supports acquisition of conservation easements, legally binding agreements transferring a negotiated set of property rights from one party to another, without removing the property from private ownership. Most FLP conservation easements restrict development, require sustainable forestry practices, and protect other values. To qualify, landowners are required to prepare a multiple resource management plan as part of the conservation easement acquisition. The federal government may fund up to 75 percent of project costs, with at least 25 percent coming from private, State, or local sources. In addition to gains associated with the sale or donation of property rights, many landowners also benefit from reduced taxes associated with limits placed on land use. In 2008, NJ has one project funded: Sparta Mountain South at $2,474,000.
Transportation Trust Fund (TTF)	*Availability*: Pre- and post-disaster *Description*: Grants are funded by the TTF through a competitive application-based process administered by the Local Aid District Offices. The County Aid Program is funded through the TTF and provides funding for eligible costs of projects included in the County's approved Annual Transportation Program. The program is intended for road and bridge infrastructure improvements under county jurisdiction. Each County receives an annual formula-based allotment that takes into consideration county road lane mileage and population.

4.1.4.1 Other Resources – Documents

FEMA has developed many documents that address implementing hazard mitigation at the local level. Key resource documents are briefly described here.

Local Mitigation Planning Handbook. This handbook is the official guide for local governments to develop, update and implement local mitigation plans. While federal requirements have not changed, the Handbook provides revised and expanded guidance, offering practical approaches, tools, worksheets, and local mitigation planning examples for how communities can engage in effective planning to reduce long-term risk from natural hazards and disasters. The Handbook can be found on the FEMA web site at: https://www.fema.gov/sites/default/files/2020-06/fema-local-mitigation-planning-handbook_03-2013.pdf

Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards. The purpose of this document is to provide a resource that communities can use to identify and evaluate a range of potential mitigation actions for reducing risk to natural hazards and disasters. The focus of this document is mitigation, which is action taken to reduce or eliminate long-term risk to hazards. Ideas for mitigation actions are presented

for the following natural hazards: drought, earthquake, erosion, extreme temperatures, , flood, hail, landslide, lightning, sea level rise, severe wind, severe winter weather, storm surge, subsidence, tornado, tsunami, and wildfire. This resource can be found on the FEMA web site at: http://www.fema.gov/media-library-data/20130726-1904-25045-0186/fema_mitigation_ideas_final508.pdf

Integrating Hazard Mitigation into Local Planning: Case Studies and Tools for Community Officials. The purpose of this document is to provide succinct and practical information to local government officials on how to best integrate hazard mitigation into the full range of community planning activities. It is intended for those who are engaged in any type of local planning, but primarily community planners and emergency managers that bear responsibility for hazard mitigation planning. This resource can be found on the FEMA web site at: http://www.fema.gov/media-library-data/20130726-1908-25045-0016/integrating_hazmit.pdf

How-to Guides. FEMA has developed a series of nine “how-to guides” to assist States, communities, and tribes in enhancing their hazard mitigation planning capabilities. The first four guides mirror the four major phases of hazard mitigation planning used in the development of the Rensselaer County Multi-Jurisdictional Hazard Mitigation Plan. The last five how-to guides address special topics that arise in hazard mitigation planning such as using benefit-cost analysis and integrating man-made hazards. The use of worksheets, checklists, and tables make these guides a practical source of guidance to address all stages of the hazard mitigation planning process. They also include special tips on meeting DMA 2000 requirements.

Post-Disaster Hazard Mitigation Planning Guidance for State and Local Governments. FEMA, Disaster Assistance Policy (DAP)-12, September 1990. This handbook explains the basic concepts of hazard mitigation and shows State and local governments how they can develop and achieve mitigation goals within the context of FEMA’s post-disaster hazard mitigation planning requirements. The handbook focuses on approaches to mitigation, with an emphasis on multi-objective planning.

Mitigation Resources for Success CD. FEMA 372, September 2001. This CD contains a wealth of information about mitigation and is useful for State and local government planners and other stakeholders in the mitigation process. It provides mitigation case studies, success stories, information about Federal mitigation programs, suggestions for mitigation measures to homes and businesses, appropriate relevant mitigation publications, and contact information.

A Guide to Federal Aid in Disasters. FEMA 262, April 1995. When disasters exceed the capabilities of State and local governments, the President’s disaster assistance program (administrated by FEMA) is the primary source of Federal assistance. This handbook discusses the procedures and process for obtaining this assistance and provides a brief overview of each program.

The Emergency Management Guide for Business and Industry. FEMA 141, October 1993. This guide provides a step-by-step approach to emergency management planning, response, and recovery. It also details a planning process that companies can follow to better prepare for a wide range of hazards and emergency events. This effort can enhance a company’s ability to recover from financial losses, loss of market share, damages to equipment, and product or business interruptions. This guide could be of great assistance to Rensselaer County industries and businesses located in hazard prone areas.

4.1.4.2 Other Resources - Websites

The following are important websites that provide focused access to valuable planning resources for communities interested in sustainable development initiatives.

- http://www.fema.gov: Web site of the Federal Emergency Management Agency includes links to information, resources, and grants that communities can use in planning and implementation of sustainable measures. Most notably:
- http://www.fema.gov/multi-hazard-mitigation-planning: For information about multi-hazard mitigation planning.

- https://www.floodsmart.gov/floodsmart/: The official site of FEMA's National Flood Insurance Program (NFIP).
- http://mitigationguide.org/: "Beyond the Basics: Best Practices in Local Mitigation Planning", a website developed as part of a multi-year research study funded by the U.S. Department of Homeland Security, and led by the Center for Sustainable Community Design within the Institute for the Environment at the University of North Carolina at Chapel Hill.
- http://www.planning.org: Web site of the American Planning Association, a non-profit professional association that serves as a resource for planners, elected officials, and citizens concerned with planning and growth initiatives.
- https://www.planning.org/nationalcenters/hazards/mitigationplanning.htm Includes information about hazard mitigation planning prepared by the association's Hazards Planning Research Center.
- http://www.ibhs.org: Web site of the Institute for Business and Home Safety, an initiative of the insurance industry to reduce deaths, injuries, property damage, economic losses, and human suffering caused by natural disasters. Online resources provide information on natural hazards, community land use, and ways you can protect your property from damage.

4.1.5 Regional and Inter-Community Considerations

Some hazard mitigation actions are strictly local. The vulnerability being addressed is limited to the municipality and can be solved at the local level. Other mitigation actions address inter-community vulnerabilities that require cooperation between two or more municipalities in a local area. There is a third level of mitigation which is regional; involving a state, regional, or federal agency or an issue that involves numerous municipalities across a wide area of the metropolitan region. This section summarizes the City's capacity and existing strategies to coordinate beyond the boundaries of Revere.

4.1.5.1 Regional Partners

In many communities, mitigating natural hazards, particularly flooding, is more than a local issue. The drainage systems that serve these communities are a complex system of storm drains, roadway drainage structures, pump stations and other facilities owned and operated by a wide array of agencies including but not limited to the City of Revere, the DCR, and MassDOT. The planning, construction, operations, and maintenance of these structures are integral to the flood hazard mitigation efforts of communities. These agencies must be considered the communities regional partners in hazard mitigation. These agencies also operate under the same constraints as communities do, including budgetary and staffing constraints and numerous competing priorities. In the sections that follow, the plan includes recommendations for activities where cooperation with these other agencies may be necessary. Implementation of these recommendations will require that all parties work together to develop solutions.

Also, Revere will continue to support and be involved with the following working groups to support regional climate change adaptation and hazard mitigation efforts:

- Resilient Mystic Collaborative (Mystic River Watershed Association)
- North Suffolk Office of Resiliency and Sustainability (Revere, Winthrop, and Chelsea)
- Saugus Pines River Collaborative (Revere, Saugus, Lynn, Malden, and Everett)
- Metro Mayors Climate Task Force (Metropolitan Planning Area Council)

4.1.5.2 Inter-Community Considerations

North Revere Brush Fires: Plan participants identified regional brush fire prevention in North Revere, in collaboration with the Town of Saugus, as a natural hazard issue of regional concern. This is a salt marsh area bisected by the Pine River and State Route 107 (Salem Turnpike), and an MBTA commuter rail line. This area, bordered by Saugus and Revere are often the target for vandals setting brush fires, as well as prone to fires started by sparks from braking trains landing on dry salt marsh grasses. The two

communities would like to cooperate to create public awareness of the problem, increase access to the marsh area and establish a cooperative mutual aid firefighting agreement to increase fire prevention and protection within North Revere and Saugus.

Sea Level Rise and Shoreline Environment: The coastal shoreline of the North Shore area is a dynamic environment where forces of sea-level rise, erosion, and deposition of are constantly at work changing the shoreline profile. This process disregards municipal boundaries as sand and other materials are moved along the coast. Shoreline protection measures such as sea walls, jetties, and others have an impact on this process with the potential of building up materials in some areas while stripping it away from others. In Revere, a shoreline issue of regional concern is the need for additional storm water and storm surge storage capacity. Though the City has made substantial progress over the decade in updating its drainage and water infrastructure, the City has expressed the need for a regional approach to adding additional storm water storage capacity by dredging both Town Line Brook and Trifone Brooks. This additional capacity would benefit Everett, Malden and Chelsea, as well as Revere.

Municipalities along the North Shore should work to understand how these processes and others associated with sea level rise and storm surge are at work locally and consider mutually beneficial means of protecting their shore side communities from the impacts of storm damage and sea-level rise. Revere should consider participating within a regional sea level rise action work group to help plan for and address sea level rise, storm surge and related climate adaptation issues on a regional basis.

4.1.6 Participation in the National Flood Insurance Program

C2. Does the plan address each jurisdiction's participation in the NFIP and continued compliance with NFIP requirements, as appropriate? (Requirement §201.6(c)(3)(ii))

National Flood Insurance Program (NFIP) – Revere is a participating community in the NFIP with 2,274 policies in force as of February 23, 2021. Since the 2015 Update, the policies in force have increased by 562. More information on NFIP claims and payouts in Revere can be found in Section 3.4.

4.2 Hazard Mitigation Goals

C3. Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards? (Requirement §201.6(c)(3)(i))

The Planning Committee approved of the Hazard Mitigation Goals at the April 27, 2021 Planning Committee Meeting #2. At that meeting, the team reviewed and discussed the goals from the 2015 Hazard Mitigation Plan for the City of Revere and agreed to carry them forward in the 2022 Update.

Table 4-12 presents the right goals that were endorsed by the Planning Committee for the 2022 Update of the Revere Hazard Mitigation Plan:

Table 4-12: Hazard Mitigation Goals

Number	Description
1	Ensure that critical infrastructure sites are protected from natural hazards
2	Protect existing residential and business areas from flooding.
3	Make efficient use of public funds for hazard mitigation.
4	Continue to enforce zoning and building regulations.
5	Educate the public about zoning and building regulations, particularly with regard to changes in regulations that may affect teardowns and new construction.
6	Encourage future development in areas that are not prone to natural hazards.

Number	Description
7	Educate the public about natural hazards and mitigation measures.
8	Protect the City's ability to respond to various natural hazard events.

4.3 Mitigation Actions

C4. Does the Plan identify and analyze a comprehensive range of specific mitigation actions and projects for each jurisdiction being considered to reduce the effects of hazards, with emphasis on new and existing buildings and infrastructure? (Requirement §201.6(c)(3)(ii))

Table 4-14 identifies a comprehensive list of specific mitigation actions and projects within Revere that are being considered to reduce the effects of hazards, with an emphasis on the build environment, which includes new and existing buildings and infrastructure.

D2. Was the plan revised to reflect progress in local mitigation efforts? (Requirement §201.6(d)(3))

At a meeting of Planning Committee, City staff reviewed the potential mitigation actions identified in the 2015 Update and determined whether each measure had been implemented or deferred, as displayed in Table 4-13. Mitigation actions from the 2015 Update, identified in Table 4-13, were updated to reflect progress in local mitigation efforts.

Table 4-13: Mitigation Actions from 2015 Update

#	2015 Mitigation Action	Priority	Implementation Responsibility	What has been completed since 2015? (Work Completed, Progress Made, None)	If not completed, include in 2022 update? (Yes, No)
1	Install pump station at Squire Road to complement the existing tide gate	High	DCR / MassDOT	None	Yes
2	Martin Street and Oak Island Pump Stations	High	DPW	None	Yes
3	Mills Avenue Seawall upgrade	High	DPW	None	Yes
4	Build new seawall from Cary Circle to Alden Avenue	High	DPW	None	Yes
5	Build new seawall section at Rice Avenue	High	DPW	None	Yes
6	Upgrade Winthrop Parkway tide gate	High	DPW	Work Completed	
7	Upgrade Pearl Avenue headwall and drain line	High	DPW	Progress Made	Yes
8	Purchase drainage maintenance equipment	High	DPW	Work Completed	
9	Purchase three 12-inch, trailer-mounted diesel pumps	High	DPW	None	Yes
10	Purchase three diesel pumps (two 8-inch, one 6-inch)	High	DPW	Work Completed	

#	2015 Mitigation Action	Priority	Implementation Responsibility	What has been completed since 2015? (Work Completed, Progress Made, None)	If not completed, include in 2022 update? (Yes, No)
11	Install backup power for 17 pump stations	High	DPW	Progress Made	Yes
12	Consider Community Rating System (CRS) application	High	CRS Committee, Conservation Commission, EM Director	None	Yes
13	Floodplain mapping updates; Revere expects to receive new maps in 2014	High	Planning/ Conservation Commission	Work Completed	
14	Acquire/preserve flood prone lands: complete land swap with DCR	High	Planning/ Conservation Commission	Progress Made	Yes
15	Complete constructed wetland project at Griswold Conservation Area	High	Planning/ Conservation Commission	None	Yes
16	Improve wetlands ordinance enforcement; hire conservation agent	High	Planning/ Conservation Commission	None	Yes
17	Upgrade fixed, emergency power generators: DPW Facility	High	Fire/DPW	Progress Made	Yes
18	Install new, fixed generator at Reservoir Pump Station	High	DPW	None	Yes
19	Install electronic evacuation signs	High	Fire/Police	Progress Made	Yes
20	Purchase mobile Incident Command Unit	High	Police/Fire	None	No
21	Purchase new 4x4 brush truck, pump and forestry hose	High	Fire	None	Yes
22	Collaborate with Saugus on marsh fire prevention and education, access and equipment sharing	High	Fire	None	Yes
23	Public education for landowners and developers to identify and mitigate conditions that aggravate brush fires.	High	Fire	Work Completed	
24	Coordinated snow removal and parking program	High	DPW/Police/ DCR/MassDOT	Work Completed	
25	Partner with utility to document hazard areas and increase resilience to storms: establish standards for tree pruning around utility lines; incorporate management of hazardous trees into the drainage	High	DPW/Utilities	Progress Made	Yes

#	2015 Mitigation Action	Priority	Implementation Responsibility	What has been completed since 2015? (Work Completed, Progress Made, None)	If not completed, include in 2022 update? (Yes, No)
	maintenance process; inspect utility poles to ensure they are wind resistant; upgrade overhead utility lines; use designed-failure mode for power line design; install redundancies and loop feeds.				
26	Master Plan/Drainage Plan Climate Update	Medium	Planning	Progress Made	Yes
27	Update subdivision and site plan review standards	Medium	Planning	Work Completed	
28	Dredge Washburn Avenue storm drain outfall	Medium	DPW	None	Yes
29	Study dredging Town Line and Trifone Brooks	Medium	DPW	None	Yes
30	Update tree maintenance program	Medium	DPW	Work Completed	
31	Distribute information to property owners to reduce risk of tree failure;	Medium	DPW	None	Yes
32	Assess public buildings and schools for wind loads and tornado vulnerability	Medium	DPW, School Dept.	None	Yes
33	Snow removal equipment	Medium	DPW	Progress Made	Yes
34	Regional Sea Level Rise Action Work Group participation	Medium	Planning/DPW/ Conservation Commission	Work Completed	
35	Assess public buildings for snow loads and identify any needed retrofits	Medium	DPW	Work Completed	
36	Re-plant section of Revere Beach dune grass	Medium	DPW/ Conservation Commission	None	Yes
37	Install levees along Belle Isle Inlet/Avenue	Medium	DPW/ Conservation Commission	None	Yes
38	Hillside development ordinance	Low	Planning	Work Completed	
39	Assess earthquake vulnerability of all public buildings,	Low	Planning	None	No
40	Wetlands and wetlands delineations database	Low	Planning/ Conservation Commission	Work Completed	
41	Wetlands and Stormwater Outreach program	Low	Conservation Commission	Work Completed	

#	2015 Mitigation Action	Priority	Implementation Responsibility	What has been completed since 2015? (Work Completed, Progress Made, None)	If not completed, include in 2022 update? (Yes, No)
42	Implement drought tolerant landscape design measures	Low	Planning/ Conservation Commission	None	No
43	Development guidelines for green buildings & parking	Low	Planning/ Conservation Commission	Progress Made	Yes

Of the mitigation actions that have been deferred, the Planning Committee evaluated whether the measure should be deleted or carried forward into the 2022 Update. The decision on whether to delete or retain a particular measure was based on the Planning Committee's assessment of the continued relevance or effectiveness of the measure and whether the deferral of action on the measure was due to the inability of the City to take action on the measure.

4.3.1 Prioritization of Mitigation Actions

C5. Does the Plan contain an action plan that describes how the actions identified will be prioritized (including cost benefit review), implemented, and administered by each jurisdiction? (Requirement §201.6(c)(3)(iv)); (Requirement §201.6(c)(3)(iii))

The last step in developing the City's mitigation strategy is to assign a level of priority to each mitigation measure to guide the focus of the City's limited resources towards those actions with the greatest potential benefit. At this stage in the process, the Planning Committee has limited access to detailed analyses of the cost and benefits of any given measure, so prioritization is based on the Planning Committee member's institutional knowledge of the existing and potential hazard impacts and an approximate sense of the costs associated with pursuing any given measure.

Prioritization occurred through discussion with the Planning Committee and through subsequent review by the Planning Committee members and public comment. Priority setting was based on local knowledge of the hazard areas, including impacts of hazard events and the extent of the area impacted and the relation of a given mitigation measure to the City's identified goals. In addition, through the discussion, the Planning Committee also took into consideration factors such as the number of homes and businesses affected, whether or not road closures occurred and what impact closures had on delivery of emergency services and the local economy, anticipated project costs, whether the City currently had the technical and administrative capability to carry out the mitigation measures, whether any environmental constraints existed, and whether Revere would be able to justify the costs relative to the anticipated benefits. Table 4-14 reflects the prioritized mitigation actions and projects being considered by the City to reduce the effects of hazards.

Table 4-14: Priority and Status of Mitigation Actions

#	2021 Mitigation Action	Hazard(s) Addressed	Type of Mitigation Project	Relevant Hazard Mitigation Goal(s)	Priority	Implementation Responsibility	Implementation Timeframe	Estimated Cost	Potential Funding Sources
1	Coordinate with DCR and MassDOT to advocate for installation of a pump station at Squire Road to complement the existing tide gate since the City is not the owner of the site and lacks the authority to do so	Inland Flooding, Coastal Flooding	Structure and Infrastructure Projects	Flood Protection and Resiliency	High	DPW	5-10 years	Medium ($100,000-$500,000)	DCR MVP Action Grant Community Investment Trust
2	Install Martin Street and Oak Island pump stations	Inland Flooding, Coastal Flooding	Structure and Infrastructure Projects	Flood Protection and Resiliency	High	DPW	3-5 years	Medium ($100,000-$500,000)	Revere Capital Improvement Fund MVP Action Grant
3	Upgrade Mills Avenue Seawall	Coastal Flooding	Structure and Infrastructure Projects	Flood Protection and Resiliency	High	DPW	2-5 years	Medium ($100,000-$500,000)	MA Dam and Seawall Repair/Removal Grant FEMA HMA ACOE
4	Build new seawall from Cary Circle to Alden Avenue	Coastal Flooding	Structure and Infrastructure Projects	Critical Infrastructure Protection, Flood Protection and Resiliency	High	DPW	3-5 years	Medium ($100,000-$500,000)	MA Dam and Seawall Repair/Removal Grant FEMA HMA

#	2021 Mitigation Action	Hazard(s) Addressed	Type of Mitigation Project	Relevant Hazard Mitigation Goal(s)	Priority	Implementation Responsibility	Implementation Timeframe	Estimated Cost	Potential Funding Sources
5	Build new seawall section at Rice Avenue	Coastal Flooding	Structure and Infrastructure Projects	Critical Infrastructure Protection, Flood Protection and Resiliency	High	DPW	3-5 years	Medium ($100,000-$500,000)	Revere General Fund Revere Community Improvement Trust Fund FEMA HMA
6	Upgrade Pearl Avenue headwall and drain line	Inland Flooding	Structure and Infrastructure Projects	Critical Infrastructure Protection, Flood Protection and Resiliency, Efficient Use of Public Funds	High	DPW	3-5 years	Medium ($100,000-$500,000)	Revere General Fund FEMA HMA
7	Purchase three 12-inch, trailer-mounted diesel pumps	Inland Flooding, Coastal Flooding	Emergency Response and Operational Preparedness Actions	Critical Infrastructure Protection, Efficient Use of Public Funds	High	DPW	1-3 years	Low (under $100,000)	Revere General Fund
8	Install backup power for 17 pump stations	Inland Flooding, Coastal Flooding	Emergency Response and Operational Preparedness Actions	City's Response to Hazards, Critical Infrastructure Protection, Efficient Use of Public Funds	High	DPW	1-3 years	High (over $500,000)	Revere ARPA MVP Action Grant FEMA HMA
9	Consider Community Rating System (CRS) Application and Hire CRS Manager	Inland Flooding, Coastal Flooding	Local Plans and Regulations	Critical Infrastructure Protection, Flood Protection and Resiliency, Efficient Use of Public Funds	High	Conservation Commission, Emergency Management Director	1-3 years	Low (under $100,000)	Revere General Fund
10	Acquire/preserve flood prone lands: complete land swap with DCR	Inland Flooding, Coastal Flooding	Structure and Infrastructure Projects	Flood Protection and Resiliency	High	Planning/Conservation Commission	1-3 years	Low (under $100,000)	Revere General Fund

#	2021 Mitigation Action	Hazard(s) Addressed	Type of Mitigation Project	Relevant Hazard Mitigation Goal(s)	Priority	Implementation Responsibility	Implementation Timeframe	Estimated Cost	Potential Funding Sources
11	Complete constructed wetland project at Griswold Conservation Area	Inland Flooding	Natural Systems Protection	Flood Protection and Resiliency, Efficient Use of Public Funds	High	Planning/Conservation Commission	5-10 years	Low (under $100,000)	Revere General Fund DCR
12	Improve wetlands ordinance enforcement; hire conservation agent	Inland Flooding	Natural Systems Protection	Flood Protection and Resiliency, Efficient Use of Public Funds	High	Planning/Conservation Commission	1 year	Low (under $100,000)	Revere General Fund
13	Upgrade fixed, emergency power generators: DPW Facility	Multi-hazard	Emergency Response and Operational Preparedness Actions	Critical Infrastructure Protection, City's Response to Hazards	High	Fire/DPW	1-3 years	Low (under $100,000)	Revere General Fund FEMA HMA
14	Install new, fixed generator at Reservoir Pump Station	Multi-hazard	Emergency Response and Operational Preparedness Actions	Critical Infrastructure Protection, Efficient Use of Public Funds	High	DPW	1-3 years	Low (under $100,000)	Revere General Fund FEMA HMA
15	Install electronic evacuation signs	Multi-hazard	Emergency Response and Operational Preparedness Actions	Public Education-Hazards and Mitigation Measures, Flood Protection and Resiliency, City's Response to Hazards, Efficient Use of Public Funds	High	Fire/Police	1-3 years	Low (under $100,000)	Revere General Fund CDBG
16	Purchase new 4x4 brush truck, pump, and forestry hose	Wildfires	Emergency Response and Operational Preparedness Actions	City's Response to Hazards, Efficient Use of Public Funds	High	Fire	1-3 years	Medium ($100,000-$500,000)	Revere General Fund

#	2021 Mitigation Action	Hazard(s) Addressed	Type of Mitigation Project	Relevant Hazard Mitigation Goal(s)	Priority	Implementation Responsibility	Implementation Timeframe	Estimated Cost	Potential Funding Sources
17	Collaborate with Saugus on marsh fire prevention and education, access and equipment sharing	Wildfires	Education and Awareness Programs	City's Response to Hazards, Public Education-Hazards and Mitigation Measures	High	Fire	1 year	Low (under $100,000) Staff Time	Revere General Fund Saugus General Fund CDBG
18	Partner with utility to document hazard areas and increase resilience to storms: establish standards for tree pruning around utility lines; incorporate management of hazardous trees into the drainage maintenance process; inspect utility poles to ensure they are wind resistant; upgrade overhead utility lines; use designed-failure mode for power line design; install redundancies and loop feeds.	Severe Winter Storms	Emergency Response and Operational Preparedness Actions	City's Response to Hazards, Critical Infrastructure Protection, Efficient Use of Public Funds	High	DPW	1-2 years	Low (under $100,000)	Tree Inventory Grant Application in 2021 Utility Company CDBG

#	2021 Mitigation Action	Hazard(s) Addressed	Type of Mitigation Project	Relevant Hazard Mitigation Goal(s)	Priority	Implementation Responsibility	Implementation Timeframe	Estimated Cost	Potential Funding Sources
19	Prepare Master Plan/Drainage Plan Climate Update	Inland Flooding	Local Plans and Regulations	City's Response to Hazards, Critical Infrastructure Protection, Efficient Use of Public Funds, Enforce Zoning/Building Regulations	Medium	Planning	1-2 years	Low (under $100,000)	Revere General Fund Water Sewer Budget I&I Fund
20	Prepare development guidelines for green buildings and parking	Extreme Temperatures	Local Plans and Regulations	Efficient Use of Public Funds, Public Education-Hazards and Mitigation Measures	Low	Planning/ Conservation Commission	1-2 years	Staff Time	Revere General Fund Green Community Grant
21	Dredge Washburn Avenue storm drain outfall	Inland Flooding	Structure and Infrastructure Projects	City's Response to Hazards, Efficient Use of Public Funds	Medium	DPW	1 year	Medium ($100,000-$500,000)	Revere General Fund
22	Study dredging Town Line and Trifone Brooks	Inland Flooding, Coastal Flooding	Emergency Response and Operational Preparedness Actions	Efficient Use of Public Funds, Public Education-Hazards and Mitigation Measures	Medium	DPW	1-2 years	Medium ($100,000-$500,000)	BRIC (DCR) MVP Action Grant ACOE
23	Distribute information to property owners to reduce risk of tree failure	Hurricanes, Tornadoes	Education and Awareness Programs	Efficient Use of Public Funds, Public Education-Hazards and Mitigation Measures	Medium	DPW	1-3 years	Staff Time	Accelerating Climate Resiliency Grant Greening the Gateway Grant - DCR
24	Assess public buildings and schools for wind loads and tornado vulnerability	Hurricanes, Tornadoes	Emergency Response and Operational Preparedness Actions	City's Response to Hazards, Critical Infrastructure Protection, Enforce Zoning/Building Regulations	Medium	DPW/School Department	1-2 years	Low (under $100,000)	Revere General Fund Tornado Fund

#	2021 Mitigation Action	Hazard(s) Addressed	Type of Mitigation Project	Relevant Hazard Mitigation Goal(s)	Priority	Implementation Responsibility	Implementation Timeframe	Estimated Cost	Potential Funding Sources
25	Snow removal equipment	Severe Winter Storms	Emergency Response and Operational Preparedness Actions	City's Response to Hazards, Efficient Use of Public Funds	Medium	DPW	1-2 years	Medium ($100,000-$500,000)	Revere General Fund
26	Coordinate with DCR for beach nourishment and erosion control for Revere Beach	Inland Flooding, Coastal Flooding	Natural Systems Protection	Flood Protection and Resiliency, City's Response to Hazards	Medium	DPW/ Conservation Commission	1 year	Medium ($100,000-$500,000)	DCR MVP Action Grant NOAA ARPA
27	Install levees along Belle Isle Inlet/Avenue	Inland Flooding, Coastal Flooding	Structure and Infrastructure Projects	City's Response to Hazards, Critical Infrastructure Protection, Efficient Use of Public Funds	Medium	DPW/ Conservation Commission	3-5 years	High (over $500,000)	Revere General Fund FEMA HMA
28	Conduct a city-wide drainage study	Inland Flooding	Local Plans and Regulations	Flood Protection and Resiliency	High	Engineering/ DPW	1-3 years	Medium ($100,000-$500,000)	Revere General Fund
29	Identify a liaison between the City and State to identify and secure funding and increase communication	Multi-hazard	Local Plans and Regulations	Efficient Use of Public Funds	High	Resiliency Coordinator	1 year	Low (under $100,000)	General Fund
30	Investigate permitting and regulatory process for sand transfer to mitigate coastline erosion	Coastal Flooding, Coastal Erosion	Local Plans and Regulations	Flood Protection and Resiliency	High	Resiliency Coordinator	1-3 years	Medium ($100,000-$500,000)	MVP Action Grant Accelerating Climate Resiliency Partner-DCR

#	2021 Mitigation Action	Hazard(s) Addressed	Type of Mitigation Project	Relevant Hazard Mitigation Goal(s)	Priority	Implementation Responsibility	Implementation Timeframe	Estimated Cost	Potential Funding Sources
31	Mitigate the impact of development and redevelopment by requiring best management practices for stormwater management and incentivizing green infrastructure and green building technologies	Inland Flooding	Local Plans and Regulations	Public Education-Zoning/Building Regulations	High	Engineering/ DPW	Ongoing	Low (under $100,000)	Revere General Fund
32	Improve the City's drainage system based on findings of the city-wide drainage study	Inland Flooding	Structure and Infrastructure Projects	Flood Protection and Resiliency, Efficient Use of Public Funds	High	DPW	Ongoing	Medium ($100,000-$500,000)	Revere General Fund
33	Improve communication with public and educate public about evacuation plans and natural hazards	Multi-hazard	Education and Awareness Programs	Public Education-Hazards and Mitigation Measures, City's Response to Hazards	High	Emergency Management	1 year	Medium ($100,000-$500,000)	Revere General Fund
34	Develop multilingual resources to aid in public education efforts	Multi-hazard	Education and Awareness Programs	Public Education-Hazards and Mitigation Measures	High	Emergency Management	Ongoing	Low (under $100,000)	Revere General Fund
35	Upgrade the Point of Pines pump station and pump	Inland Flooding	Structure and Infrastructure Projects	City's Response to Hazards, Efficient Use of Public Funds	High	DPW	1 year	Medium ($100,000-$500,000)	Revere General Fund

#	2021 Mitigation Action	Hazard(s) Addressed	Type of Mitigation Project	Relevant Hazard Mitigation Goal(s)	Priority	Implementation Responsibility	Implementation Timeframe	Estimated Cost	Potential Funding Sources
36	Add new drainage outfall from Malden Street/Washington Avenue area to the Town Line Brook	Inland Flooding	Structure and Infrastructure Projects	Flood Protection and Resiliency, Efficient Use of Public Funds	High	DPW	1-2 years	Low (under $100,000)	NOAA MVP Action Grant Revere General Fund BRIC
37	Increase the city's tree canopy to reduce heat island effect	Extreme Temperatures	Natural Systems Protection	City's Response to Hazards, Efficient Use of Public Funds	High	DPW	Ongoing	Low (under $100,000)	DCR-Greening the Gateway CDBG
38	Complete Oak Island marsh restoration efforts within east and west sides of Route 1A (marshland acquisition required)	Inland Flooding, Coastal Flooding	Natural Systems Protection	Flood Protection and Resiliency, Efficient Use of Public Funds	High	DPW	1-3 years	Medium ($100,000-$500,000)	NOAA CZM
39	Conduct beach nourishment and dune restoration for Point of Pines	Coastal Flooding, Coastal Erosion	Natural Systems Protection	Flood Protection and Resiliency, City's Response to Hazards, Efficient Use of Public Funds	High	DPW	2-5 years	Low (under $100,000)	NOAA MVP Action Grant CZM
40	Construct Ambrose Park drainage improvements as part of park reconstruction	Inland Flooding	Structure and Infrastructure Projects	Flood Protection and Resiliency, Efficient Use of Public Funds	High	DPW	1 year	Low (under $100,000)	PARC Grant CDBG
41	Provide drainage improvements under Route 1A	Inland Flooding, Coastal Flooding	Structure and Infrastructure Projects	Flood Protection and Resiliency, Efficient Use of Public Funds	High	MassDOT	3-5 years	Medium ($100,000-$500,000)	MassDOT CZM

#	2021 Mitigation Action	Hazard(s) Addressed	Type of Mitigation Project	Relevant Hazard Mitigation Goal(s)	Priority	Implementation Responsibility	Implementation Timeframe	Estimated Cost	Potential Funding Sources
42	Conduct Route 95 embankment / marsh restoration	Inland Flooding, Coastal Flooding	Natural Systems Protection	Flood Protection and Resiliency, Efficient Use of Public Funds	High	ACOE	5-10 years	High (over $500,000)	ACOE
43	Implement Riverfront Master Plan stormwater management and resilience recommendations : • Tide gates and backflow prevention • Install a pump station and improve interior drainage • Stormwater management including subsurface storage at Gibson Park • Expand/create salt marsh	Inland Flooding, Coastal Flooding	Structure and Infrastructure Projects	Flood Protection and Resiliency, Efficient Use of Public Funds	High	DPCD/DPW	1-3 years	High (over $500,000)	MVP Action Grant

#	2021 Mitigation Action	Hazard(s) Addressed	Type of Mitigation Project	Relevant Hazard Mitigation Goal(s)	Priority	Implementation Responsibility	Implementation Timeframe	Estimated Cost	Potential Funding Sources
44	Implement preliminary recommendations from Point of Pines /Riverside Coastal Resilience Feasibility Study: • Beach management plan • Deployable and on-site flood protection measures • Long-term resilience measures under development	Coastal Flooding	Structure and Infrastructure Projects	Flood Protection and Resiliency, Efficient Use of Public Funds	High	POPBA/DPCD/ DPW	1-3 years	High (over $500,000)	MVP Action Grant ACOE Revere General Fund
45	Purchase high water fire trucks	Inland Flooding, Coastal Flooding	Emergency Response and Operational Preparedness Actions	City's Response to Hazards	High	Fire Dept.	1-2 years	Low (under $100,000)	Revere General Fund
46	Expand Point of Pines sewer pump station wet well	Inland Flooding, Coastal Flooding	Structure and Infrastructure Projects	Flood Protection and Resiliency	High	DPW	1 year	High (over $500,000)	ARPA Revere General Fund
47	Advocate for ACOE's Regional Flood Protection Project, which may include a flood gate for the Saugus River	Coastal Flooding	Structure and Infrastructure Projects	Flood Protection and Resiliency	High	Planning/DPW	ASAP	High (over $500,000)	ACOE EOEEA CZM FEMA HMA

#	2021 Mitigation Action	Hazard(s) Addressed	Type of Mitigation Project	Relevant Hazard Mitigation Goal(s)	Priority	Implementation Responsibility	Implementation Timeframe	Estimated Cost	Potential Funding Sources
48	Reinforce Winthrop Parkway Seawall	Coastal Flooding	Structure and Infrastructure Projects	Flood Protection and Resiliency	High	DCR	2-5 years	High (over $500,000)	MA Dam and Seawall Repair/Removal Grant FEMA HMA ACOE
49	Reconstruct the catch basins and Outfalls in the Riverside neighborhood	Inland Flooding	Structure and Infrastructure Projects	Flood Protection and Resiliency	High	Planning/DPW	2-5 years	High (over $500,000)	FEMA HMA
50	New Seawall to Prevent flooding on Mills Ave and Riverside Neighborhood (contingent on Action #49)	Coastal Flooding	Structure and Infrastructure Projects	Flood Protection and Resiliency	High	Planning/DPW	5-10 years	High (over $500,000)	FEMA HMA
51	Citywide Flood Path Analysis for Inland and Coastal Flooding	Inland and Coastal Flooding	Planning	Flood Protection and Resiliency	High	Planning/DPW	1-2 years	Medium ($100,000-$500,000)	MVP Action Grant FEMA HMA
52	Gibson Park – Resiliency Construction	Inland and Coastal Flooding	Structure and Infrastructure Projects	Flood Protection and Resiliency	High	Planning/DPW	1-2 years	High (over $500,000)	MVP Action Grant FEMA HMA
53	Support Flood Mitigation Efforts Recommended by City of Boston	Inland and Coastal Flooding	Structure and Infrastructure Projects	Flood Protection and Resiliency	High	Planning, MassDOT, City of Boston	5-10 years	High (over $500,000)	MVP Action Grant FEMA HMA

#	2021 Mitigation Action	Hazard(s) Addressed	Type of Mitigation Project	Relevant Hazard Mitigation Goal(s)	Priority	Implementation Responsibility	Implementation Timeframe	Estimated Cost	Potential Funding Sources
54	Fredericks Park Resilience Design and Construction	Coastal Flooding	Structure and Infrastructure Projects	Flood Protection and Resiliency	High	Planning	2-5 years	High (over $500,000)	MVP Action Grant FEMA HMA PARC Environmental Bond Bill

Legend:
2015 HMP action carried forward for the 2022 update (deferred)
New actions identified through the City's MVP planning process
New actions identified by the Local Hazard Mitigation Planning Committee and stakeholders

4.4 Integration with Other Planning Mechanisms

C6. Does the Plan describe a process by which local governments will integrate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate? (Requirement §201.6(c)(4)(ii))

As stated in Section 2.2, the City recognizes hazard mitigation planning should not occur independent of other community planning activities. The City has held stakeholder workshops to support the Revere MVP Program and workshops specific to the Coastal Resilience Feasibility Study for the Point of Pines Riverside Area. Stakeholder engagement activities taken to support these efforts are summarized in the following sections.

Many measures identified in previous plan updates are now considered on-going aspects of the regular work of City staff from the department head level to the regular work of Public Works staff. Individual projects have been incorporated into the City's capital improvement plan and the City continues to seek FEMA HMA funding to implement the home elevation program. There will be more opportunities to incorporate hazard mitigation into the City's decision-making processes. Barriers to implementing many mitigation actions are primarily a result of funding and staffing constraints. The following ongoing initiatives and planning mechanisms are integrating requirements of the mitigation plan to improve community resilience:

- Coastal Resilience Study for Riverside and Point of Pines – MVP Action Grant
- Suffolk Downs redevelopment

Regional and Inter-Community Considerations are further discussed in Section 4.1.5.

Lastly, the Planning Committee encompasses an interdisciplinary group of stakeholders from the City, and includes representation from first responders and emergency managers, planning and development, engineers and infrastructure operators, and the City's school department. In addition, the Planning Committee includes stakeholder who represent community members with access and functional needs. Through encompassing an interdisciplinary set of stakeholders, the Planning Committee can integrate the findings of the risk assessment and mitigate strategy into other municipal plans and response procedures, where appropriate.

5. Plan Adoption and Maintenance

The Revere Hazard Mitigation Plan was adopted by the City Council on [ADD DATE]. See Appendix C for documentation. The plan was approved by FEMA on [ADD DATE] for a five-year period that will expire on [ADD DATE].

5.1 Public Participation during Plan Maintenance

A5. Is there discussion of how the community(ies) will continue public participation in the plan maintenance process? (Requirement §201.6(c)(4)(iii))

Planning is a dynamic and ongoing process, and as such, the 2022 Update will be reviewed annually between formal approval and the beginning of the next update to internally review and update the hazard mitigation strategy / action status.

The Planning Committee will morph into the Implementation Committee and will continue to meet on an annual basis to function as the Local Hazard Mitigation Implementation Committee, with the Emergency Management Director designated as the coordinator. Additional members could be added to the local implementation group from businesses, non-profits, and institutions. The City will continue public participation during the next 5-year planning cycle. Updates and reviews of the plan will be publicly noticed in accordance with City and state open meeting laws, and the current plan will be available to the public on the City's website.

Furthermore, the 2022 Update will be posted on the City’s website, allowing for public review and comment throughout the plan’s 5-year lifecycle.

5.2 Keeping the Plan Current

A6. Is there a description of the method and schedule for keeping the plan current (monitoring, evaluating and updating the mitigation plan within a 5-year cycle)? (Requirement §201.6(c)(4)(i))

5.2.1 Implementation and Maintenance Schedule

The City will conduct annual plan maintenance meetings in the Fall to internally review and update the hazard mitigation strategy / action status. Furthermore, the coordinator of the Implementation Committee will prepare and distribute a survey in year three of the plan. The survey will be distributed to all the local implementation group members and other interested local stakeholders. The survey will poll the members on any changes or revisions to the plan that may be needed, progress and accomplishments for implementation, and any new hazards or problem areas that have been identified.

This information will be reflected in the planning section of the subsequent plan update. The Implementation Committee will have primary responsibility for tracking progress and Planning Committee will again be responsible for subsequent updates of the plan.

5.2.2 Begin to Prepare for the next Plan Update

Given the lead time needed to secure funding and conduct the planning process, the Planning Committee will begin to prepare for an update of the plan in year three. The Planning Committee will use the information collected during the annual review process to identify the needs and priorities for the next plan update and seek funding for the plan update process. Potential sources of funding may include FEMA HMA, which includes BRIC and HMGP funding. Both grant programs can pay for 75% of a planning project, with a 25% local cost share required.

5.2.3 Prepare and Adopt an Updated Local Hazard Mitigation Plan

FEMA's approval of this plan is valid for five years, by which time an updated plan must be approved by FEMA to maintain the City's approved plan status and its eligibility for FEMA HMA. Once the resources have been secured for the next update, the Planning Committee will need to review the current FEMA hazard mitigation plan guidelines for any changes. The update of the Revere Hazard Mitigation Plan will then be forwarded to MEMA and DCR for review and to FEMA for approval.

5.2.4 Integration of the Plans with Other Planning Initiatives

Upon FEMA approval and adoption of the 2022 Update, the Local Hazard Mitigation Implementation Committee will provide all interested parties and implementing departments with a copy of the plan and will initiate a discussion regarding how the plan can be integrated into that department's ongoing work. Discussions will focus on how recommendations in the 2022 Update can be integrated into the City's capital improvement planning program, master planning process, zoning, wetlands, and stormwater or subdivision regulations.

At a minimum, the 2022 Update will be reviewed and discussed with the following departments:

- Fire / Emergency Management
- Police
- Public Services / Highway
- Engineering
- Planning and Community Development
- Conservation
- Parks and Recreation
- Health
- Building

The findings of the 2022 Update will be integrated into other city planning initiatives and policies as they are updated and renewed, including the Revere Comprehensive Plan, Open Space Plan, Comprehensive Emergency Management Plan, and Capital Investment Program.

Other groups that will be coordinated with include large institutions, Chambers of Commerce, land conservation organizations and watershed groups. The plans will also be posted on a community's website with the caveat that local team coordinator will review the plan for sensitive information that would be inappropriate for public posting. The posting of the plan on a web site will include a mechanism for citizen feedback such as an e-mail address to send comments.

Appendix A Planning Process

AECOM Imagine it. Delivered.

Meeting Minutes

Meeting name Local Hazard Mitigation Planning Committee Meeting #1	**Meeting date** January 20, 2021	**Attendees** See Section 1.0 for attendee list
Time 2:00PM-4:00PM	**Location** Virtual Zoom Meeting	
AECOM project number 60648765	**Prepared by** Aaron Weieneth	

Subject: Hazard Mitigation Plan Update – Local Hazard Mitigation Planning Committee Meeting #1

1.0 Introductions

- Attendees: AECOM: Amanda Shanahan, Aaron Weieneth, Anna Foley

  City of Revere: Elle Baker, Frank Stringi, James Cullen, Joe Maglione, Bob O'Brien, David Callahan
- Elle Baker made introductions and turned things over to Aaron Weieneth for the formal presentation. A PDF of the presentation is attached to these notes and provides additional details.
- Elle introduced the project, previous meeting items and actions.
- Aaron Weieneth provided welcome and opening remarks to the group and proceeded to give an overview of HMP agenda and materials to be covered.

2.0 Importance of Hazard Mitigation Plan Update (Led by Anna Foley)

- Anna Foley took over presentation and asked the group who has been involved in HMP planning before.
  - Elle indicated she had not been involved but works closely on the City's related Municipal Vulnerability Preparedness (MVP) work. Frank Stringi was involved with the previous HMP update.
- Anna reviewed why hazard mitigation is important: combination of factors that dictate the degree of impact felt when a disaster occurs.
- Hazard mitigation planning is the key to resiliency because natural hazards are inevitable. Communities need to have a well-rounded understanding of all vulnerabilities, not just the most recent events that have caused issues. This process will allow the City to make better informed decisions of how to allocate resources.
- Hazard mitigation breaks the cycle of hazards becoming disasters. It reduces exposure, saves communities money, and protects property and lives.
- In 2018, the Multi-Hazard Mitigation Council performed a study of cost-effective grant funded mitigation projects and found those projects provided towns with 6:1 cost savings.
- Disaster Mitigation Act (2000) added a new requirement for local communities to have HMPs in place to be eligible to apply for federal hazard mitigation project grant money. Previously, the eligibility requirement was tied to the State having a mitigation plan in place.
- HMPs are living documents and need to be continually updated on an ongoing basis, at least every 5 years, to address natural hazards.
- Benefits of mitigation planning include compliance with DMA2000 and ability to apply for project grants, create a path to resiliency, facilitates putting together funding applications, applications will be more competitive.
- Once the plan is approved, various projects fall under FEMA's funding opportunities (listed on slide).
- Regular updates of the HMP ensure information in population, development, FEMA mapping, recent hazard and associated impacts, and recent outlier events is up to date and represents the City's best path forward.

- A 5-year HMP update reflects current conditions and changes.
  - Elle noted 1,200-1,500 additional housing units.
  - Frank said since 2014 they have added about 3,500 units, major area along Revere Beach Blvd, 850 in permitting stage at Suffolk Downs.
  - Anna noted that increases level of risk since more people and property will be in harm's way in the event of a natural disaster.

3.0 What is included in a plan update? (Anna Foley reviewed information on PowerPoint)

- A 5-year window starts the date the plan was adopted, which is why we reference first plan update as 2015 (though the bulk of the City's first plan update activities occurred in 2014).
- This second plan update should be completed by the end of 2021.
- The 2015 plan focused on 8 hazards that were prominent in the state plan at the time of first plan update.
- Anna stressed how important outreach is for the plan update, to both the general public and other stakeholders. Outreach must be documented throughout the plan update timeline where various avenues are used to reach those groups of people. For example, there should be digital outreach, hard copies posted in public venues, and brought up in regularly scheduled City meetings.
  - Elle Baker noted the City could conduct a survey of some sort through Revere TV and their website. She referenced their current practices for public outreach for open space planning and the RiverFront Master Plan. Need to coordinate the best avenues for outreach. Recently applied for a flood barrier application with 5 other communities. Working with Chelsea and Winthrop on other initiatives, so Revere is okay with contacting other communities to weigh in.
  - Bob O'Brien added that outreach in Revere needs to be multi-lingual as was done for the City's recent Master Plan so it is broad enough to reach everyone in their diverse community. He referenced recent translations of City documents into Spanish, Portuguese, Cambodian, and Arabic.
- Anna recommended discussing the plan update at regularly scheduled meetings open to the public – things like council meetings, planning board meetings, etc. that are already advertised and open to the public. Though unrelated to this project, those meetings offer an opportunity to share brief information about the plan update and where to go for more information, to submit comments, or to become involved. This approach casts a wider net, as it is sometimes difficult to realize high attendee numbers at meetings designed strictly to discuss the HMP; people sometimes do not come out unless it is a post-disaster situation where natural hazards are front and center in everyone's minds. Additionally, use newsletters, newspapers, community TV, radio, etc. She also noted that reaching out to neighboring communities allows doors of communication to open, since natural hazards do not recognize municipal boundaries. It is good to initiate conversations to invite neighboring communities to learn more and/or become involved. Also, channels of communication can bring to light things that may be occurring in neighboring communities that have impacts (negative or positive) on Revere, and vice versa. It is also good to coordinate if neighboring communities are planning, or presently undergoing, a similar HMP project.
- Who are "other stakeholders"? Anna briefly touched on a list of examples. In short, they are not municipal employees, and are not the general public. A full list is on slide #29 of the attached PowerPoint.
- Anna noted that it is important to make sure that that City is documenting outreach over the project timeline so it is not a red flag at the end; for example if there is only one outreach platform used, or if all outreach activities are conducted in the last month of the project timeline, that is not a good sign.
- Anna handed presentation back over to Aaron who described the plan update fact sheet.
- Aaron reviewed the project timeline starting with completed items and then the key future activities and related dates.
  - Aaron noted he has been in touch with the plan reviewer from the State, and he has a good track record with getting plans reviewed in a timely manner.

4.0 General Discussion / Q&A

- Bob O'Brien asked if we could identify infrastructure projects now that a new administration has taken over.

- Anna responded that projects in the action lists all fall under different funding streams so yes, when you prepare project list, the better idea you have of where you will seek funding from in planning stage it is better for your municipality. It is best to document a variety of funding sources, not strictly FEMA funding streams.
- Bob responded that they will need a list because they could be provided with funding opportunities sooner rather than later. Riverfront Master plan has many resiliency elements in it that involves POP/Riverside communities, so we should use the master plan to inform our work. The Boston Region Municipal Planning Organization work involves assessing flooding in the Rt 1A transportation corridor that passes through Revere. He thinks we should reference those parallel planning efforts and be familiar with those recommendations and conclusions. Bob wants all planning efforts/projects to be referenced.
- Bob brought up the Regional Saugus River Floodgate Project that is potentially being reconsidered by the US Army Corps of Engineers. It could be planned in conjunction with the replacement of the Edwards Bridge, which spans the Saugus River. He wants us to raise that issue with MassDOT. Bob also noted insurance implications: Flood insurance costs are a driver in community participation due to flooding shown in FEMA maps that inform insurance rates. The City noted that FEMA's 2016 flood maps expanded the V-zone, and mapped some V-zones into the landward side of the line of protection, which brought one home's annual flood insurance premium to $50,000. Bob also mentioned the new fire station that is being constructed in the Point of Pines, which is important for emergency response efforts in this portion of the city.

- Elle responded echoing that point, noting that public safety is affected when the fire station is cut off from the Point of Pines and Riverside population. Also, the growth on Revere Beach Boulevard will benefit from this new permanent station.
- James Cullen stated that the Fire Department will have a high-water vehicle (not for 2 years), and that the department is looking forward to having a permanent station in the Point of Pines. The high-water vehicle is being funded through an Urban Area Security Committee grant.
- Bob suggested that "Shovel Worthy" projects that could be applicable for infrastructure funding such as pump stations and seawall repairs that could be incorporated into this work.
- Elle noted her department has been working with Ed Fortuna to create an evacuation center at the senior center, and took a generator from the Beachmont fire station that will allow the senior center to be used as an evacuation space. The City also purchased a number of flood barriers for the senior center.
- Bob suggested that the MWRA's new water line that is proposed to cross the Saugus River into the Point of Pines should be referenced in the plan.
- Elle and Frank noted that the City's outreach to other stakeholders should include MassDOT, DCR, and the MBTA as they own and/or operate a lot of property in Revere. Also noted important developers.

5.0 Discussion Item #1 – Update of Status of Mitigation Measures

- Aaron reviewed the action table, which includes 43 actions that were designated by the City in the 2015 plan. The City initiated an update of the status of these actions during a Local Hazard Mitigation Planning Committee meeting that was held in February 2020.
- Regarding mitigation needs at sites not owned by the City, Anna noted the importance of the action description – so while the City may not own the property (and therefore cannot have the action of implementing a particular project) their action could be to meet with the property owner to make them aware of the problem, the impacts of this problem on the City, and any mitigation measures that the City would like to advocate for (that would ultimately be implemented by the owner). The example Anna used was for the problem of flooding on a State-owned roadway running through a municipality, say from an undersized culvert. The municipality does not have the authority to undertake a hazard mitigation project on a State-owned road. However, since the flood conditions affect the City, their action item could be to reach out to the State and possibly schedule a meeting to discuss the problem, its impacts, and possible solutions that the City would like to see (i.e., for the State to increase the size of the culvert running under the roadway so it no longer floods).
- Elle noted that for action item 3, seawall upgrade, they are trying to identify what the best resiliency option is as part of the ongoing coastal resilience feasibility study for the Point of Pines and Riverside area.
- New items from the Master Plan that need to be added include Gibson Park updated, North Shore Boatyard at 27 Thayer Avenue (acquire property and then make upgrades to mitigate flooding in neighborhood).

- Elle asked if the list should be categorized by if it is infrastructure, plan, upgrade, equipment? This grouping could help with comprehension of funding sources for each project.
- Elle added it may be helpful to identify the location of actions on a map to aide in visualization of risk.
- Revere Local Hazard Mitigation Planning Committee members will review list and update accordingly.

6.0 Discussion Item #2 – Update List of Critical Infrastructure

- Aaron talked about the need to update this list to accurately reflect what we are considering critical infrastructure.
- Elle asked if the list could be tiered to identify higher and lower priority places.
- Anna highlighted the nuances between mitigation and emergency response, this is driven by mitigation and not response.
- Aaron agreed and said AECOM will address this in current critical infrastructure list before handing it back to Revere to update.

7.0 Discussion Item #3 - Update on Hazard Mitigation Issues

- Anna discussed a table that needs to be updated with recent natural hazard event occurrences that have happened since last update was completed. These are organized by natural hazard, and the City can also identify any actions that are ongoing or possible mitigation strategies.
- There was a discussion about extreme weather events and mitigation actions over the last 5-6 years: (Aaron transcribed in a separate table)
  - Frank: Tornado in summer 2014.
  - Joe: High tides and nor'easter in March 2018.
  - Bob: Noted that the biggest issue is when a multitude of issues occur at once.
  - Bob: Stated the City has done beach nourishment to help with erosion.
  - Elle: Implemented a program in the Pearl Avenue area to elevate houses. The City has looked at expanding this program, but some upfront costs would need to be incurred by homeowners prior to receiving grant funds. Noted it is an uphill battle with outreach and City Council. Also noted that FEMA buyout for repetitive loss properties is an option to consider.
  - Frank: Major hazards centralize around flooding due to extreme precipitation and high tides combined with storm events.
- The City noted it is interested in purchasing properties along Route 1A for marshland restoration purposes (flood mitigation).
- Aaron noted NFIP Severe Repetitive Loss (SRL) properties in Revere are on the State radar in terms of areas in need of mitigation.

8.0 Final Talking Points, Comments, or Questions

- Elle stated t is important to reference the regional flood gate project in the HMP update. She has shared materials with AECOM.
- Elle noted it would be helpful to have a way to record data from 311 calls. This would allow for capturing some basic information about location and hazard impacts that could be used to supplement discussions in the plan of not only areas impacted by hazard but frequency of occurrence, typical impacts, etc.

9.0 Action Items

- Elle to coordinate the review and update of the mitigation actions included in the 2015 plan.
- Elle to coordinate development of a stakeholder list and initiate outreach activities.
- AECOM to progress the list of critical facilities/infrastructure and provide to the City for additional revisions.

City of Revere
Hazard Mitigation Plan Update

Local Hazard Mitigation Planning Committee Meeting #1

January 20, 2021

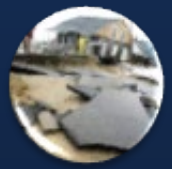
2:00 pm – 4:00 pm

Kickoff Meeting Agenda

Welcome and Opening Remarks	City of Revere
Why is Hazard Mitigation Important?	AECOM
Mitigation Planning and Plan Updates	AECOM
Overview of the Current Plan	AECOM
Participation Requirements and Timeline	AECOM
General Discussion/Q & A	City of Revere
Discussion Items	AECOM
Wrap-up	City of Revere
Adjourn	

Welcome and Opening Remarks

Natural hazards are a part of our past, and they will be a part of our future.



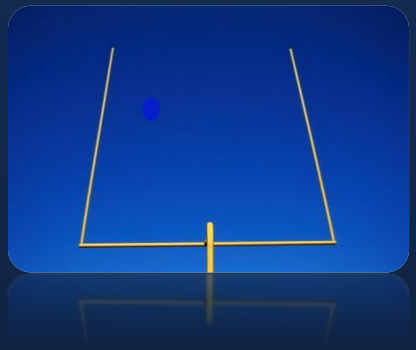
Damages and impacts from an event can be staggering and often have long-term consequences.

Federal dollars are not always available to aid in the recovery process for every occurrence.

Welcome and Opening Remarks

Goal:

- More sustainable and disaster resistant communities



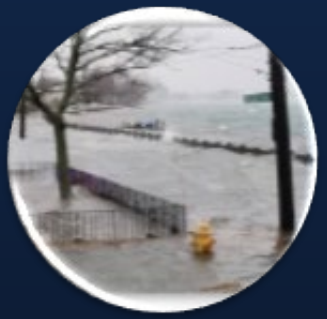
Welcome and Opening Remarks

Hazard mitigation planning helps to achieve that goal:

- Identifying the hazards
- Evaluating the risks
- Developing a suite of mitigation actions to reduce key risks
- Implementing the actions identified in the plan

Why is hazard mitigation important?

Most people have been affected by natural hazards in some way. Our communities are vulnerable to a variety of hazards ranging from floods, hurricanes, and severe winter weather to storms, extreme winds and heat waves.



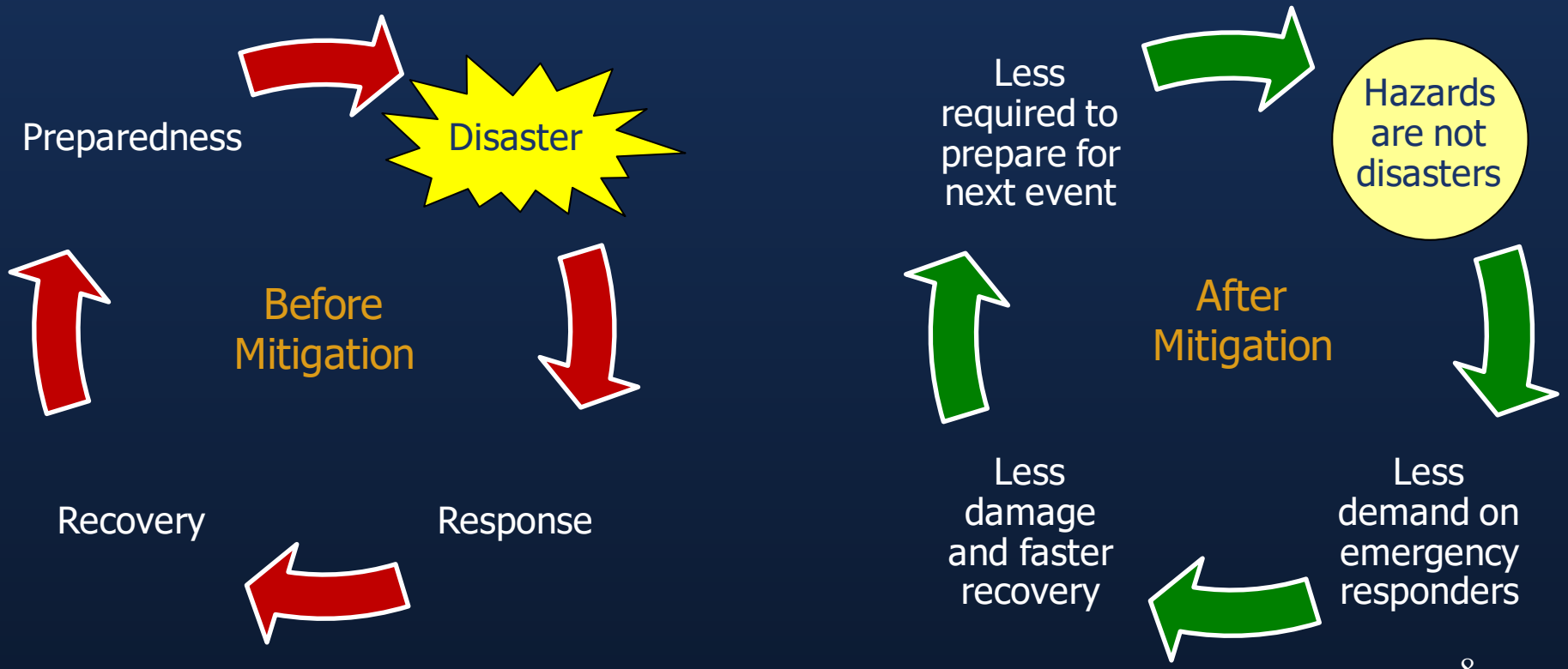
The magnitude of a disaster depends on the intensity of the event, the number of people and structures exposed, and the effectiveness of pre-disaster mitigation actions in protecting people and property.

Why is hazard mitigation important?

Hazard mitigation is the key to resiliency.

Why is hazard mitigation important?

HAZARD MITIGATION BREAKS THE CYCLE



Why is hazard mitigation important?

Mitigation Works!

Reduces exposure *Saves money* *Protects lives and property*

Why is hazard mitigation important?

Implemented hazard mitigation measures will reduce:

- the risk of damage to lives and property
- the impacts of a hazard event on the economic and social fabric of a community
- response time and costs

Why is hazard mitigation important?

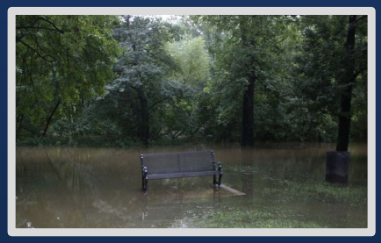
Updated study by the Multi-Hazard Mitigation Council (part of the National Institute of Building Sciences):

National Benefit-Cost Ratio Per Peril *BCR numbers in this study have been rounded	Federally Funded	Beyond Code Requirements
Overall Hazard Benefit-Cost Ratio	6:1	4:1
Riverine Flood	7:1	5:1
Hurricane Surge	Too few grants	7:1
Wind	5:1	5:1
Earthquake	3:1	4:1
Wildland-Urban Interface Fire	3:1	4:1

Table 1. Benefit-Cost Ratio by Hazard and Mitigation Measure.

Why is hazard mitigation important?

Natural disasters can't be prevented, but their impacts can be reduced through hazard mitigation.




Mitigation Planning and Plan Updates

Disaster Mitigation Act of 2000 (DMA 2000):

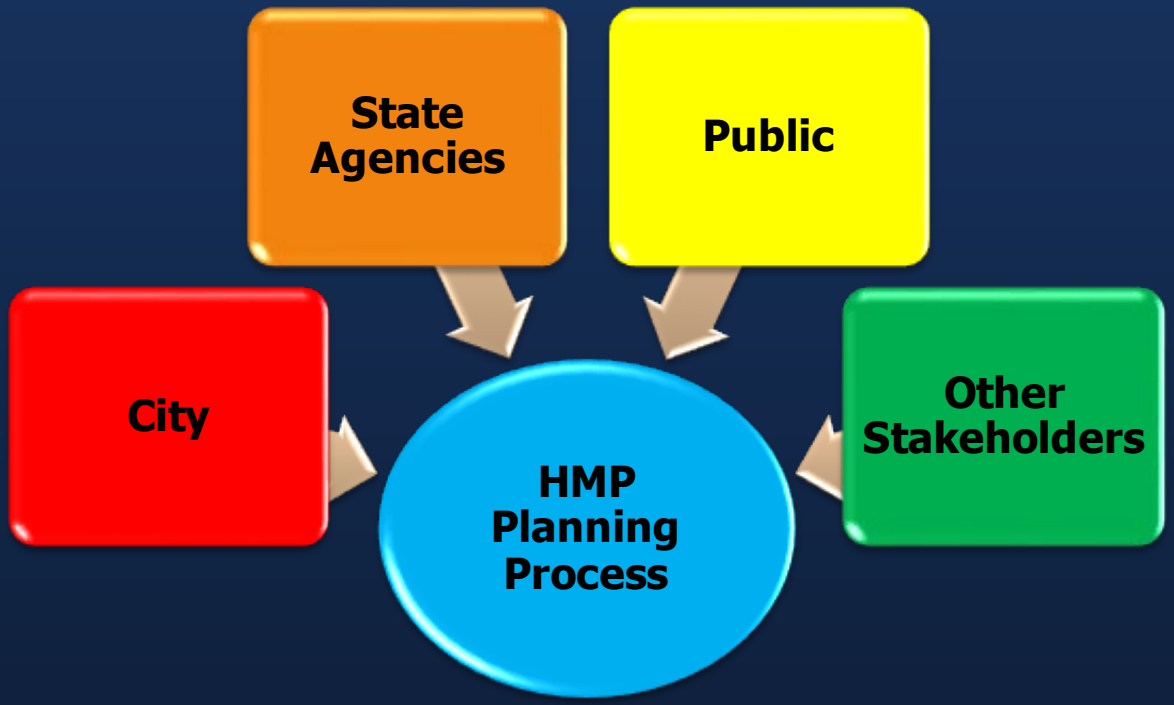
- Continued requirement for a State mitigation plan as a condition of disaster assistance
- Established a new requirement for local mitigation plans as a condition to apply for hazard mitigation project grants
- 2018 State Hazard Mitigation and Climate Adaptation Plan
    - Local Plans should address updated hazards
    - 2018 Update incorporates climate change, which should also be considered

Mitigation Planning and Plan Updates

Hazard mitigation plans must be:

- Developed to meet the requirements of DMA2000
- Implemented on an ongoing basis (projects)
- Updated every five years
- Prepared to address natural hazards

Mitigation Planning and Plan Updates



Every participant provides input to the Revere HMP Upda

Mitigation Planning and Plan Updates

Building disaster resistance through mitigation planning:

- Requires an ongoing commitment at the local level to implement the projects identified in the plan

- Involves striking a balance between competing constraints
  - staff members
  - their time
  - local funding availability

Mitigation Planning and Plan Updates

Benefits of mitigation planning:

- Continued compliance with DMA2000
  - In turn, continued eligibility to apply for hazard mitigation project grants

- Path to resiliency
  - Evaluation of hazards, risks
  - Development of appropriate strategies for reducing risks – projects "on the shelf"
  - Facilitates funding applications, allocation, and more effective risk reduction projects.

Mitigation Planning and Plan Updates

Once the plan is approved, City will be eligible to apply for grant funding for projects like these:

- Acquire/elevate/ floodproof/ relocate structures
- Road raising/relocation
- Culvert upgrades
- Bridge retrofits
- Wind retrofits
- Utility system protective measures
- Minor localized flood reduction projects (inc. retention/ detention basins)
- Soil stabilization (geotextiles, rip rap, etc.)
- Wildfire mitigation (defensible space, ignition-resistant construction, fuel reduction)
- Generators and similar types of projects for energy resiliency

Mitigation Planning and Plan Updates

Regular updates ensure:

- That the plan remains applicable to present-day understanding of vulnerabilities based on most recent studies, reports, event histories, etc.; and

- That the plan continues to present the best path forward for reducing future damages when hazard events, inevitably, occur.

Mitigation Planning and Plan Updates

5-year Updates to Reflect Current Conditions:

- Assess current development patterns and development pressures
- Evaluate new hazard or risk information
- Describe progress in local plan maintenance and plan integration efforts
- Assess previous goals and actions
- Summarize progress in implementing actions
- Adjust actions to address current realities
- Explain changes in priorities
- Address changes in Federal/State requirements

Mitigation Planning and Plan Updates

Plan updates:

- Outreach to the public and other stakeholders
- Update hazard and vulnerability data to reflect recent events, new data/studies/reports, etc.
- Update NFIP data (i.e., RLP, SRL, DFIRMs)
- Updates to reflect changes in development in hazard prone areas

Mitigation Planning and Plan Updates

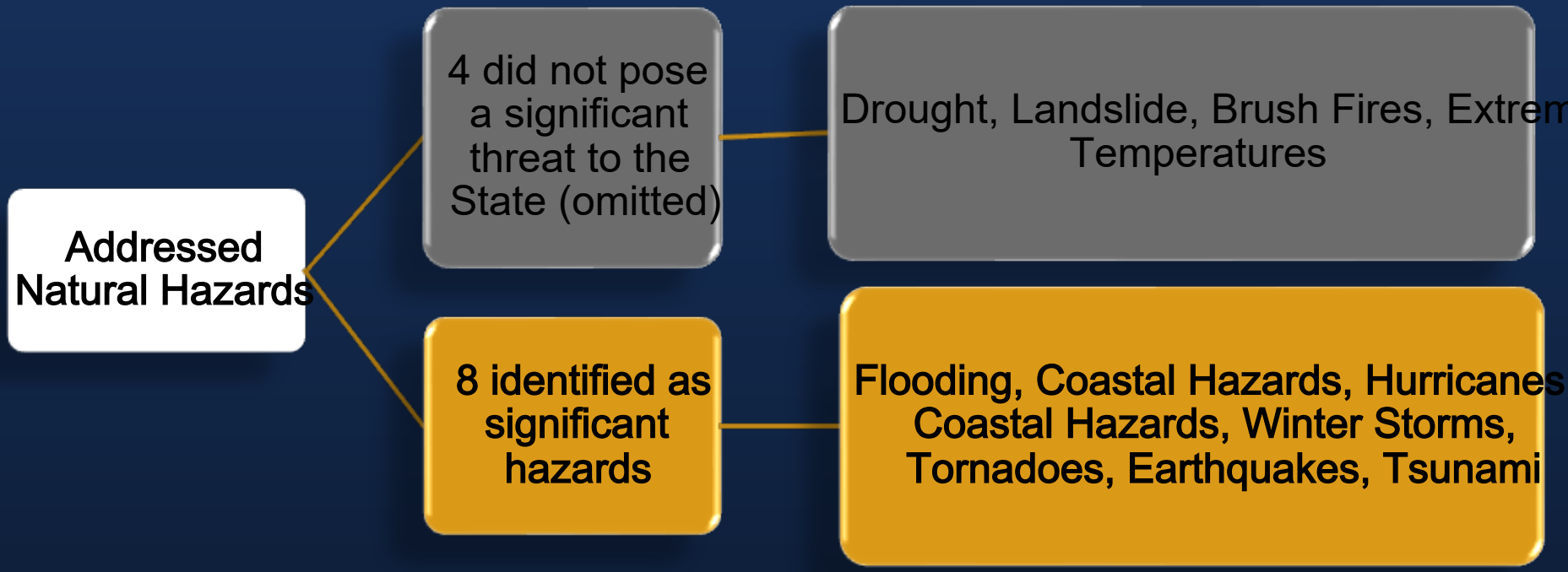
- Update/expand mitigation strategies to ensure a comprehensive range of mitigation actions covering identified risks in each jurisdiction
- Describe status of each mitigation measure in previous plan
  - Completed?
  - Still relevant?
  - Will it be included in the updated action plan?
  - Have any priorities changed? If so, how/why?
- 2015 mitigation measures to be reviewed *(discussion item)*
- List of critical infrastructure to be reviewed *(discussion item)*

Overview of the Current Plan

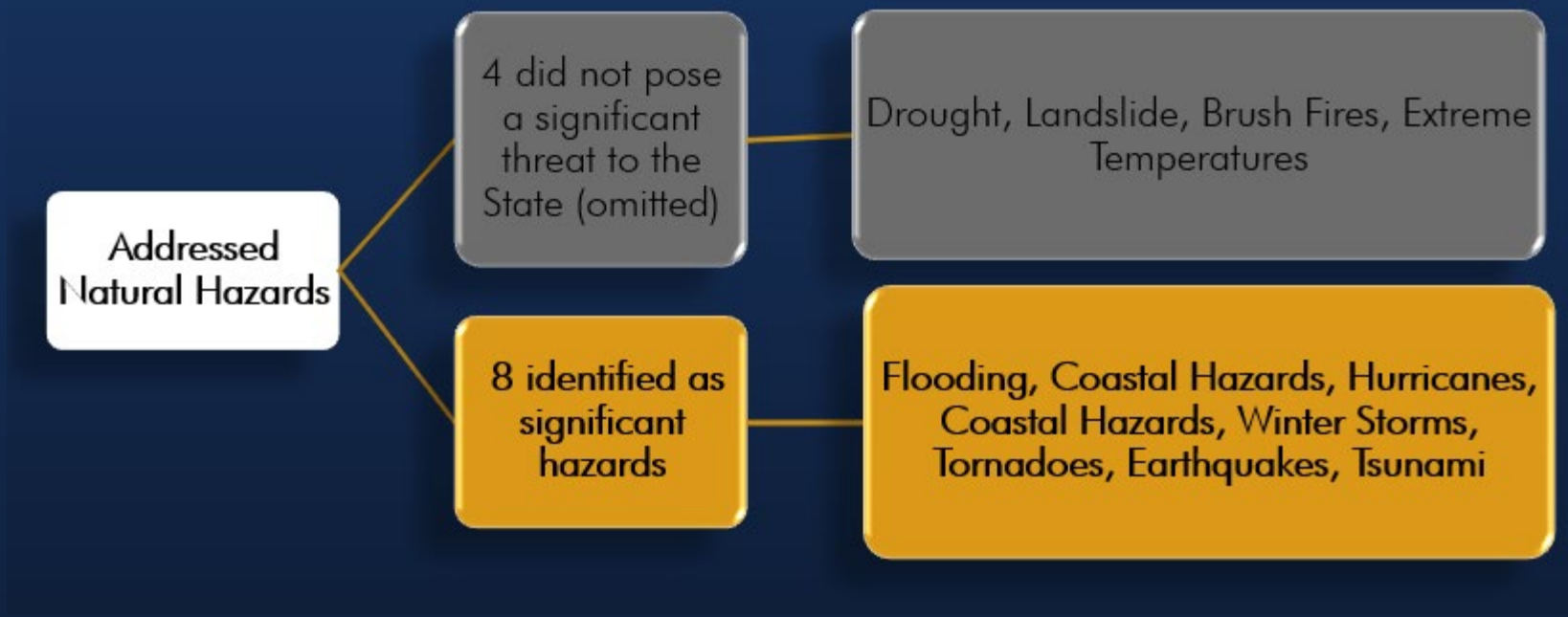
The current Natural Hazard Mitigation Plan:

- Requirement to comply with DMA2000
- Initial Plan – 2005
- First Plan Update - 2015
  - Updated hazard areas and development trends
  - Some ongoing and some new mitigation measures
- Second Plan Update - 2021 (anticipated)
  - Include climate-based hazards following the 2018 MA State Hazard Mitigation and Climate Adaptation Plan
  - Review and comment on previous mitigation actions
  - Identify any new hazards/mitigation measures

Overview of the Current Plan



Overview of the Current Plan



Group Discussion:
Notable occurrences since the plan was first prepared?

Overview of the Current Plan

Municipal Actions

- 43 actions grouped by hazard priority in the 2015 Plan
- Priorities (High to Low): Flooding, Multi-Hazard, Fire, Winter Storm, Wind, Geologic, Drought, Extreme Temperatures

Hazards Addressed

- All identified hazards touched upon
- Overwhelming focus on flooding

- Update local hazard mitigation issues *(discussion item)*

Participation Requirements and Timeline

Outreach

- To the general public and other stakeholders
- Throughout the update process and during plan maintenance stages
- Concerted efforts using various avenues
- Note: Meetings with your own municipal staff members are not considered 'outreach'








Participation Requirements and Timeline

Get the word out about the plan on a regular basis starting now

- Discuss the plan update at open public meetings (i.e., counc meetings, planning board meetings, school board, etc.)
- Widely distribute the fact sheet (notice boards, mailing insert
- Use municipal web sites and social media
- Newsletters/newspapers and radio/tv
- Provide the public and other stakeholders with opportunities review and provide comments and feedback particularly about updates to your action plan (projects), as well as on th Draft Plan Update document itself

Participation Requirements and Timeline

Outreach: Who Are Other Stakeholders?

Must include:

- Neighboring communities
- Local and regional agencies involved in hazard mitigation activities
- Agencies that have authority to regulate development
- Other interests

Other interests, include:

- Non-profit organizations (i.e., Red Cross, Salvation Army)
- Environmental groups
- Historic preservation groups
- Church organizations
- Parks organizations
- State, federal, and local government offices
- Business and development organizations
- Transportation entities
- Emergency service providers
- Academic institutions
- Utility providers
- Hospitals
- Tribal groups
- Large businesses
- Regional planning organizations

Participation Requirements and Timeline

Targeted outreach to key stakeholders can be as simple as a phone call, letter or email sent to a list of key stakeholders that:

- Alerts them to the plan update
- Provides them with a link to the City web site for more information on the process
- Identifies a point of contact if they have detailed questions or would like to become involved
- Offers to send them copies of meeting minutes and a notification when the Draft is released, on request.

Participation Requirements and Timeline

Outreach

City of Revere
Hazard Mitigation Plan Update

OUTREACH LOG:
Summary of Outreach Activities to the General Public and Other Stakeholders

DATE OF ACTIVITY	TYPE OF ACTIVITY	ACTIVITY DETAILS	LEAD DEPARTMENT AND/OR STAFF TITLE WHO UNDERTOOK ACTIVITY

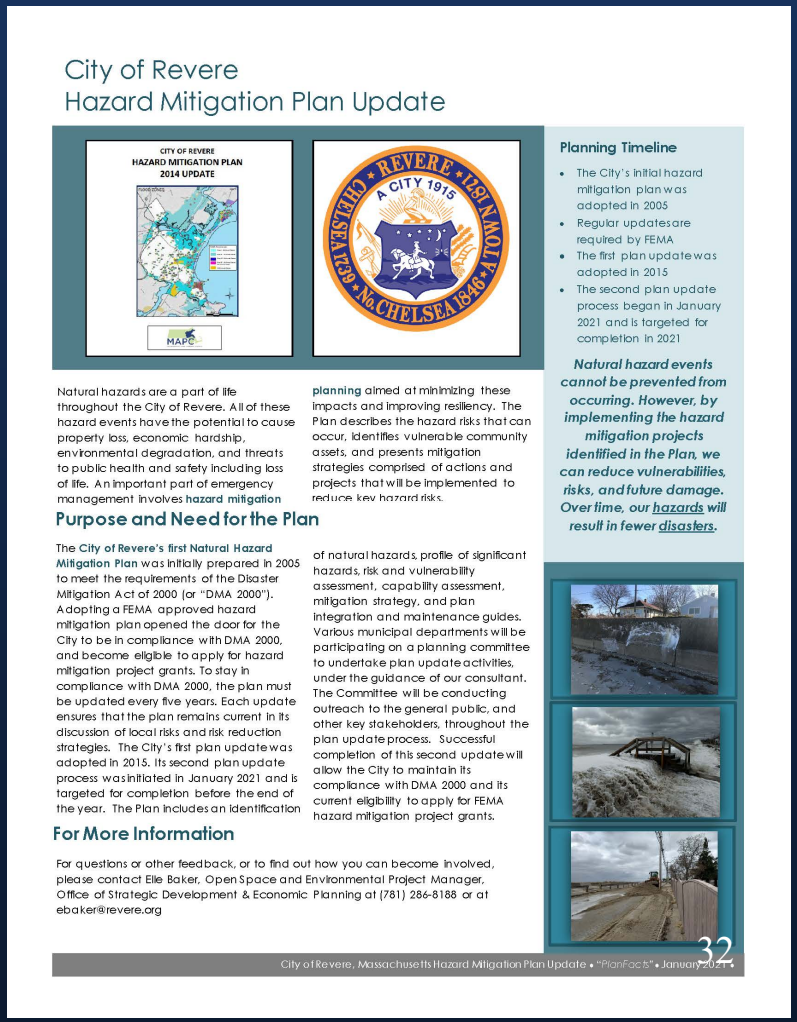
Please complete electronically and email to ebaker@revere.org.

Guidance Memorandum: Outreach to the Public and Other Stakeholders
City of Revere, MA Hazard Mitigation Plan Update *Page 1*

Participation Requirements and Timeline

Distribute the Project Fact Sheet

- Public Outreach Required
- Develop Project Fact Sheet
- Post content on Revere Website
  - 2015 HMP
  - Fact Sheet
  - Short paragraph regarding process
  - Link for comment submittal



City of Revere
Hazard Mitigation Plan Update

CITY OF REVERE
HAZARD MITIGATION PLAN
2014 UPDATE

Planning Timeline

- The City's initial hazard mitigation plan was adopted in 2005
- Regular updates are required by FEMA
- The first plan update was adopted in 2015
- The second plan update process began in January 2021 and is targeted for completion in 2021

Natural hazard events cannot be prevented from occurring. However, by implementing the hazard mitigation projects identified in the Plan, we can reduce vulnerabilities, risks, and future damage. Over time, our hazards will result in fewer disasters.

Natural hazards are a part of life throughout the City of Revere. All of these hazard events have the potential to cause property loss, economic hardship, environmental degradation, and threats to public health and safety including loss of life. An important part of emergency management involves **hazard mitigation planning** aimed at minimizing these impacts and improving resiliency. The Plan describes the hazard risks that can occur, identifies vulnerable community assets, and presents mitigation strategies comprised of actions and projects that will be implemented to reduce key hazard risks.

Purpose and Need for the Plan

The **City of Revere's first Natural Hazard Mitigation Plan** was initially prepared in 2005 to meet the requirements of the Disaster Mitigation Act of 2000 (or "DMA 2000"). Adopting a FEMA approved hazard mitigation plan opened the door for the City to be in compliance with DMA 2000, and become eligible to apply for hazard mitigation project grants. To stay in compliance with DMA 2000, the plan must be updated every five years. Each update ensures that the plan remains current in its discussion of local risks and risk reduction strategies. The City's first plan update was adopted in 2015. Its second plan update process was initiated in January 2021 and is targeted for completion before the end of the year. The Plan includes an identification of natural hazards, profile of significant hazards, risk and vulnerability assessment, capability assessment, mitigation strategy, and plan integration and maintenance guides. Various municipal departments will be participating on a planning committee to undertake plan update activities, under the guidance of our consultant. The Committee will be conducting outreach to the general public, and other key stakeholders, throughout the plan update process. Successful completion of this second update will allow the City to maintain its compliance with DMA 2000 and its current eligibility to apply for FEMA hazard mitigation project grants.

For More Information

For questions or other feedback, or to find out how you can become involved, please contact Elle Baker, Open Space and Environmental Project Manager, Office of Strategic Development & Economic Planning at (781) 286-8188 or at ebaker@revere.org

City of Revere, Massachusetts Hazard Mitigation Plan Update • "PlanFacts" • January 2021 • 32

Timeline

First plan update process has already begun! Activities to date:

- September 2020– January 2021
  - Contract Execution
  - Process Initiation
  - Revised schedule based on contract execution date
  - Project Initiation Meeting with City of Revere
  - Fact sheet prepared
  - Sample text for press releases prepared
  - Initiated update of critical infrastructure list
  - Initiated update of mitigation measures list

Timeline

Key future activities include:

- January 2021 — Local HMP Committee Meeting #1
- February 2021 — Public Stakeholder Meeting #1
- Early April 2021 — Draft Updated HMP
- Late April 2021 — Local HMP Committee Meeting #2

- Early May 2021 — Public Stakeholder Meeting #2

- Early June 2021 — MEMA/FEMA Draft HMP Update
- August 2021 — MEMA/FEMA Revised HMP Update
- TBD — Adoption by City Council

General Discussion / Q&A

Discussion Item #1 – Update Status of Mitigation Measures

City of Revere
Hazard Mitigation Plan Update
Local Planning Committee Meeting – January 20, 2021

Discussion: Status of Mitigation Measures from the City of Revere Hazard Mitigation Plan 2015 Update

Note: Table below reflects input provided by local Hazard Mitigation Planning Committee during February 26, 2020 meeting.

#	2015 Mitigation Measure	Priority	Implementation Responsibility	What has been completed since 2015? (Work Completed, Progress Made, None)	If not completed, include in 2021 update? (Yes, No)
1	Install pump station at Squire Road to complement the existing tide gate	High	DPW	None	Yes
2	Martin Street and Oak Island Pump Stations	High	DPW	None	Yes
3	Mills Avenue Seawall upgrade	High	DPW	None	Yes
4	Build new seawall from Cary Circle to Alden Avenue	High	DPW	None	Yes
5	Build new seawall section at Rice Avenue	High	DPW	None	Yes
6	Upgrade Winthrop Parkway tide gate	High	DPW	Work Completed	
7	Upgrade Pearl Avenue headwall and drain line	High	DPW	Progress Made	**Yes?**
8	Purchase drainage maintenance equipment	High	DPW	Work Completed	
9	Purchase three 12-inch, trailer-mounted diesel pumps	High	DPW	None	Yes
10	Purchase three diesel pumps (two 8-inch, one 6-inch)	High	DPW	Work Completed	
11	Install backup power for 17 pump stations	High	DPW	Progress Made	**Yes?**
12	Consider Community Rating System (CRS) application	High	CRS Committee, Conservation Commission, EM Director	None	Yes

Page **1** of **4**

Discussion Item #2 – Update List of Critical Infrastructure

Critical facilities include:

- Emergency operations centers
- City offices
- Sewage pump stations
- Police and fire stations
- Schools
- Hospitals
- Day-care facilities
- Public works facilities
- Nursing homes/elderly housing
- Emergency shelters

Table 21: Relationship of Critical Infrastructure to Hazard Areas

ID	NAME	TYPE	Landslide	Within FEMA Flood Zone	Within Locally Identified Area of Flooding	Average Annual Snow Fall	Hurricane Surge Areas (Category#)
1	Synagogue	Place of Worship	Moderate Susceptibility	0.2 PCT ANNUAL CHANCE FLOOD HAZARD	No	Low	2
2	Church	Place of Worship	Moderate Susceptibility	0.2 PCT ANNUAL CHANCE FLOOD HAZARD	No	Low	2
3	Church	Place of Worship	Moderate Susceptibility	No	No	Low	0
4	First Congregational Church	Place of Worship	Moderate Susceptibility	No	No	Low	0
5	Church	Place of Worship	Moderate Susceptibility	No	No	Low	0
6	Church	Place of Worship	Moderate Susceptibility	No	Asti Avenue Neighborhood	Low	2
7	Church	Place of Worship	Moderate Susceptibility	No	Asti Avenue Neighborhood	Low	1
8	Church	Place of Worship	Moderate Susceptibility	No	No	Low	4
9	Salem Street Pumping Station	Pumping Station	Moderate Susceptibility	No	No	Low	2
10	Marsh View Pumping Station	Pumping Station	Moderate Susceptibility	No	No	Low	0
11	Pumping Station	Pumping Station	Moderate Susceptibility	AE	No	Low	1
12	Beachmont / Broadsound Seawall	Flood Protection	Moderate Susceptibility	0.2 PCT ANNUAL CHANCE FLOOD HAZARD	No	Low	2
13	Rice Ave Seawall	Flood Protection	Moderate	AE	Rice Avenue	Low	1

Discussion Item #3 – Update on Hazard Mitigation Issues

Community Resilience Building Risk Matrix — **Combined Master Matrix** — www.CommunityResilienceBuilding.org

H-**M**-**L** priority for action over the **S**hort or **L**ong term (and **O**ngoing)
V = Vulnerability **S** = Strength

Top Priority Hazards (tornado, floods, wildfire, hurricanes, earthquake, drought, sea level rise, heat wave, etc.)

Features	Location	Ownership	V or S	Flooding (Coastal/Back Shore) (1)	Extreme Temps (2)	Hurricanes, Nor'easters (3)	Winter Storms (4)	Priority H - M - L	Time Short Long Ongoing
Infrastructural									
Seawalls/ rock revetments/ parks/ levees	Beach	DCR	V/S	Reconstruction of wall and revetments along Winthrop Pkwy (1)(3)				H	O
				Short Beach breakers need to be set higher; Dredge Belle Isle Creek; Install levees/natural berms to prevent flooding in abutting properties				H	S
Roadways	All	City/State	V						
Drainage system/ sewer system	All	City/State	V	Improve sewer/drainage systems in vulnerable areas (Belle Isle Ave, Crystal Ave, Pearl Ave, Winthrop Ave, Broadsound Ave, Evarde Street, Montfern Ave, Bennington St)				H	S
Pumping Stations	Broadsound Ave, Bennington St	DCR	V/S	Develop more pumping stations in Beachmont, Pearl Ave.				H	S
Beachmont School	Bennington St	City/State	V	Berms and drainage to protect school				H	S
Flood Gates	Winthrop Pkwy	DCR/City	S	Regular maintenance of gates				M	O
Trash racks - Tide gates	Bennington St	DCR	V	Regular maintenance of gates				M	O
Power Grid/ Communications	All	Nat Grid	V	Awareness program to increase awareness about preparedness during outages				L	O
				Increase communications with utility, identify most vulnerable poles and infrastructure				L	S
Public transit system	Beachmont Sq	MBTA	V	Raise rail bed				L	L
Dolphin Ave Elderly Housing	Dolphin Ave	RHA	V	Review and/or augment plan for evacuation				M	S
Roadways	Revere Beach Parkway / 1A / Mills Ave/ Rice Ave	City, State, DCR	V	Roadway and seawall, feasibility study, include education about; Mills Ave (wall), Rice Ave (add wall hardened/fix wall /build dune/remove sand); Point of Pines Yacht Club (remove sand)				H	S
Private property - homes	Pines, Riverside Blvd	Private	V	Install back flow prevent on homeowner service - must be maintained and accessible				H	S
Seawall - Natural Barrier	Riverside, Pines, Mills Ave	City, POP Beach Association	V/S	Snow fencing and dunes and dune grass - zig zag walkways				H	S
Pier/ docks/ access points	POP Yacht Club, POP Beach	Multiple	S/V						
Drainage	Mills Ave	City	V	Check valves are installed - maintenance is ongoing spring and summer 2019				H	O
Pump stations	Multiple	City	S/V	New sewer pump station, new catch basin pump station - work to line the pipes to the pump station				H	O

Initiated as part of the City's MVP Planning Process

Wrap-Up

For more information, please contact:

Office of Strategic Planning & Economic Development: (781) 2[illegible]8

Elle Baker

AECOM: (617) 251-8304

Aaron Weieneth

AECOM Imagine it. Delivered.

Meeting Minutes

Meeting name Local Hazard Mitigation Planning Committee Meeting #2	**Meeting date** April 27, 2021	**Attendees** See Section 1.0 for attendee list
Time 2:30PM-3:45PM	**Location** Virtual Zoom Meeting	
AECOM project number 60648765	**Prepared by** Aaron Weieneth	

Subject: Hazard Mitigation Plan Update – Local Hazard Mitigation Planning Committee Meeting #1

1.0 Welcome and Opening Remarks

- Attendees: AECOM: Anna Foley, Tom Redstone, Aaron Weieneth

  City of Revere: Elle Baker, Rob Fortuna, Nick Rystrom, Chief Bright, Don Ciaramella
- Elle Baker made introductions and turned things over to Aaron Weieneth for the formal presentation. A PDF of the presentation is attached to these notes and provides additional details.
- Aaron Weieneth provided welcome and opening remarks to the group and proceeded to give an overview of HMP agenda and materials to be covered. Desired outcome is that actions in mitigation strategy will be formed by findings of the risk and vulnerability assessment.

2.0 Updated Risk Assessment (Led by Tom Redstone)

- Tom Redstone took over presentation and discussed the intent of the risk assessment in hazard mitigation plans, benefits of updating the risk assessment, and the findings of the risk assessment for this update.
- Identified following assessments since 2015 Plan: FEMA defined Special Flood Hazard Area was updated in 2017; Revere Municipal Vulnerability Preparedness (MVP) Summary of Findings Report completed in 2019.
- Changes to risk and vulnerability assessment since 2015 Plan: natural hazards are assessed through the context of climate change, in alignment with the 2018 State Hazard Mitigation and Climate Adaptation Plan (SHMCAP).
- While not a traditional natural hazard, invasive species have been added to the 2021 Update to be consistent with SHMCAP. Aside from minor modifications (river flooding now classified as inland flooding), no significant changes were made to the hazards profiled.
- Tom reviewed the high-level recurrence intervals that were identified for each hazard, necessary to identify probability of occurrence. Elle noted increasing coastal flooding, precipitation, erosion, high temperatures, and extreme weather. These hazards are already grouped as “high” frequency (recurrence interval of less than 10 years). General consensus was that while there are upticks, observed trends still seem to align with what was in the 2015 Plan. Tom indicated that based on this feedback, he’ll keep as-is, but add text to provide context regarding local observations
- Tom summarized the findings of the risk analysis and loss estimation, noting that the findings came from FEMA’s National Risk Index (NRI). Tom acknowledged the following benefits of the NRI data:
  - Expands loss estimations from 2015 Plan to include the following hazards: drought, landslides, hurricanes (beyond wind), severe winter storms, and tornadoes.
  - 2015 Plan just estimated damages from flooding, hurricane winds, and earthquakes.
- Tom acknowledged the following shortcomings of the NRI data:
  - Demonstrated by value of hazard exposure (built environment) – should be equal for community-wide hazards (extreme temperatures, hurricanes, severe winter storms, tornadoes, and earthquakes).

  - Census tract data was pulled from a nationwide dataset, and resultantly, required some extrapolation.

- Aaron acknowledged limitations of NRI data mentioned that HAZUS would be a good option, but it is not in the scope of this Update.
- Elle stated that the City was not prepared to make a decision on whether to include NRI data in the risk assessment at this time.

3.0 Updated Mitigation Goals (Led by Anna Foley)

- Anna reviewed goals from the 2015 Plan, informing Committee that mitigation goals are:
  - General guidelines that explain what a community hopes to achieve with a mitigation plan.
  - Broad statements that represent visions for reducing or avoiding future damages and losses.
  - Each action in the mitigation strategy should tie back to one or more goals.
- An evaluation or prior goals is required as part of the plan update process. Jurisdictions can either choose to:
  - Keep the previous goals as they were, or
  - Revise them to better reflect current conditions and local priorities.
- Anna noted there was a ninth goal in the 2015 plan; however, it was a duplicate and so we removed (Goal #3 and Goal #8 in the prior version both said, “make efficient use of public funds for hazard mitigation”).
- During AECOM’s review, the team noticed that the 2015 mitigation strategy did not have any action items falling under the two goals:
  - Education public about zoning/building regulations, particularly with regard to changes in regulations that may affect teardowns and new construction.
  - Encourage future development in areas that are not prone to natural hazards.
  - FEMA reviewers are going to want to see actions to align with goals. Understand that mitigation plans are often robust and that it may not be desirable to add more actions.
    - One option would be to remove these goals.
    - Alternatively, the City could opt to keep the goals as is but round out the mitigation strategy to add action items that address Goals 5 and 6.
      - Regarding #5 – public outreach during the plan maintenance phase (the next 5 years after the update is adopted) is a requirement anyway, so this is just quantifying a topic under an activity that is required
      - Regarding #6 – The City is presently wrapping up its Capability Assessment, but the in-progress version highlights several areas of improvement, particularly regarding the safe growth audit.
      - Additionally, the City floodplain manager is probably undertaking some activities on a day-to-day basis that align with both these goals.
- Anna asked if there was a general consensus to carry forward the goals from the 2015 Plan?
  - The City concurred. Yes, the 2015 goals will be carried forward. Actions will be added to align with Goals 5 and 6. Anna will craft action item text around the themes presented in her presentation and they will be provided to the City for their review.

4.0 Updated Mitigation Actions (Led by Aaron Weieneth)

- Aaron provided a general summary of progress on mitigation actions since the 2015 Plan.
  - A total of 43 actions were included in the 2015 Plan:
    - 13 actions have been completed.
    - 9 actions are in progress.
    - 27 actions were carried forward into the 2021 Update.

- 7 new actions have been identified through the City's MVP planning process and 14 new actions were identified by Local Hazard Mitigation Planning Committee and feedback from Stakeholder Meeting #1.
- Aaron informed Committee that City needs to identify priority level, implementation responsibility, implementation schedule, and the estimated cost.
- Aaron asked the City to keep in mind that high priority actions would be more likely to rise to the top in competitive grant programs.
- Local review to follow; City to provide comments back to AECOM by the end of the week as far as finalizing priority levels.
- General discussion occurred regarding update of mitigation actions:
  - Don mentioned the City is in process of cleaning ditch – all have to be attended to; cleaned ditch off Ocean Ave, process of permitting Green Creek ditch; permitting process of cleaning Traphony Brook – how the City gets to dewater every 12 hours before low tide, has not gotten that opportunity because ditches are so full of sediment.
  - City emphasized the importance of water and drainage projects to the City. City will continue to seek money from local, state, and federal sources to fund these projects.
  - Don mentioned that projects in Riverside, Point of Pines, and Dunn Road are critical for the City.
  - Elle identified preliminary recommendations for Point of Pines. There is a proposed option for a seawall that retracts and is used when necessary. City is also working towards longer-term interventions, such as putting in a flood wall barrier along Mills Riverside Avenue. There is the issue of needing to come back to tie seawall into a high point, and potential logistical challenges with tie in at Route 1A, otherwise flood waters will still enter City. Underground utilities may be a deal breaker.
  - Nick stated that the proposed plan has trench drains at the beginning of each side street, Catch basins do not always function because they are connected to corrugated pipes that were installed in the 1940's and 1950's and have been eroded by seawater. First items the City needs is drainage infrastructure and a pump station to remove unwanted water, followed by a seawall. Need pump station to get water back out if wall is breached. Interior drainage is critical element. City looking into a phased approach.
  - Rob mentioned resiliency measures as part of redevelopment plan. Boston and Revere are working on a joint project at Suffolk Downs. Boston is on the same track regarding the Suffolk Downs development. Rob recommended clarifying that drainage project is in the preliminary planning phases.
  - Including projects at preliminary concept level will increase the opportunity of securing regional grants.
  - Elle acknowledged that with so much development going on, some mitigation measures will be paid for by private developers and some will be public. Even if we just add an appendix of mitigation measures paid for by private developers that will be helpful.

5.0 Next Steps (Led by Aaron Weieneth)

- Present timeline shows Draft in mid-May. Given that this committee meeting was pushed back a bit the Draft may, in turn, extend out toward late-May.

6.0 General Discussion / Q&A

- None.

7.0 Action Items

- City to provide comments back to AECOM by the end of the week as far as finalizing priority levels.
- City to determine whether NRI data should be included in risk and vulnerability assessment.
- City to send follow up info to Aaron; possible addition of an appendix of mitigation measures being implemented at private developments throughout the City.
- AECOM to work to craft a couple of mitigation actions to tie back to mitigation goals that currently lack actions.

City of Revere
Hazard Mitigation Plan Update

Local Hazard Mitigation Planning Committee Meeting #2
April 27, 2021
2:30 PM – 4:00 PM
Office of Strategic Planning & Economic Development
Virtual Meeting

Local Hazard Mitigation Planning Committee Meeting #2 Agenda

Welcome and Opening Remarks	City of Revere
Updated Risk Assessment	AECOM
Updated Mitigation Goals	AECOM
Updated Mitigation Actions	AECOM
Next Steps	AECOM
General Discussion/Q & A	City of Revere
Wrap-up	City of Revere
Adjourn	

Local Hazard Mitigation Planning Committee

Elle Baker, Open Space and Environmental Planner
Frank Stringi, City Planner
Paul Argenzio, Superintendent DPW
Don Ciaramella, Chief of Infrastructure
Joe Maglione, Water, Sever and Drain
Nick Rystrom, City Engineer
Chief Bright, Revere Fire Department
Captain Robert Fortuna , Revere Fire Department
Chief Callahan, Chief of Police
Nick Moulaison, Chair Conservation Commission
Dr. Diane Kelly, Superintendent-Revere Public Schools
Robert O'Brien Director of Revere Planning and Development
Mike Hinojosa, Director of Parks and Recreation
Dean Harris, Revere Housing Authority
Ralph Decicco, Chair, Commission on Disabilities

Local Hazard Mitigation Planning Committee

HMP Planning Committee #2 Goals

- Confirm Risk/Vulnerability Analysis Results
- Review 2015 Goal Statements and Revise if Needed for 2021 Plan
- Review Possible Mitigation Actions
  - Ongoing from 2015
  - CRB/MVP Planning Actions
  - Other Priority Actions

Updated Risk Assessment

Risk Assessment

- Potential for damages created by the interaction of natural hazards and the community.
- Provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards.
- Local risk assessments must provide information to identify and prioritize mitigation actions to reduce losses from identified hazards.

Source: FEMA, 2013

Provides a foundation for the community's decision makers to evaluate mitigation measures that can help reduce the impacts of a hazard when one occurs.

Updated Risk Assessment

Regular updates of the risk assessment ensure:

- That the plan remains applicable to present-day understanding of vulnerabilities based on most recent assessments, development patterns, and community experiences.
- That the plan continues to present the best path forward for reducing future damages when natural hazards inevitably occur.
- Promotes participation and community buy-in.

Source: Revere MVP Summary of Findings Report

Updated Risk Assessment

Notable assessments and changes since 2015 update:

Assessments

- FEMA defined Special Flood Hazard Area (SFHA) updated in 2017.
- Revere Municipal Vulnerability Preparedness (MVP) Summary of Findings Report.

Changes

- Natural hazards assessed through the context of climate change.
- Incorporated data from FEMA's National Risk Index into each hazard profiled (where data is available).

Revere SFHA. Source: Mass GIS

Updated Risk Assessment

Changes in hazards profiled since 2015 Plan

Primary Climate Change Interaction	Hazard	Previously Identified As
Changes in Precipitation	Inland Flooding	River flooding (under flood related hazard)
	Drought	Drought
	Landslides	Landslide (under geologic hazard)
Sea Level Rise	Coastal Flooding	Coastal flooding (under flood related hazard)
	Coastal Erosion	Coastal erosion (under flood related hazard)
	Tsunamis	Tsunami (under flood related hazard)
Rising Temperatures	Extreme Temperatures	Extreme temperatures
	Wildfires	Wildfires
	Invasive Species	NEW
Extreme Weather	Hurricanes/Tropical Storms	Hurricanes (wind related hazard)
	Severe Winter Storms	Winter storms
	Tornadoes	Tornadoes (under wind related hazards)
Non-Climate Influenced Hazards	Earthquakes	Earthquakes (under geologic hazard)

Updated Risk Assessment

Verification of hazard frequencies

Primary Climate Change Interaction	Hazard	Frequency Identified in 2015 Plan (recurrence interval)
Changes in Precipitation	Inland Flooding	High (less than 10 years)
	Drought	Low (100 – 1,000 years)
	Landslides	Very low (greater than 1,000 years)
Sea Level Rise	Coastal Flooding	High (less than 10 years)
	Coastal Erosion	High (less than 10 years)
	Tsunamis	Very low (greater than 1,000 years)
Rising Temperatures	Extreme Temperatures	High (less than 10 years)
	Wildfires	High (less than 10 years)
	Invasive Species	Not Applicable
Extreme Weather	Hurricanes/Tropical Storms	Medium (10 – 100 years)
	Severe Winter Storms	High (less than 10 years)
	Tornadoes	Medium (10 – 100 years)
Non-Climate Influenced Hazards	Earthquakes	Very low (greater than 1,000 years)

Updated Risk Assessment

Risk analysis and loss estimation

Hazard	Exposed Population	Value of Hazard Exposure (in $B)	Estimated Annual Loss	Estimated Annual Loss Rating	Risk Rating
Changes in Precipitation					
Inland Flooding	10,000	$77.2	$321,000	Relatively Low to Relatively High	Relatively Low to Relatively High
Drought	0	$0	$100	Very Low	Very Low
Landslides	37,000	$280.0	$24,800	Very Low to Relatively Low	Very Low to Relatively Low
Sea Level Rise					
Coastal Flooding	29,000	$218.9	$29,800	Very Low to Relatively Low	Very Low to Relatively Low
Coastal Erosion	*Not Quantified*				
Tsunamis	0	$0	$0	*Insufficient Data*	

Updated Risk Assessment

Risk analysis and loss estimation (continued)

Hazard	Exposed Population	Value of Hazard Exposure (in $B)	Estimated Annual Loss	Estimated Annual Loss Rating	Risk Rating
Rising Temperatures					
Extreme Temperatures	54,000	$381.7	$13,100	Very Low to Relatively Low	Relatively Low
Wildfires	0	$1.9	$900	None Expected to Relatively Low	Very Low to Relatively Low
Invasive Species			*Not quantified*		
Extreme Weather					
Hurricanes/ Tropical Storms	54,000	$385.1	$6,700	Very Low	Very Low
Severe Winter Storms	54,000	$382.3	$5,900	Very Low to Relatively Low	Relatively Low
Tornadoes	54,000	$340.5	$80,000	Very Low to Relatively Low	Very Low to Relatively Low
Non-Climate Influenced Hazards					
Earthquakes	54,000	$388.0	$318,700	Relatively Low to Relatively Moderate	Relatively Low

Updated Risk Assessment

Summary of impacts and vulnerability

Hazard	Impacts	Vulnerability
Changes in Precipitation		
Inland Flooding	• Damage to buildings and infrastructure	• Low-lying areas • Land in the SFHA • West/North Revere • Sales Creek area
Drought	• Agricultural production and water access	• Residents on private water supply (not a concern in Revere)
Landslides	• Damage to buildings and infrastructure	• Entire City
Sea Level Rise		
Coastal Flooding	• Damage to buildings and infrastructure	• Low-lying coastal areas • Beachmont • Point of Pines/Riverside • Oak Island/Revere Beach
Coastal Erosion	• Increases vulnerability of residents further from to coast to coastal flooding	• Residents adjacent to coastline
Tsunamis	• Damage to buildings and infrastructure	• Residents adjacent to coastline

Updated Risk Assessment

Summary of impacts and vulnerability (continued)

Hazard	Impacts	Vulnerability
Rising Temperatures		
Extreme Temperatures	• Public health Access to lifeline utilities such as electricity and potable water	• Entire city Emphasis on low-income and elderly residents
Wildfires	• Damage to buildings	• Residents most adjacent to shrubland and MBTA lands
Invasive Species	• Rarely impact humans directly	• Entire City
Extreme Weather		
Hurricanes/Tropical Storms	• Damage to buildings and infrastructure	• Entire City is vulnerable to hurricane winds Low-lying coastal areas are most vulnerable to storm surge
Severe Winter Storms	• Inhibit travel • Power outages • Structure fires	• Entire city • Emphasis on low-income and elderly residents
Tornadoes	• Damage to buildings and infrastructure	• Entire City
Non-Climate Influenced Hazards		
Earthquakes	• Damage to buildings and infrastructure	• Entire City

Updated Mitigation Goals

Goals from 2015 Plan

1. Ensure that critical infrastructure sites are protected from natural hazards.
2. Protect existing residential and business areas from flooding.
3. Make efficient use of public funds for hazard mitigation.
4. Continue to enforce existing zoning/building regulations.
5. Educate public about zoning/building regulations, particularly with regard to changes in regulations that may affect tear-downs and new construction.
6. Encourage future development in areas that are not prone to natural hazards.
7. Educate the public about natural hazards and mitigation measures.
8. Protect the City's ability to respond to various natural hazard events.

Consensus that Goals Should Continue?

Updated Mitigation Actions

- Updated the status of mitigation actions included in the 2015 plan as part of the Local Hazard Mitigation Planning Meeting #1 conducted in January 2021.
- A total of 43 actions were included in the 2015 plan:
  - 13 actions completed
  - 9 actions in progress
  - 27 actions carried forward for the 2021 update
- 7 new actions identified through the City's MVP planning process.
- 14 new actions identified by Local Hazard Mitigation Planning Committee and feedback from Stakeholder Meeting #1.
- Consider additional actions based on results of the updated risk and vulnerability assessment.

Updated Mitigation Actions

For actions included in the plan, the City needs to identify:

- Natural hazard(s) addressed
- Type of mitigation project
  - Local plans and regulations
  - Structure and infrastructure projects
  - Natural systems protection
  - Education and awareness programs
  - Emergency response and operational preparedness actions
- Relevant hazard mitigation goal(s)

Updated Mitigation Actions

For actions included in the plan, the City needs to identify (continued):

- Priority level (High, Medium, Low)
  - Costs reasonable compared to probable benefits
  - Agreement on outstanding impacts from recent hazard events
  - Necessity for advancing longer-term outcomes
  - Contribution towards meeting existing local and regional planning objectives
- Implementation responsibility
- Implementation schedule (start and end year)
- Estimated cost
  - Low (under $100,000)
  - Medium ($100,000-$500,000)
  - High (over $500,000)
- Potential funding sources

Updated Mitigation Actions

#	2021 Mitigation Action	Hazard(s) Addressed	Type of Mitigation Project	Relevant Hazard Mitigation Goal(s)	Priority	Implementation Responsibility	Implementation Schedule (Estimated Start and End Year)	Estimated Cost	Potential Funding Sources
1	Coordinate with DCR and MassDOT to advocate for installation of a pump station at Squire Road to complement the existing tide gate since the City is not the owner of the site and lacks the authority to do so	Inland Flooding, Coastal Flooding	Structure and Infrastructure Projects	Flood Protection and Resiliency	High	DPW		Medium ($100,000-$500,000)	DCR
2	Install Martin Street and Oak Island pump stations	Inland Flooding, Coastal Flooding	Structure and Infrastructure Projects	Flood Protection and Resiliency	High	DPW		Medium ($100,000-$500,000)	Revere DPW/FEMA HMA
3	Mills Avenue Seawall upgrade	Coastal Flooding	Structure and Infrastructure Projects	Flood Protection and Resiliency	High	DPW		Medium ($100,000-$500,000)	Revere DPW/FEMA HMA
4	Build new seawall from Cary Circle to Alden Avenue	Coastal Flooding	Structure and Infrastructure Projects	Critical Infrastructure Protection, Flood Protection and Resiliency	High	DPW		Medium ($100,000-$500,000)	Revere DPW/FEMA HMA
5	Build new seawall section at Rice Avenue	Coastal Flooding	Structure and Infrastructure Projects	Critical Infrastructure Protection, Flood Protection and Resiliency	High	DPW		Medium ($100,000-$500,000)	Revere DPW/FEMA HMA
6	Upgrade Pearl Avenue headwall and drain line	Inland Flooding	Structure and Infrastructure Projects	Critical Infrastructure Protection, Flood Protection and Resiliency, Efficient Use of Public Funds	High	DPW		Low (under $100,000)	Revere DPW/FEMA HMA
7	Purchase three 12-inch, trailer-mounted diesel pumps	Inland Flooding, Coastal Flooding	Emergency Response and Operational Preparedness Actions	Critical Infrastructure Protection, Efficient Use of Public Funds	High	DPW		Low (under $100,000)	Revere DPW
8	Install backup power for 17 pump stations	Inland Flooding, Coastal Flooding	Emergency Response and Operational Preparedness Actions	City's Response to Hazards, Critical Infrastructure Protection, Efficient Use of Public Funds	High	DPW		High (over $500,000)	Revere DPW/FEMA HMA

See Separate File

Updated Mitigation Actions

New actions identified through the City's MVP planning process:

- Conduct a city-wide drainage study
- Identify a liaison between the City and State to identify and secure funding and increase communication
- Investigate permitting and regulatory process for sand transfer to mitigate coastline erosion
- Mitigate the impact of development and redevelopment by requiring best management practices for stormwater management and incentivizing green infrastructure and green building technologies
- Improve the City's drainage system based on findings of the city-wide drainage study

Updated Mitigation Actions

New actions identified through the City's MVP planning process (continued):

- Improve communication with public and educate public about evacuation plans and natural hazards
- Develop multilingual resources to aid in public education efforts

Updated Mitigation Actions

New actions identified for the 2021 plan by Local HMP Committee and stakeholders:

- Upgrade the Point of Pines pump station and pump
- Add new drainage outfall from Malden Street/Washington Avenue area to the Town Line Brook
- Increase the city's tree canopy to reduce heat island effect
- Complete Oak Island marsh restoration efforts within east and west sides of Route 1A (marshland acquisition required)
- Beach nourishment and erosion control for Revere Beach
- Beach nourishment and dune restoration for Point of Pines
- Ambrose Park drainage improvements included with park reconstruction

Updated Mitigation Actions

New actions identified for the 2021 plan by Local HMP Committee and stakeholders (continued):

- Drainage improvements under Route 1A
- Route 95 embankment / marsh restoration
- Riverfront Master Plan stormwater management and resilience recommendations
- Preliminary recommendations from Point of Pines /Riverside Coastal Resilience Feasibility Study
- Purchase highwater fire trucks
- Expand Point of Pines sewer pump station wet well

Updated Mitigation Actions

New actions identified for the 2021 plan by Local HMP Committee and stakeholders (continued):

- Advocate for ACOE's Regional Flood Protection Project
- Reinforce Winthrop Parkway Seawall

Discuss additional actions to be included in the 2021 update.

- Consider results from the Risk Assessment and Capability Assessment

Next Steps / Timeline

Key activities include:

• Mid April 2021	Local HMP Committee Meeting #2
• Mid May 2021	Draft Updated HMP
• Late May 2021	Public Stakeholder Meeting #2
• Early June 2021	MEMA/FEMA Draft HMP Update
• Late June 2021	MEMA/FEMA Revised HMP Update
• TBD	Adoption by City Council

General Discussion / Q&A

Questions?

Wrap-Up

For more information, please contact:

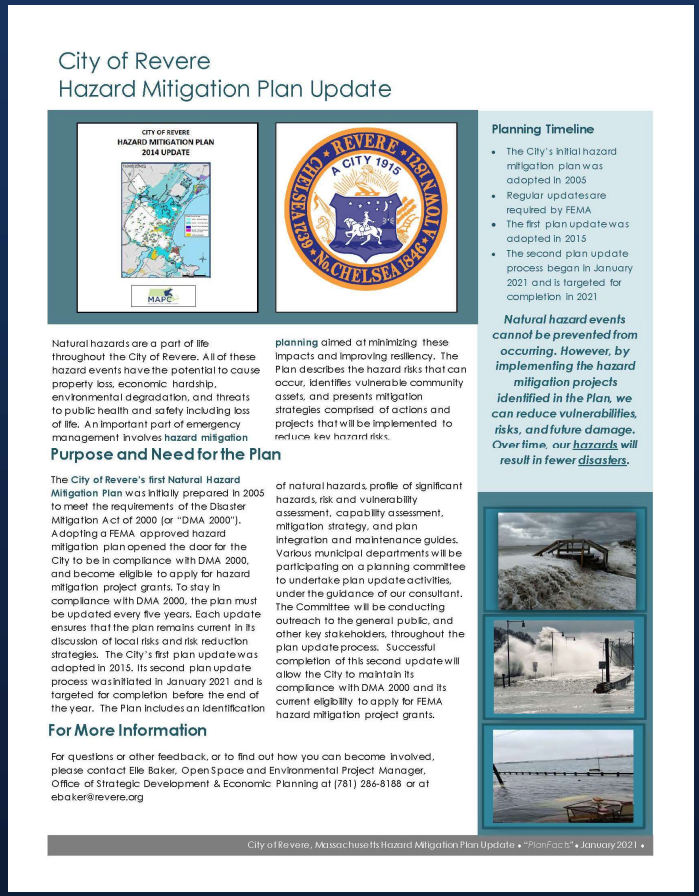
Office of Strategic Planning & Economic Development: (781) 286-8188

Elle Baker

AECOM: (617) 251-8304

Aaron Weieneth

City's Website: https://www.revere.org/



City of Revere
Hazard Mitigation Plan Update

CITY OF REVERE
HAZARD MITIGATION PLAN
2014 UPDATE

MAPC

Planning Timeline

- The City's initial hazard mitigation plan was adopted in 2005
- Regular updates are required by FEMA
- The first plan update was adopted in 2015
- The second plan update process began in January 2021 and is targeted for completion in 2021

Natural hazard events cannot be prevented from occurring. However, by implementing the hazard mitigation projects identified in the Plan, we can reduce vulnerabilities, risks, and future damage. Over time, our hazards will result in fewer disasters.

Natural hazards are a part of life throughout the City of Revere. All of these hazard events have the potential to cause property loss, economic hardship, environmental degradation, and threats to public health and safety including loss of life. An important part of emergency management involves **hazard mitigation planning** aimed at minimizing these impacts and improving resiliency. The Plan describes the hazard risks that can occur, identifies vulnerable community assets, and presents mitigation strategies comprised of actions and projects that will be implemented to reduce key hazard risks.

Purpose and Need for the Plan

The **City of Revere's first Natural Hazard Mitigation Plan** was initially prepared in 2005 to meet the requirements of the Disaster Mitigation Act of 2000 (or "DMA 2000"). Adopting a FEMA approved hazard mitigation plan opened the door for the City to be in compliance with DMA 2000, and become eligible to apply for hazard mitigation project grants. To stay in compliance with DMA 2000, the plan must be updated every five years. Each update ensures that the plan remains current in its discussion of local risks and risk reduction strategies. The City's first plan update was adopted in 2015. Its second plan update process was initiated in January 2021 and is targeted for completion before the end of the year. The Plan includes an identification of natural hazards, profile of significant hazards, risk and vulnerability assessment, capability assessment, mitigation strategy, and plan integration and maintenance guides. Various municipal departments will be participating on a planning committee to undertake plan update activities, under the guidance of our consultant. The Committee will be conducting outreach to the general public, and other key stakeholders, throughout the plan update process. Successful completion of this second update will allow the City to maintain its compliance with DMA 2000 and its current eligibility to apply for FEMA hazard mitigation project grants.

For More Information

For questions or other feedback, or to find out how you can become involved, please contact Elle Baker, Open Space and Environmental Project Manager, Office of Strategic Development & Economic Planning at (781) 286-8188 or at ebaker@revere.org

City of Revere, Massachusetts Hazard Mitigation Plan Update • "PlanFacts" • January 2021 •

- Donald Ciaramella, Project Manager, Department of Engineering
- Nick Rystrom, City Engineer, Department of Engineering

The Core Project Team, with assistance from Aaron Weieneth (State certified MVP provider), Amanda Shanahan, and Liz Durfee of AECOM, planned and implemented the workshops.

AECOM was responsible for preparing workshop materials, leading presentations, facilitating large group discussions, and overseeing the small group discussions. The Core Project Team members and additional City staff were responsible for facilitating and note taking during the small group discussion.

Workshop Participants

Sixty-nine stakeholders representing departments and decisions-makers from the City of Revere, neighborhoods, business associations, and regional and state entities were invited to the workshops. A total of 38 stakeholders attended Workshop 1 on January 10, 2019 (Figure 1). Twenty-eight stakeholders attended Workshop 2 on January 31, 2019. Both workshops were held at the Point of Pines Yacht Club, located at 28 Rice Avenue in Revere. A complete list of invitees and attendees is included in Appendix A. The stakeholders who attended represented several departments of the City of Revere; Revere neighborhood associations, including individuals from Beachmont, West Revere, and Riverside Association; Point of Pines Yacht Club; Point of Pines Beach Association; Massachusetts Department of Conservation and Recreation; and other entities.

Figure 1: Participants of Workshop 1 at the Point of Pines Yacht Club

Process

Workshop 1

Workshop 1 began with welcome and introductions led by Elle Baker, City of Revere, and a presentation by Aaron Weieneth, AECOM. The presentation included an overview of the MVP program and an introduction to climate change projections and natural hazards. After the presentation, AECOM led a group discussion to identify the top hazards in Revere and recorded these hazards on large flip charts.

The remainder of the workshop was dedicated to small group activities and a report out to the larger group. AECOM provided instructions for the breakout group activity. Participants were organized in five groups representing five

geographic areas of the city that had been predetermined by the Core Project Team (Figure 2). These geographic areas included:

- Beachmont
- Point of Pines / Riverside
- Oak Island / Revere Beach
- West / North Revere
- Sales Creek

During Workshop 1, participants identified the need to expand the Sales Creek area to include Youngs Hill. The geographic area approach was used to help facilitate focused discussions on areas of the City that have historically been affected by natural hazards are particularly vulnerable to the effects of climate change. The breakout groups were also instructed to consider portions of the City located beyond their assigned area.

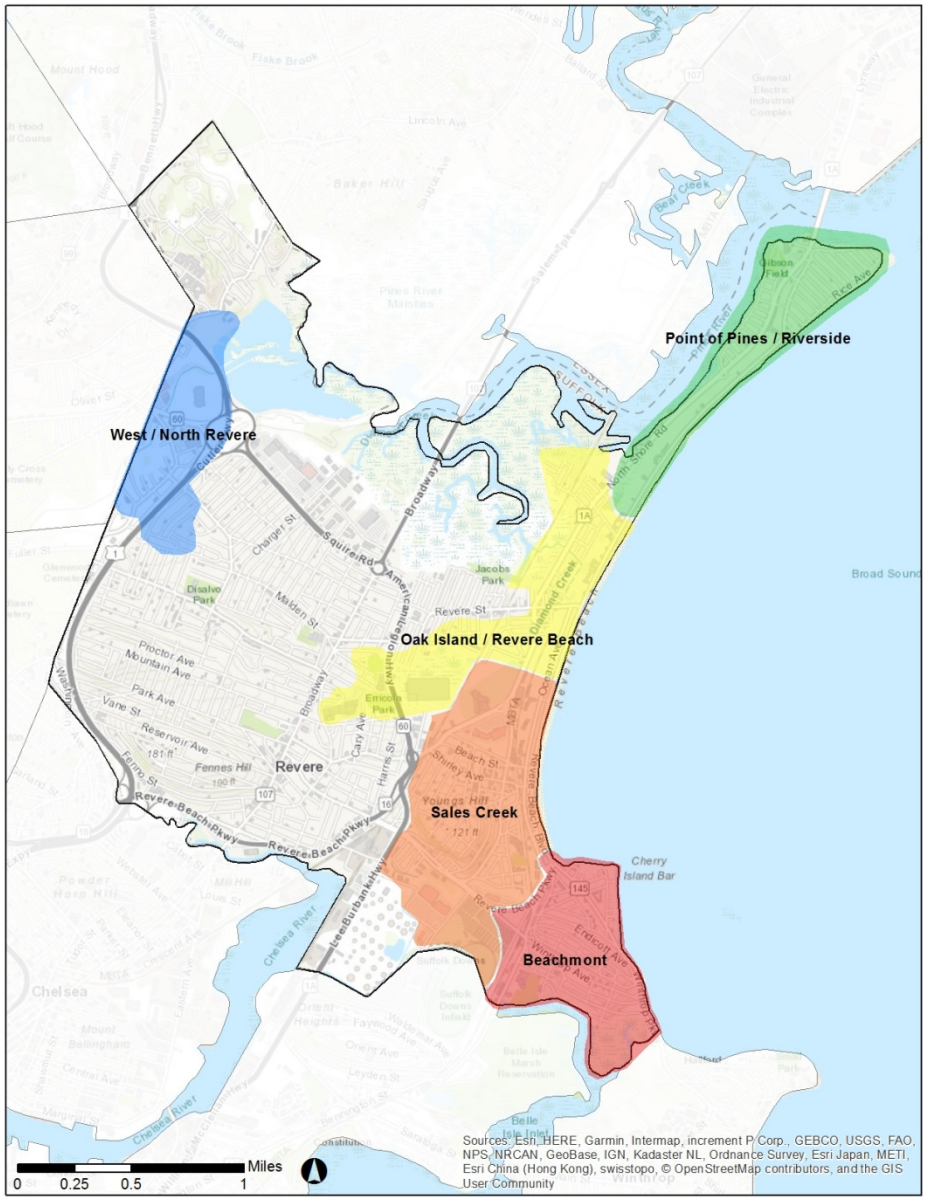


Figure 2: Five geographic areas identified in Revere for MVP Workshops

Each breakout group consisted of four to ten individuals and a facilitator. Several workshop participants were identified as 'City-wide' experts and instructed to participate in the small group discussions in all five geographic areas.

The first assignment for each group was to identify the top four hazards the city faces. After discussing and evaluating natural hazards, each group recorded their top four hazards in the "Top Priority Hazards" section of the CRB Risk Matrix, a tool developed as part of the CRB framework.

All groups were then tasked with identifying infrastructural, societal, and environmental features that would be impacted by the top four hazards. Participants recorded the ownership and identified the location of each feature on base maps (Figure 3) and in the CRB Risk Matrix (Figure 4). Each feature was categorized as a *strength (S)* or a *vulnerability (V)*. The breakout group facilitator guided the process of identifying and characterizing features. AECOM staff oversaw the small group discussions and provided assistance as needed. After each group had selected four top priority hazards and populated the *Features, Location, Ownership*, and *V or S* columns of the CRB Risk Matrix, AECOM staff led a report out session. A spokesperson from each group reviewed the top four hazards and select infrastructure, society, and environmental features for their geographic area. A summary of these features was captured on a large flip chart.

Copies of the base maps used in the workshop are included in Appendix B. Completed CRB Risk Matrices for each geographic area/breakout group are included in Appendix C. Refer to Appendix D for the agenda and meeting materials for Workshop 1.

Figure 3: Participants map (left) and discuss (right) features in Workshop 1

Workshop 2

Workshop 2 included a brief presentation by Aaron Weieneth, AECOM, to review:

- The City's objectives for the MVP program
- Local natural and climate-related hazards of concern identified in Workshop 1
- Existing and future infrastructural, societal, and environmental strengths and vulnerabilities

Following this overview, five geographic area breakout groups were reconvened to develop prioritized actions for the City. With the assistance of a designated facilitator, each group reviewed the CRB Risk Matrix that was initiated in Workshop 1. The next step was to brainstorm actions to reduce vulnerability and reinforce strengths for each of the infrastructural, societal, and environmental features identified in Workshop 1. Participants were given examples of potential actions as well as a list of hazard mitigation measures identified during the preparation of Revere's Hazard Mitigation Plan in 2014.

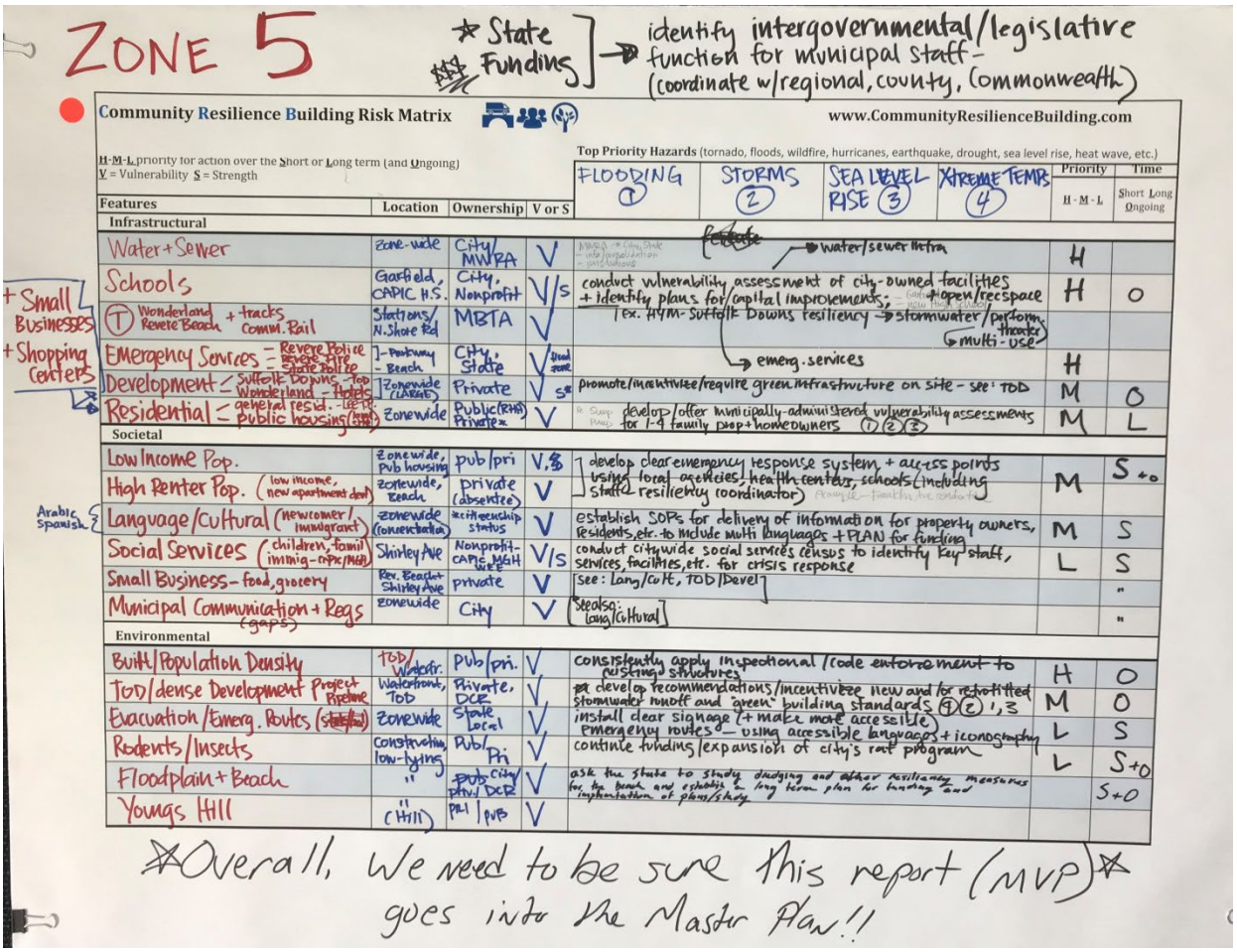


Figure 4: Example of a completed CRB Risk Matrix from Sales Creek area participants

Several human-caused hazards in Revere were identified during Workshop 1 and documented in the CRB Risk Matrices. While the Core Project Team and other workshop participants recognize that it is important to address these hazards, it was determined that human-caused hazards were out of the scope of this project. The breakout groups were instructed to focus on developing actions for natural and climate-related hazards in Workshop 2.

A combined total of 79 actions were developed for Revere. Where appropriate, groups identified which priority hazard(s) each action addressed. The majority of actions addressed flood hazards or multiple hazards. Refer to the CRB Risk Matrices in Appendix D for a complete list of actions.

Each breakout group then ranked the priority and identified the timeframe for all proposed actions. Actions were assigned a high (H), medium (M), or low (L) priority based on factors including funding availability, impacts from recent hazards, necessity for advancing longer-term outcomes, contribution towards meeting existing planning objectives, and geographic scope. Participants considered the timeframe to implement actions with respect to factors including need or urgency, feasibility, and cost. Actions were assigned an ongoing (O), short (S), or long (L) timeframe (Figure 4).

Each breakout group determined three to five highest priority actions to report out to the large group. The AECOM staff captured these highest priority actions on a flip chart during the report out session, and action commonalities across the breakout groups were identified. For the final step in prioritizing actions, participants were asked to vote on their top five priorities by placing sticky dots next to the actions they considered the highest priorities for the City regardless of the geographic areas (Figure 5). Appendix D includes meeting materials from Workshop 2, and a photograph of Workshop 2 participants is provided as Figure 6.

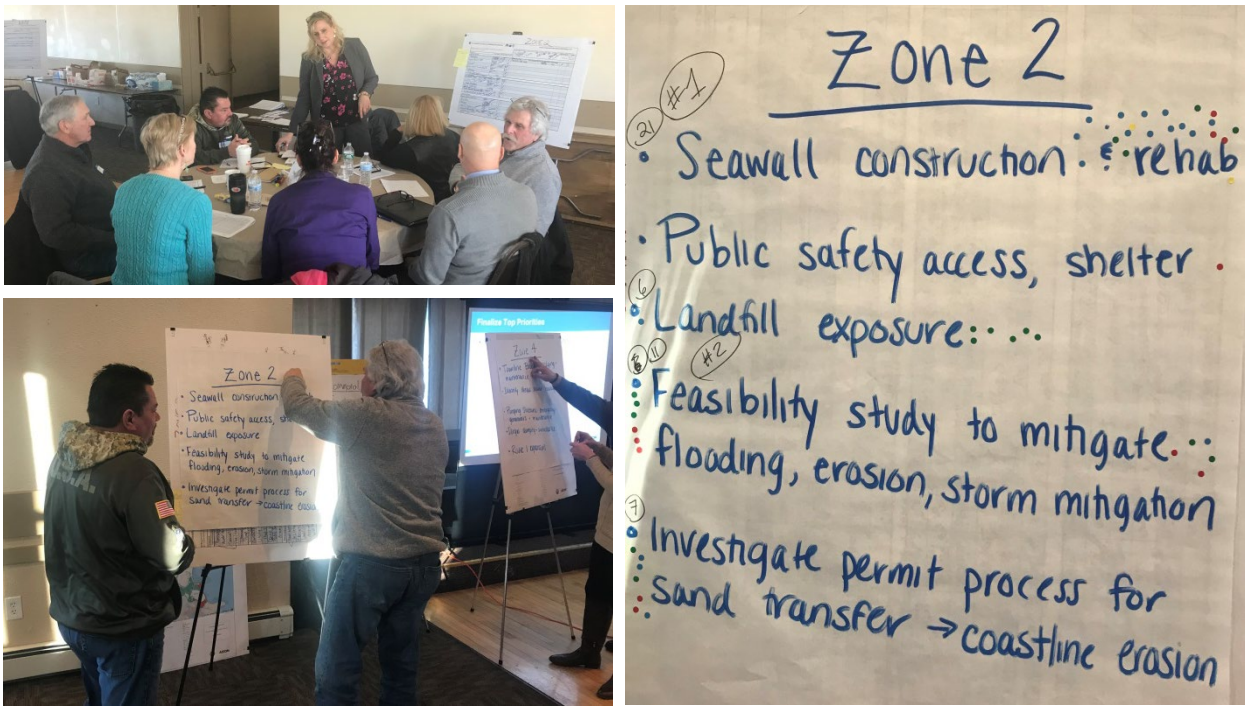


Figure 5: Clockwise from top left: Participants discuss actions in Workshop 2, Voting results for actions in the Point of Pines / Riverside area, Participants rank actions

Figure 6: Group photo of Workshop 2 participants at the Point of Pines Yacht Club

7. Community Listening Session

Revere hosted a public information and listening session titled “Climate Change & Revere: A Community Listening Session” on April 4, 2019 from 6:30-7:30PM at the Rumney Marsh Academy Auditorium (140 American Legion Highway, Revere, MA). The listening session was advertised on the City’s website, social media, distribution lists, and in the Revere Journal. It was also recorded by RevereTV and posted online. The listening session was kicked off by Mayor Brian Arrigo and provided the public with the opportunity to learn about the MVP workshops and to ask questions and provide feedback about the key findings and top priorities identified during the workshops (Figure 11). Participants also had an opportunity to identify additional issues they are aware of that were not identified in this MVP Summary of Findings Report. Information collected during the listening session is included in Appendix E.

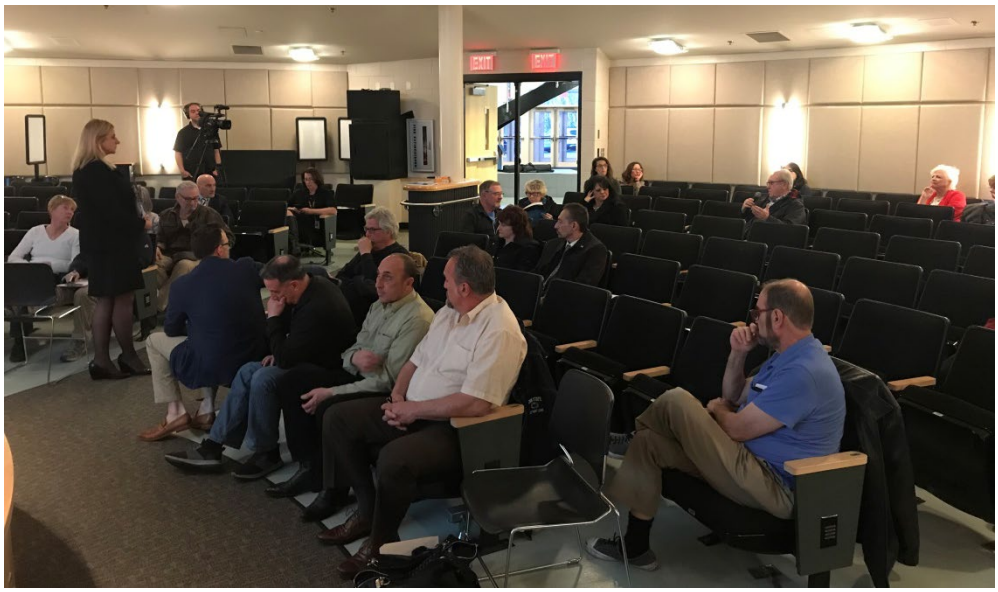


Figure 11: Photo of listening session participants

8. Conclusion and Next Steps

The priorities identified during the MVP workshops, outlined in this report, and identified during the listening session will be integrated into existing and future municipal planning efforts, including the City’s Master Plan Update, Capital Improvement Plan, and Hazard Mitigation Plan Update. The City will seek funding from the MVP Action Grant Program and other sources to implement the priority actions identified in this report to improve Revere’s resilience to natural hazards and climate change. The City will also submit annual progress reports to the Commonwealth that outline steps taken toward implementing its priority actions to maintain designation as an MVP community.

9. Acknowledgements

The MVP Program in Revere was made possible through the leadership and support of the City’s Core Project Team:

- Frank Stringi, City Planner, Department of Community Development (MVP Project Manager)
- Elle Baker, Project Planner, Department of Community Development
- Paul Argenzio, Superintendent, Department of Public Works
- Joe Maglione, Revere Water Facilities Director

AECOM Imagine it. Delivered.

Meeting Minutes

Meeting name Coastal Resilience Feasibility Study for the Point of Pines/Riverside Area – Stakeholder Workshop #1	**Meeting date** December 15, 2020	**Attendees** See Section 1.0 for attendee list
Time 6:00PM	**Location** Virtual Zoom Meeting	
AECOM project number 60646341	**Prepared by** Aaron Weieneth	

Subject: Coastal Resilience Feasibility Study for the Point of Pines/Riverside Area – Stakeholder Workshop #1

1.0 Introductions

- Attendees: AECOM: Amanda Shanahan, Aaron Weieneth, Brian Stobbie, Rickey Torres-Cooban

  City of Revere: Elle Baker, Frank Stringi, Ward 5 Councilor John Powers, Joe Maglione, Robert O'Brien, Paul Argenzio, Nick Moulaison

  Project Partners: Carolyn Meklenburg (MVP Regional Support Staff), Greg Robbins (DCR), Steve Miller (MassDOT), Loretta LeCentra (Riverside Area Resident), John Polcari (Point of Pines Beach Association)

  Community Members: Elaine Hurley, JD Jaramillo
- Elle Baker made introductions and turned things over to Aaron Weieneth for the formal presentation. A PDF of the presentation is attached to these notes and provides additional details.
- Aaron Weieneth introduced project and meeting agenda and continued with the presentation

2.0 Update on MVP Program to Date

Aaron Weieneth provided the following updates to the group:

- A Point of Pines/Riverside Area coastal resilience study was identified as a top priority action from MVP planning grant process.
- Past flooding/storm events and re-existing FEMA flood hazard zone mapping were reviewed.
- The Massachusetts Coast Flood Risk Model (MC-FRM), developed by Woods Hole Group for the Massachusetts Department of Transportation, provides projected coastal flooding for the study area due to sea level rise and coastal storms. The MC-FRM does not take into consideration high precipitation events or inland flooding.
- The MC-FRM provides results for Present Day, 2030, 2050, and 2070.
- There are two main MC-FRM data products:
  - Annual Coastal Flood Exceedance Probability – shows the likelihood that a location will be flooded
  - Estimated flood depth – provides the anticipated depth of flood water in affected areas
- Property ownership in the study area was reviewed and includes a mix of municipal, private, and state-owned properties.
- Past studies have been conducted; however, it is time to take a fresh look to identify potential coastal resilience adaptation measures.
- The City was awarded a MVP Action Grant to conduct a new feasibility study.

3.0 MVP Action Grant Scope of Work

Aaron Weieneth provided an overview of the following six tasks that comprise the MVP Action grant scope of work:

- Task 1: Stakeholder Outreach and Engagement
- Task 2: Assessment of Current and Future Conditions
- Task 3: Identify Short-Term Resilience Measures
- Task 4: Develop Coastal Resilience Toolkit
- Task 5: Assess Feasibility of Coastal Resilience Options
- Task 6: Point of Pines and Riverside Area Coastal Resilience Feasibility Report

4.0 Project Schedule

Aaron Weieneth explained that the coastal resilience feasibility study was kicked off in October 2020, and the project performance period extends through June 2021. He presented a detailed schedule that was included in the presentation.

5.0 Potential Collaboration Opportunities

- Aaron Weieneth noted that there are several other projects underway in the study area, including:
  - Boatyard project with potential community rowing/boating access
  - Boston Region MPO Route 1A Corridor Vulnerability Assessment
  - DCR Revere Beach Reservation Vulnerability Assessment
  - RiverFront District Master Plan
- Aaron Weieneth presented some detail on stormwater and flooding control measures for the RiverFront District Master Plan. He noted the Point of Pines and Riverside Area Coastal Resilience Feasibility Study will take into consideration recommendations that come out of the master planning effort.

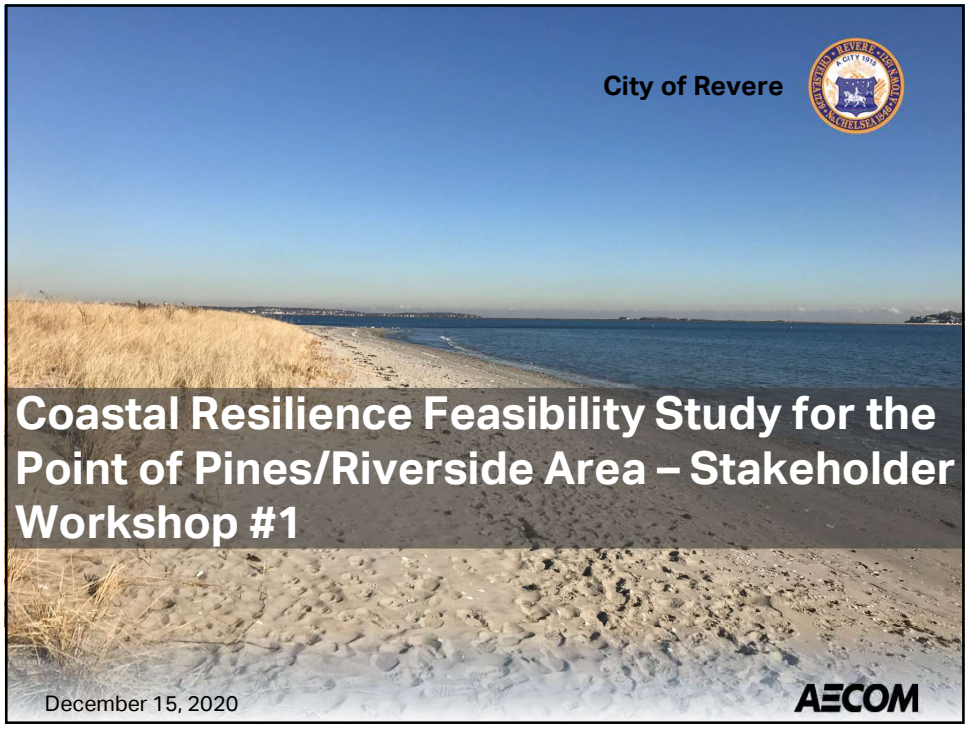
6.0 Stakeholder and Project Partner Feedback and Discussion

- Elle Baker indicated that the City of Revere submitted an application to the US Army Corps of Engineers (USACE) to revisit a study conducted in the 1990s that recommended a regional flood gate across the Saugus River, along with other proposed flood protection measures. The City expects to receive an update from the USACE in late spring/early summer. (Note: Additional detail on the Regional Saugus River Floodgate Project is available online: https://saugusriverfloodgates.com/.)
- Bob O'Brien commented that the primary focus of the study is coastal flooding rather than inland flooding, which includes rain events. He thinks that rain events contribute to flooding that the Riverside Area is currently experiencing and asked how the study would account for inland flooding.
  - Aaron Weieneth stated that MC-FRM mapping does not factor in extreme precipitation events, but we will be looking at precipitation data that is available from ResilientMA and other sources. The City does not have its drainage system modeled in this area, but we have anecdotal information and other resources we can draw from. He noted the need to be careful when building berms and seawalls to account for inland drainage. Otherwise the coastal interventions may result in impoundment areas.
  - Brian Stobbie followed up stating they are dependent on one another; you do not want to retain water and have ponding.
- Bob O'Brien noted that although the study is looking at Riverside and Point of Pines together, the study should make distinctions between them given the varying coastal conditions.
- Steve Miller commented that there is a substantial difference between storm surge and piped infrastructure. Generally speaking, storm surge overwhelms the precipitation factor. Tide gates are used to prevent inland flooding that would otherwise result from coastal waters during high tides/surges. The Boston Water and Sewer Commission (BWSC) did a study of piped infrastructure and how it interfaced with projected coastal conditions. Piped infrastructure can conflict with coastal infrastructure such as tide gates because they do not allow inland flooding to escape.
- Elaine Hurley lives on River Avenue and stated that her neighborhood floods regularly during king tides and dependent on which way the wind blows. She stated that she believes the Saugus River flood gate is needed to alleviate the backshore flooding along the Pines River. Elaine worked with the steering committee for the USACE study for four years.
  - Elle Baker reiterated that the City wants to revive the regional flood gate project.

- Bob O'Brien commented on the Boston Region Metropolitan Planning Organization (MPO) Route 1A vulnerability assessment study, stating that it will be important that whatever results from the Point of Pines/Riverside Area study compliment MPO study.
  - Steve Miller stated that MassDOT engaged the MPO because there is a need for a regional solution for supply chain and general commuting routes that are on the coasts. He is hoping that the MPO study will consider the susceptibility of Route 1A to routine flooding in the future, and what that means to the neighborhoods and cities that Route 1A connects. His focus is on a wider lens than just Revere for how the coast looks in the future.
- Bob O'Brien asked if the Saugus River Floodgate project would be among the options considered in the MVP study.
  - Aaron Weieneth stated that although the Floodgate project would be noted in this study, it is a regional project that is outside the scope of the MVP Action grant study. This is not something Revere alone could progress, but it is an important part of a regional solution moving forward.
  - Frank Stringi stated that the Floodgate project is the "save-all" solution for the region. It was authorized in 1992 and was ready for construction, but the Commonwealth's Executive Office of Energy and Environmental Affairs stopped it due to concerns about the emphasis on the structural approach. The City is working to get that project back on the front burner and bring it back to life.
  - Bob O'Brien stated that if the Floodgate project becomes part of the recommendation of this study, it can support pushing a regional solution forward and advocating for it on other projects.
- Councilor Powers asked how the overtopping by the old boat house in the Riverside area in the near-term could be abated without seawalls?
  - Aaron Weieneth stated that both short-term and long-term solutions will be evaluated as part of the study. A short-term measure could be temporary barriers that are deployable when storms or extreme high tides are forecast.
  - Nick Moulaison stated that Mills Avenue to the Marina needs immediate attention.
- Robert O'Brien stated that the existing infrastructure is failing and there is a need to look at what is in place and not functioning.
  - Joe Maglione stated that some storm drain lines/outfalls have been excavated, but sand has since washed back and is now covering them. A special permit is required in order to go onto the beach with equipment. The City sometimes digs out outfalls by hand. A lot of the pipe is corrugated. He commented that there is a lot of study needed in this area.
  - Elle Baker stated that it is important to look at the condition of existing infrastructure as part of the study, and what improvements are needed.
- Councilor Powers noted that on Gilbert Avenue, every time there was a storm it used to flood. The City cleaned out the outfall pipes and put flapper valves on some. Councilor Powers asked if flapper valves can be installed on Wadleigh Avenue as well. He believes there is a landing nearby that has an 8- or 10-inch outfall; he also asked if jersey barriers can help.
  - Joe Maglione noted that some of the outfalls in this area have filled in/been clogged with sand. He stated that jersey barriers will not help as part of a temporary solution because the water will flow between/around them; they are not watertight.
- Bob O'Brien stated that this study is needed to develop longer lasting solutions that will not be wrecked by the next big storm.
- Carolyn Meklenburg expressed enthusiasm and availability to support the MVP project.

7.0 Next Steps

- Project Partners meeting scheduled for late January 2021.
- Second stakeholder workshop will be conducted in February 2021 to share available findings from Tasks 2, 3, and 4.



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Coastal Resilience Feasibility Study for the Point of Pines/Riverside Area – Stakeholder Workshop #1

Elected Officials

- Mayor Brian Arrigo
- Ward 5 Councilor, John Powers

Revere City Staff

- Robert O'Brien – Director, Revere Office of Planning and Development
- Elle Baker – Project Planner
- Frank Stringi – City Planner
- Don Ciaramella, Superintendent Water, Sewer and Drain
- Joe Maglione – Assistant Superintendent Water, Sewer and Drain
- Paul Argenzio – Superintendent Revere Department of Public Works
- Nick Moulaison – Conservation Commission

Project Consultants – AECOM

- Aaron Weieneth – Project Manager
- Brian Stobbie – Coastal Engineer
- Ricky Torres-Cooban – Resilience Specialist
- Amanda Shanahan – Water Resources Engineer

Project Partners

- Loretta LeCentra – Riverside Area Resident
- Elaine Hurley – Riverside Area Resident
- John Polcari – Point of Pines Beach Association
- Angela Sawaya – Point of Pines Beach Association
- Stacy Livote – The Marina Restaurant
- Carolyn Meklenburg – MVP Regional Coordinator
- Greg Robbins – DCR Waterways
- Mary Lester – Saugus River Watershed Council
- Michelle O'Toole – MEMA, Hazard Mitigation Planning
- Brian Lajiness – MBTA, Manager of Emergency Operations
- Steve Miller –MassDOT, Climate Change Project Manager

2

Agenda

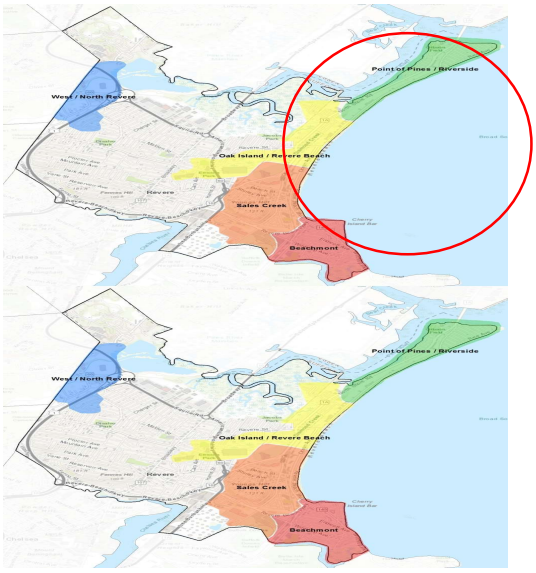
1. Welcome and Introductions
2. Update on Municipal Vulnerability Preparedness (MVP) Program
3. Coastal Resilience Feasibility Study Scope of Work
4. Project Schedule
5. Collaboration Opportunities
6. Discussion
7. Next Steps

Municipal Vulnerability Preparedness Program

- City completed the MVP Planning Grant process in 2019, implementing a Community Resilience Building Workshop framework
- Core Project Team established
- State certified MVP provider, AECOM, engaged

Municipal Vulnerability Preparedness Program

Point of Pines / Riverside Area was identified as the most vulnerable area



Municipal Vulnerability Preparedness Program

Top Priority Actions Based on Voting

Number of Votes	Action
21	*Seawall construction and rehabilitation in the Point of Pines / Riverside area.*
11	***Conduct a feasibility study to determine the best strategies to mitigate flooding, erosion, and storm impacts in the Point of Pines / Riverside area.***
8	Reconstruct seawall to mitigate flooding in the Beachmont area.
8	Dredge and maintain Town Line Brook in the northwest side of Revere.
7	Liaison between City and State to position for funding sources and increase communication city-wide, especially in regions with dense and/or diverse populations, such as Sales Creek.
7	Encourage thoughtful future development in relation to flooding and drainage in the Oak Island / Revere Beach area and throughout the city.
7	Investigate permit process for sand transfer to mitigate coastline erosion in the Point of Pines / Riverside area.

Point of Pines / Riverside Area Existing Conditions

Dune erosion

Seawall deterioration

Sand deposition / accretion near West Channel

Sand overtopping seawall

Point of Pines / Riverside Area Existing Conditions

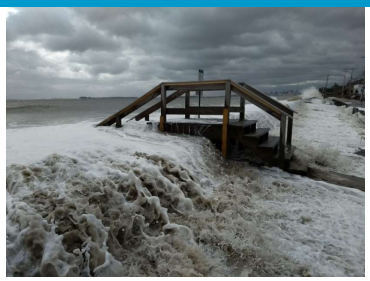


Photo Credit: John Polcari

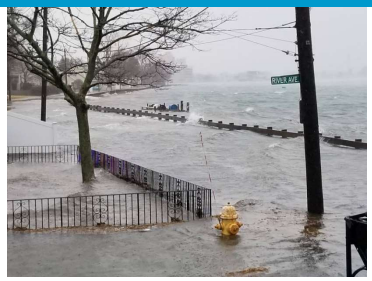
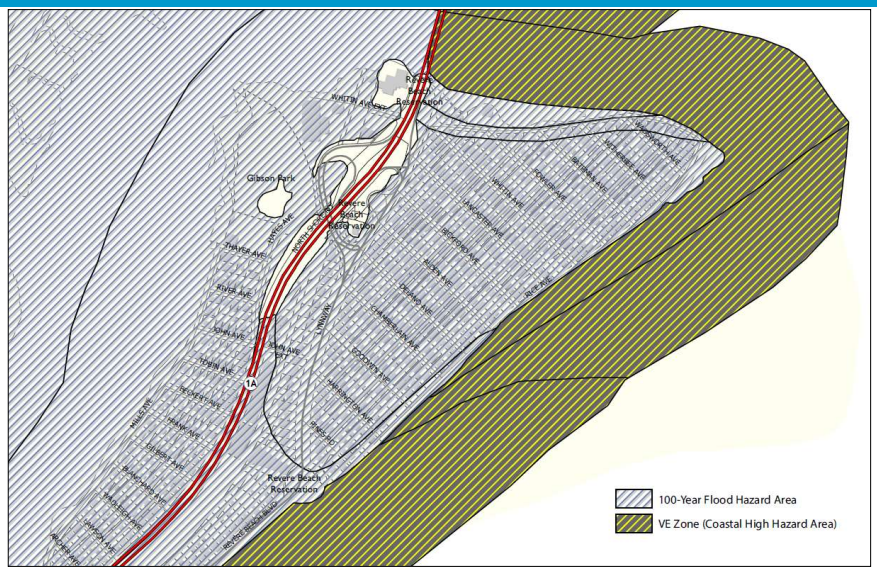


Photo Credit: Loretta LaCentra

Photo Credit: Elaine Hurley

Photo Credit: John Polcari

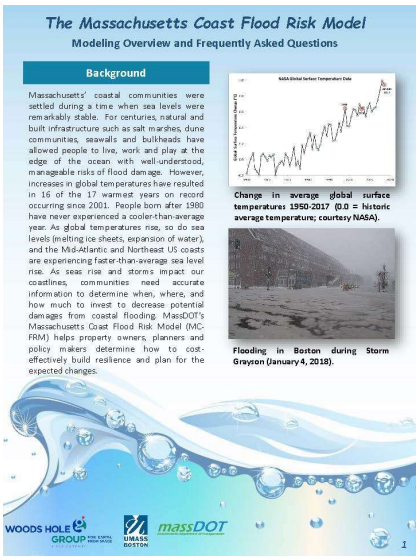
Current FEMA Flood Zone Mapping



Source: MassGIS, FEMA NFHL 1/29/2019

Projected Coastal Flooding

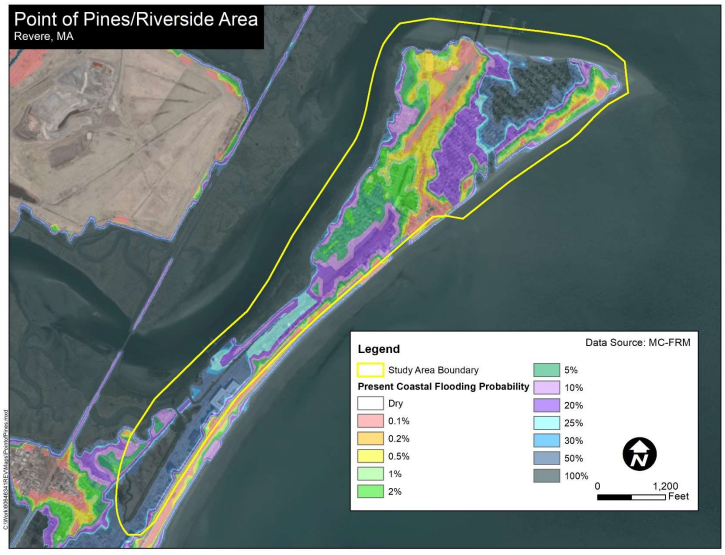
- Central Artery/Tunnel Vulnerability and Adaptation Assessment completed in 2015
  - Created the Boston Harbor Flood Risk Model (BH-FRM) to identify risk and depth of water resulting from storm surge induced coastal flooding
- Massachusetts Coast Flood Risk Model (MC-FRM)
  - Expanded to model entire coast and islands
  - Sea level rise and coastal storms (not extreme precipitation)
  - Used to support regional scale vulnerability analysis and conceptual adaptation strategies
  - Results for Present Day, 2030, 2050, and 2070 (2100 under development)



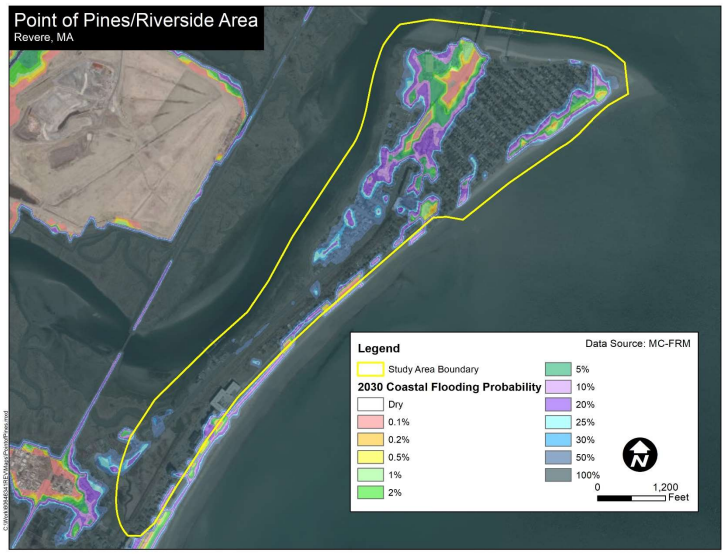
Projected Coastal Flooding

- Annual Coastal Flood Exceedance Probability (ACFEP)
  - Shows the "likelihood" that a location will be flooded
  - Ranges from 0.1% (probability associated with the 1,000-year water surface elevation) to 100% (1-year return period, not the average high tide)
- Estimated Flood Depth
  - Anticipated depth of flood water in affected areas
  - Available for 1% ACFEP (100-year), 0.5% ACFEP (200-year), and 0.1% ACFEP (1,000-year)

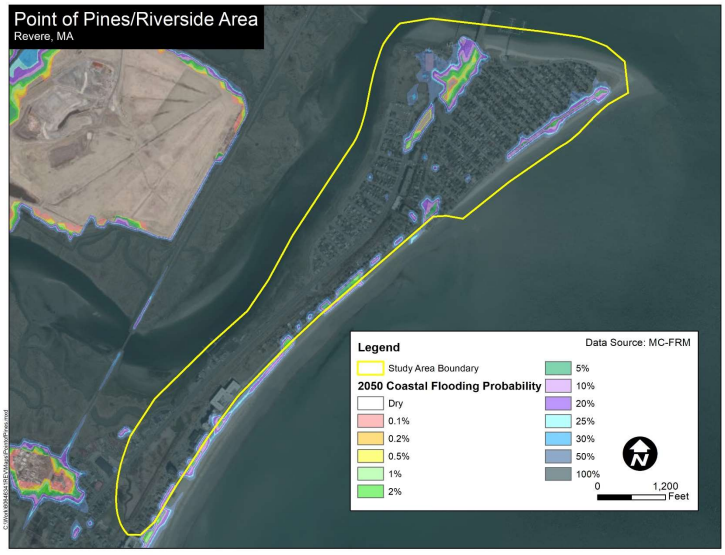
Projected Coastal Flooding – Present Day



Projected Coastal Flooding – 2030



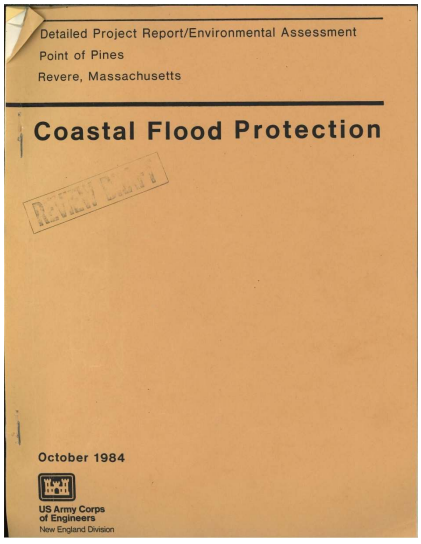
Projected Coastal Flooding – 2050



Projected Coastal Flooding – 2070

Not a New Concern

- Subject of a Coastal Flood Protection study conducted by the U.S. Army Corps of Engineers in 1984
- Recommendations:
  - Rock revetments
  - Sand dune development
  - Beach nourishment
  - Concrete seawall
- Study not implemented
- Dune plantings and seawall repairs carried out by others



Property Ownership Considerations

Time to Take a Fresh Look

- Conduct a new feasibility study to identify potential resilience/adaptation measures
- Identified as a priority action during the MVP planning process
- City awarded a FY2020 MVP Action Grant

MVP Action Grant Scope of Work

- Feasibility study will include:
  - Task 1: Stakeholder Outreach and Engagement
  - Task 2: Assessment of Current and Future Conditions
  - Task 3: Identify Short-Term Resilience Measures
  - Task 4: Develop Coastal Resilience Toolkit
  - Task 5: Assess Feasibility of Coastal Resilience Options
  - Task 6: Point of Pines and Riverside Area Coastal Resilience Feasibility Report

Task 1: Stakeholder Outreach and Engagement

First Workshop:
- Present feasibility study scope of work
- Seek early community input

Second Workshop:
- Share findings from Tasks 2 through 4
- Assess feasibility of coastal resilience options

Third Workshop:
- Present findings of study
- Discuss action items moving forward

Task 2: Assessment of Current and Future Conditions

- Review past studies and reports relevant to project area
- Identify and review up to 5 coastal resilience case studies to inform feasibility study
- Obtain and review existing coastal survey, mapping, and other historical data
- Deliverables: Past Studies and Case Study Memo, Climate Science and Vulnerability Assessment Memo

https://www.revere.org/revere-beach

Task 3: Identify Short-Term Resilience Measures

- Identify temporary and near-term and lower cost actions to implement immediately

https://floodcontrolinternational.com/products/noaq-boxwall/

- Beach Management Plan will be created
- Emergency Response Plan will be updated
- Point of Pines Beach Association to provide existing concerns

Task 4: Develop Coastal Resilience Toolkit

- Identify structural, non-structural, and nature based adaptation measures for climate resilience in the Point of Pines and Riverside Area
- Toolkit will include design components and implementation scenarios for each options

- Example Options:
  - Beach/dune protection
  - Flood storage area creation
  - Wetland preservation and restoration
  - Coastal structures
  - Green infrastructure for stormwater management
  - Living shorelines
  - Floodproofing buildings

Task 5: Assess Feasibility of Coastal Resilience Options

- Develop decision matrix assessing feasibility of various coastal resiliency options
- Matrix will assess:
  - Cost and funding opportunities
  - Ownership
  - Community acceptance
  - Conservation and permitting requirements
  - Identify responsible parties

Task 6: Point of Pines and Riverside Area Coastal Feasibility Report

- Final report including an implementation plan identifying:
  - Action items
  - Responsibilities
  - Potential funding sources

Project Schedule

Proposed Schedule for Point of Pines and Riverside Area Coastal Resilience Feasibility Study

Task	October	November	December	January	February	March	April	May	June
Task 0: Kick-off meeting with Town, EEA, and Consultant									
Task 1: Stakeholder Outreach and Engagement									
Sub-task 1.1 Workshop #1									
Sub-task 1.2 Workshop #2									
Sub-task 1.3 Workshop #3									
Task 2: Assess Current and Future Conditions									
Sub-task 2.1 Past Studies and Case Study Memo									
Sub-task 2.2 Climate Science and Vulnerability Assessment Memo									
Task 3: Identify Short-Term Resilience Measures									
Sub-task 3.1 Draft Memo									
Sub-task 3.2 Final Memo									
Task 4: Develop Coastal Resilience Toolkit									
Sub-task 4.1 Draft Memo/Toolkit									
Sub-task 4.2 Final Memo/Toolkit									
Task 5: Assess Feasibility of Coastal Resilience Options									
Sub-task 5.1 Draft Memo									
Sub-task 5.2 Final Memo									
Task 6: Point of Pines and Riverside Area Coastal Resilience Feasibility Report									
Sub-task 6.1 Draft Report									
Sub-task 6.2 Final Report									

Collaboration Opportunities

- Other ongoing projects in the study area
  - Boston Region MPO Route 1A Corridor Vulnerability Assessment
  - DCR Revere Beach Reservation Vulnerability Assessment
  - RiverFront District Master Plan
  - Boatyard project

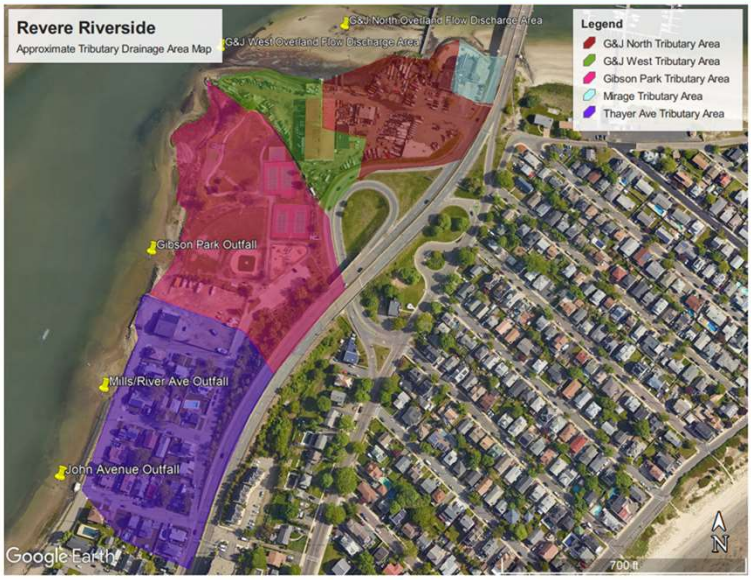
RiverFront District Master Plan

RiverFront District Master Plan

Stormwater and Flooding Review

- There are 5 tributary drainage areas in the Study area
  - Thayer Ave Area
  - Gibson Park Area
  - The western part of the G&J Property
  - The northern part of the G&J Property
  - Mirage Site
- No storage capacity beyond surface flooding
- The outfalls are tidally influenced – can't discharge when the tide is up

RiverFront District Master Plan



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RiverFront District Master Plan

Stormwater and Flooding Proposed Improvements

- Providing relief and storage for the neighborhood and Gibson Park
  - Tie into existing infrastructure on Thayer Ave to provide a "relief valve"
  - Provide a toe drain and raingardens for surface runoff
  - Bioswales and raingardens along North Shore Road to remove flow that currently goes into the neighborhood
  - Subsurface storage under the field
- 210 ft x 360 ft could allow 1.62 to 2.0 acre-feet of storage
- This could store rainfall volume of a 4-inch to a 4.6-inch storm event (10 yr return period)

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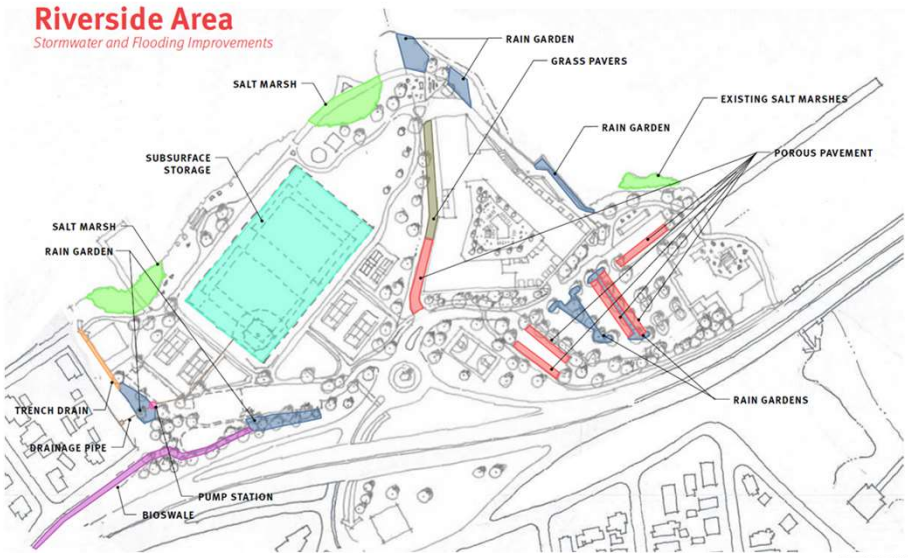
RiverFront District Master Plan



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Stakeholder and Project Partner Feedback and Discussion

Photo credit: Ricci LeCentra

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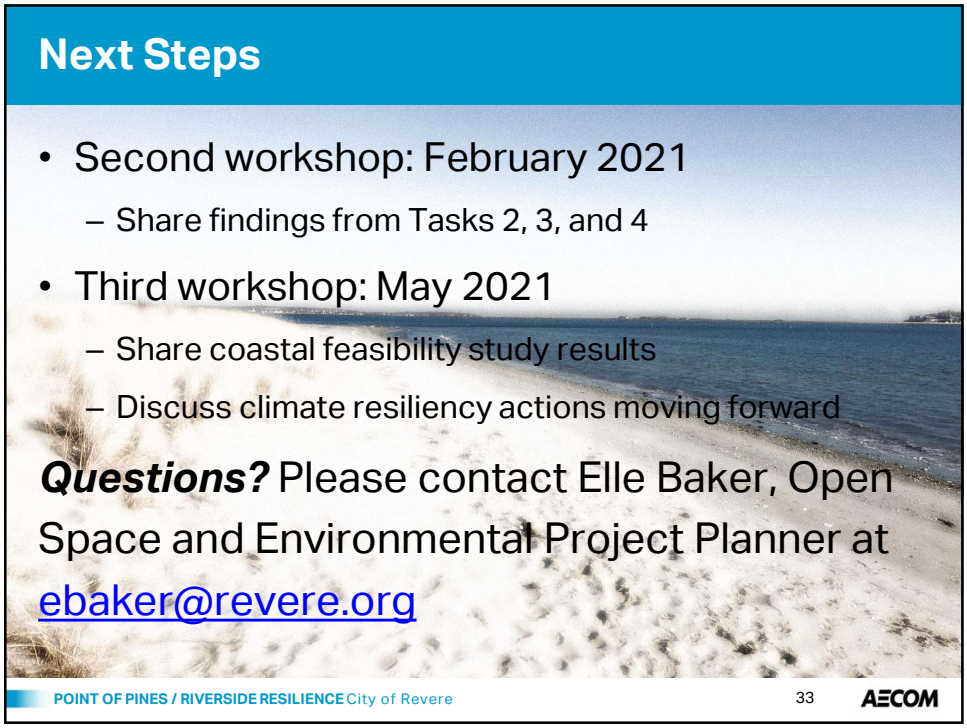
Next Steps
• Second workshop: February 2021
– Share findings from Tasks 2, 3, and 4
• Third workshop: May 2021
– Share coastal feasibility study results
– Discuss climate resiliency actions moving forward
Questions? Please contact Elle Baker, Open Space and Environmental Project Planner at ebaker@revere.org
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Meeting Minutes

Meeting Name
Coastal Resilience Feasibility Study for the Point of Pines/Riverside Area – Partners Meeting #2

Time
2:00PM

AECOM project number
60646341

Meeting date
January 26, 2021

Location
Virtual Meeting

Prepared by
Aaron Weieneth

Attendees
Frank Stringi, Elle Baker, Bob O'Brien (City of Revere); Loretta LeCentra (Riverside Area Resident); Stacey Livote (The Marina at the Wharf Restaurant); Greg Robbins (DCR); Steve Miller (MassDOT); John Polcari (Point of Pines Beach Association); Aaron Weieneth (AECOM)

Subject: Coastal Resilience Feasibility Study for the Point of Pines/Riverside Area – Partners Meeting #2

1.0 Introductions

- Elle Baker led introductions.
- Aaron Weieneth provided an overview of the purpose of the meeting, which is to provide an update on the study and discuss early deliverables from Task 2: Assess Current and Future Conditions and Task 3: Identify Short-Term Resilience Measures.

2.0 Review of Draft Past Studies, Case Studies, and Historical Data Memo

- Aaron Weieneth provided an overview of the draft memo. He noted the purpose of the memo is to review past reports related to the study area and identify coastal resilience case studies to inform the feasibility study.
- Greg Robbins from DCR commented that DCR is initiating a climate change vulnerability assessment of Revere Beach, which scheduled to be complete by June 2021. He noted that Jessica Rowcroft is the DCR point of contact for this project. The results might be too late for the Revere study, but he or Jessica can provide updates.
- Loretta LeCentra asked if the past studies have been helpful to inform the current study, and if the past recommendations are applicable today.
  - Aaron Weieneth responded the past studies and reports have provided a lot of helpful background information and data that is being used for the current study. Some elements of the previous recommendations might still be applicable, but they would need to be re-evaluated since site conditions, science, and technologies have changed over time.
-

3.0 Review of Draft Point of Pines Beach Management Plan

- Aaron Weieneth stated the purpose of the plan is to provide the Point of Pines Beach Association and other stakeholders (such as the City of Revere, Commonwealth of Massachusetts, and private landowners) with near-term and lower cost actions that can be implemented as longer-term climate resilience interventions are designed, permitted, and constructed. He reviewed the recommended actions that can be implemented as time and budget allow.
- John Polcari stated he is interested in conducting a mapping project for the Point of Pines to document changes in the shoreline over time, potentially using a drone.
  - Elle Baker and Frank Stringi noted that the City has aerial photographs of the city that have been taken every five years that could potentially be reviewed for past conditions.
  - Aaron Weieneth responded that the Massachusetts Office of Coastal Zone Management conducted a shoreline change project that illustrates how the shoreline has shifted over time, and that the AECOM team is using this as a data source (https://www.mass.gov/service-details/massachusetts-shoreline-change-project).

  - Bob O'Brien commented that in addition to gradual changes that occur over time, significant impacts to the shoreline can occur due to extreme weather events.

- Elle Baker stated she like the recommendation of establishing a record-keeping system. She also liked the recommendation of installing elevated walkways, she but noted this would likely be a higher cost option and could require some permitting.
- Steve Miller asked if the City has engaged a coastal engineering firm to evaluate conditions.
  - Elle Baker responded that the POPBA has not worked with such a firm, but coastal engineers were involved with past Army Corps of Engineers studies and design/installation of existing seawalls.
  - Aaron Weieneth clarified that the AECOM team includes coastal engineers who are contributing to the coastal resilience feasibility study, and that they will be involved with presenting study findings and future stakeholder workshops.
- Elle Baker noted the Point of Pines Beach Association (POPBA) has already proceeded with installing some sand fences as well as public education signage. She said it would be helpful to update the mapping included in the draft plan to show the existing fencing and have the suggested additional fencing be informed by the placement of the existing fencing.
- John Polcari stated that it might be beneficial to extend the sand fencing at the end of the pathways to the beach to help discourage people disturbing the dunes. It would also be helpful to compare the effectiveness of various placements of fencing.
- Steve Miller stated that many coastal municipalities have used jetties to help with shoreline erosion issues.
  - Greg Robbins noted that the Point of Pines is a barrier beach, and these types or structures are not allowed for installation.

4.0 Climate Science and Vulnerability Assessment Memo – In Progress

- Aaron Weieneth shared initial findings from the climate science and vulnerability assessment memo, noting that more findings will be presented at the next stakeholder workshop.
- Steve Miller suggested the source for the Massachusetts Coast Flood Risk Model (MC-FRM) be revised. The current footnote suggests the projections show conditions for year 2020, which was not one of the years of analysis. He also recommended replacing the NOAA sea level rise graphic with the sea level rise values that are used for the MC-FRM.

5.0 Short-Term Resilience Measures Memo – In Progress

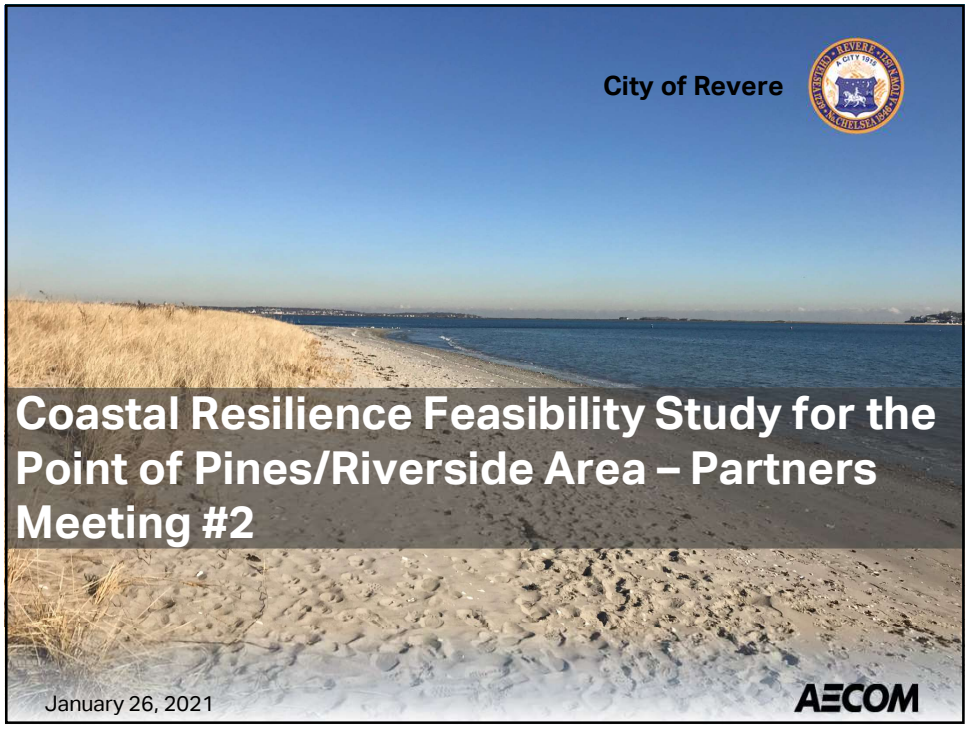
- Aaron Weieneth provided an overview of the progress to date on the short-term resilience measures memo.

6.0 Project Schedule

- Aaron Weieneth stated the team will be wrapping up Task 2 and 3 over the next few weeks and will progress Task 4 Develop Coastal Resilience Toolkit. Will also be preparing for Stakeholder Workshop #2.

7.0 Next Steps

- Second stakeholder workshop will be held February 23, 2021 from 6-7PM. The workshop will cover:
  - Findings from Task 2: Assess Current and Future Conditions
  - Findings from Task 3: Identify Short-Term Resilience Measures
  - Findings from Task 4: Develop Coastal Resilience Toolkit
  - Seek input on criteria used to assess feasibility of coastal resilience options
- Schedule final partners meeting
  - Week of April 5, 2021 (tentative)
- Elle Baker requested that the Partners provide her with their comments on the Draft Past Studies, Case Studies, and Historical Data Memo and Draft Beach Management Plan by February 5, 2021.


City of Revere
Coastal Resilience Feasibility Study for the Point of Pines/Riverside Area – Partners Meeting #2
January 26, 2021
AECOM

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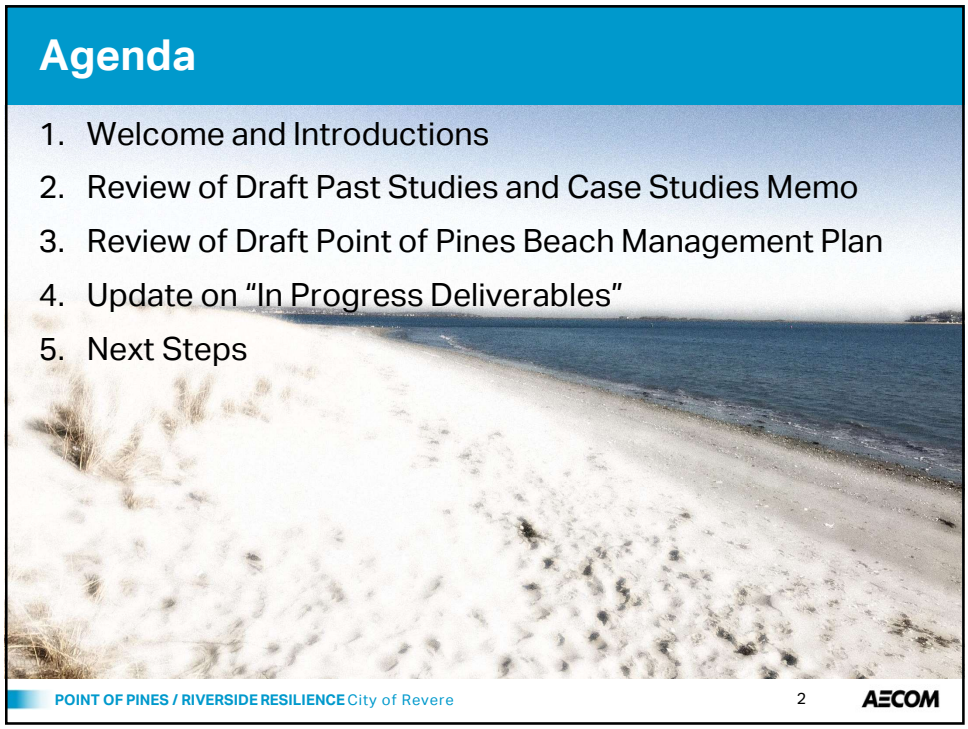
Agenda
1. Welcome and Introductions
2. Review of Draft Past Studies and Case Studies Memo
3. Review of Draft Point of Pines Beach Management Plan
4. Update on "In Progress Deliverables"
5. Next Steps
POINT OF PINES / RIVERSIDE RESILIENCE City of Revere
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Draft Past Studies and Case Studies Memo

- Route 1A Corridor Vulnerability Assessment, 2020
  - Pilot Study to identify problems and recommend solutions to make Route 1A more resilient.
- Revere MVP Planning Workshop Findings Report, 2019
  - Identified top climate change hazards and vulnerabilities in the City and ranked priority adaptation actions.
- Revere Hazard Mitigation Plan, 2015
  - Report focused on identifying natural hazards and providing a list of future response actions needed promote resilience in the event of a natural hazard occurrence.
- USACE Revere Beach Erosion Control Report, 1991
  - Discussed primary reasons for beach advancement and shoreline erosion and suggested potential mitigation strategies for beach preservation.
- USACE Flood Damage Reduction Study for the Saugus River and Tributaries, 1990
  - Investigation of potential regional solutions to protect against coastal flooding.

3

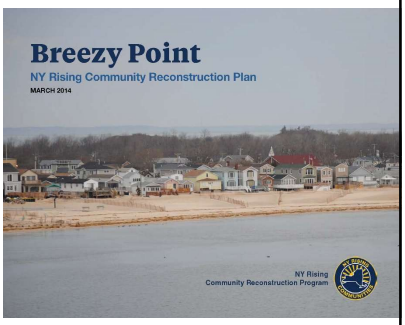
Draft Past Studies and Case Studies Memo

- RiverFront Master Plan (ongoing)
  - Exploring redevelopment opportunities and challenges related to the district in and around Gibson Park.
  - Identifying targeted interventions to reduce the impact of extreme events.
- Waterfront Access Development 29 Thayer Ave (ongoing)
  - Planning report for waterfront development.
  - Develop waterfront facilities for rowing activities.
  - Create public waterfront access facility.

4

Draft Past Studies and Case Studies Memo

- Coastal Resiliency Planning, Falmouth, 2020
  - MVP planning process evaluated high priority areas in Falmouth vulnerable to flooding and erosion and recommended actions to provide resilience.
- Manchester-by-the-Sea Sawmill Brook Restoration, 2019
  - Recommended salt marsh planning and flexible block retaining wall with public stairway providing access to water.
- Climate Ready Boston, 2016
  - Established the roadmap for the City of Boston to plan for the impacts of climate change and build a resilient future, with an emphasis on addressing coastal flooding.
- Resilient Cape Cod Project, 2018
  - Focused on identifying natural hazards effecting Cape Cod and developing a Coastal Planner tool.
- Breezy Point – NY Rising Community Reconstruction Plan, 2014
  - Focused on coastal adaptation strategies to help mitigate effects of future climate change events on the Rockaway Peninsula in Queens, NY.



5

Draft Beach Management Plan

- Purpose of plan is to provide near-term and lower cost actions that can be implemented
  - Plan includes several categories of recommended actions

6

Draft Beach Management Plan

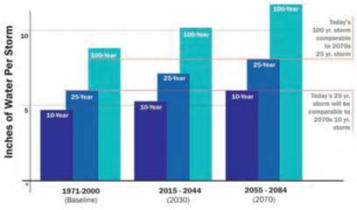
Recommendations include:

- Establishment and use of a record-keeping system
- Monitoring of infrastructure and site conditions
- Routine and periodic maintenance
- Potential closure and restoration of some existing access paths
- Sand augmentation
- Sand Fence Installation
- Elevated walkways
- Vegetation Planting
- Rare species preservation
- Public education, outreach, and signage

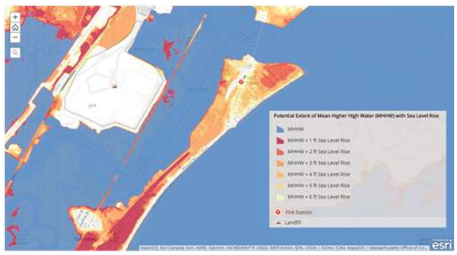
Climate Science and Vulnerability Assessment Memo – *In Progress*

Climate Science Review

- Temperature
- Precipitation
- Sea level change and coastal flooding



Source: Cambridge CCVA, 2015



Source: MA Sea Level Rise and Coastal Flood Viewer

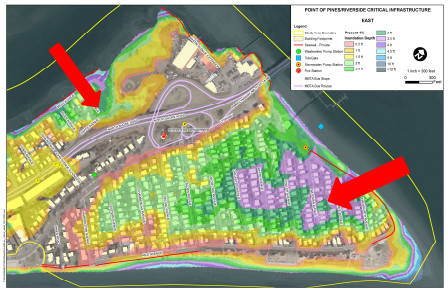
Temperature Indicator	Baseline (Days)	Percentile of Model/Scenario Output	2030s (Days)	2050s (Days)	2070s (Days)	2090s (Days)
Annual number of days hotter than 90° F	11	90th	32	52	69	96
		Median (50th)	22	30	38	44
		10th	12	14	16	13
Annual number of days cooler than 32° F	112	90th	87	79	49	32
		Median (50th)	100	93	81	76
		10th	115	113	115	106

Source: Resilient MA

Climate Science and Vulnerability Assessment Memo – *In Progress*

Future Conditions Vulnerability

- Stormwater and groundwater
- Erosion
- Coastal flooding
  - Probability of flooding
  - Pathways of flooding
  - Timing of permanent inundation
  - Comparison of existing infrastructure to future flood frequencies



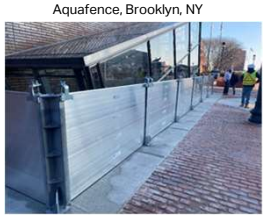
Source: MC-FRM

Short-Term Resilience Measures Memo – *In Progress*

Deployable Measures

- Require storage at a secondary location
- Require a deployment team/plan
- Less visual impact

Aquafence, Brooklyn, NY



Stop Logs, Aquarium Station, Boston, MA

On-Site Measures

- No deployment required
- Significant day to day visual impact

Hesco Barriers, Kane Berm, Hackensack, NJ

TrapBags, Sarasota, FL

Project Schedule

Schedule for Point of Pines and Riverside Area Coastal Resilience Feasibility Study

Task	October	November	December	January	February	March	April	May	June
Task 0: Kick-off meeting with Town, EEA, and Consultant									
Task 1: Stakeholder Outreach and Engagement									
Sub-task 1.1 Workshop #1									
Sub-task 1.2 Workshop #2									
Sub-task 1.3 Workshop #3									
Task 2: Assess Current and Future Conditions									
Sub-task 2.1 Past Studies and Case Study Memo									
Sub-task 2.2 Climate Science and Vulnerability Assessment Memo									
Task 3: Identify Short-Term Resilience Measures									
Sub-task 3.1 Draft Memo									
Sub-task 3.2 Final Memo									
Task 4: Develop Coastal Resilience Toolkit									
Sub-task 4.1 Draft Memo/Toolkit									
Sub-task 4.2 Final Memo/Toolkit									
Task 5: Assess Feasibility of Coastal Resilience Options									
Sub-task 5.1 Draft Memo									
Sub-task 5.2 Final Memo									
Task 6: Point of Pines and Riverside Area Coastal Resilience Feasibility Report									
Sub-task 6.1 Draft Report									
Sub-task 6.2 Final Report									

We are here

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Next Steps

- Second stakeholder workshop: February 23, 2021
  - Findings from Task 2: Assess Current and Future Conditions
  - Findings from Task 3: Identify Short-Term Resilience Measures
  - Findings from Task 4: Develop Coastal Resilience Toolkit
  - Seek input on criteria used to assess feasibility of coastal resilience options
- Schedule final partners meeting
  - Week of April 5, 2021

Questions? Please contact Elle Baker, Open Space and Environmental Project Planner at ebaker@revere.org

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AECOM Imagine it. Delivered.

Meeting Minutes

Meeting Name Hazard Mitigation Plan Update – Public Stakeholder Meeting #1	**Meeting date** March 3, 2021	**Attendees** See Section 1.0 for attendee list
Time 6:00PM	**Location** Virtual Zoom Meeting	
AECOM project number 60648765	**Prepared by** Aaron Weieneth	

Subject: Hazard Mitigation Plan Update – Public Stakeholder Meeting #1

1.0 Welcome and Opening Remarks

- Attendees: AECOM: Amanda Shanahan, Aaron Weieneth, Anna Foley

  City of Revere: Elle Baker (Open Space and Environmental Planner), Frank Stringi, (City Planner) Bob O'Brien (Director of Revere Planning and Development), Paul Argenzio (DPW Superintendent), Nick Moulaison (Conservation Commission), Julie DeMauro (Active Transportation Manager), Ralph Decicco (Commission on Disabilities), Chris Bright (Fire Chief)

  Additional Stakeholders: Names not captured.
- Webinar format held on Zoom. The meeting was recorded and also broadcast live on RevereTV and streamed on the City's YouTube channel.
- Elle Baker made introductions and opening remarks regarding the importance of the project, before turning things over to Aaron Weieneth. A PDF of the presentation is attached to these notes and provides additional details.
- Aaron Weieneth introduced the team and gave attendees an overview of the meeting agenda. He then discussed how the hazard mitigation planning process, and the implementation of the hazard mitigation plan (HMP), can help Revere achieve its goal of becoming more sustainable and resilient.
- Aaron started off the presentation talking about natural hazards; they are a part of Revere's past and future. Damages can have long term consequences and federal funding isn't always available after a disaster.
- The overall objective of a HMP is to make the City more sustainable and resilient in the short/long term.
- Hazard mitigation helps achieve that goal by identifying hazards, evaluating risks, developing mitigation actions, and then successfully implementing those actions.
- Aaron turned things over to Anna Foley.

2.0 Why is Hazard Mitigation Important? (Anna Foley presented)

- Anna noted that most people have been affected by a natural hazard.
- The magnitude depends on the intensity of the event, the number of people and structures exposed, and the effectiveness of pre-disaster mitigation actions in protecting people and property.
- Hazard mitigation is the key to resiliency. By mitigating at-risk elements of the built environment today, and incorporating mitigation and resiliency concepts into areas of future development, we can reduce the impacts of future natural disaster events.
- Typically, when a hazard event occurs, communities go through a cycle of disaster response, recovery, mitigation, and planning for next event. Hazard mitigation breaks the cycle. As communities implement mitigation measures, the hazards they are impacted by create fewer emergency situations for local responders to attend to, and cause less damage in need of costly repairs. The community's recovery is facilitated by reduced impacts to the economic and

social fabric of the community, and there is generally less to be done to get the community back to the point where they are sufficiently prepared for future events.

- Mitigation works. It reduces exposure, saves money, and protects lives and property. An updated study by the Multi-Hazard Mitigation Council (part of that National of Institute Building Sciences) estimated that federally funded hazard mitigation projects had an overall benefit cost ratio of 6 to 1. Meaning that on average, $6 would be saved for every $1 spent on mitigation projects. This is not true for every project, but it does speak to the overall value of investing in hazard mitigation projects – done properly, they will save far more money than their project cost.
- Natural disasters can't be prevented, but their impacts can be reduced. For example, raising utilities, elevating structures, building protective dunes.

3.0 Mitigation Planning and Plan Updates (Anna Foley presented)

- Prior to the passage of the Disaster Mitigation Act of 2000 (DMA 2000) local communities were considered eligible applicants for federal hazard mitigation project funding streams as long as their State had a hazard mitigation plan in place. With the passage of DMA 2000, the State plan requirement was continued, and a new requirement was added for local communities to also have a hazard mitigation plan in place for eligibility to apply for mitigation project grants.
- Local plans can benefit from updated hazard assessments in their State plans. Revere's plan update will be informed by the 2018 Massachusetts Hazard Mitigation and Climate Adaptation Plan by, among other things, incorporating climate change impacts for various hazards.
- Plans must be updated every five years (with reapproval by FEMA, and readoption by the community).
- Anna explained how stakeholder input is critical for the success of the HMP.
- The HMP requires ongoing commitment at a local level to implement the projects identified in the plan. This involves striking a balance between competing constraints such as staff capabilities, their time, and funding availability.
- Benefits of mitigation planning:
  - Eligibility to apply for hazard mitigation project grants
  - Path to resiliency
- By updating the plan, the City will maintain its eligibility to apply for grant funding for projects such as road raising, culvert upgrades, minor localized flood reduction projects, generators, bridge retrofits, utility protection.
- Regular updates make sure the plan represents present-day conditions in the community and a current understanding of vulnerabilities based on the most current mapping, data, and technical information. Updates also ensure that the plan implementation strategy still accurately represents what the City would like to see and do moving forward.
- Initial Revere HMP was adopted in 2005. The first update was in 2015. The second plan update process began in 2020 and will be completed this year, 2021.

4.0 Overview of Current Plan (Anna Foley presented)

- The State Plan included four hazards that were deemed to not pose a significant threat and therefore were not included in the plan. Eight hazards were identified as significant hazards and were included.
- AECOM then opened the floor for comments from attendees regarding notable hazard occurrences in Revere since 2015. **(Open discussion)**
  - Bob O'Brien noted flooding on the Pines River area during high tides and storm events. Beach erosion and scouring. Major transportation routes such as Route 1A, Route 107, and the MBTA Blue Line have been flooded, which has isolated parts of the City.
  - Frank Stringi brought up the tornado of 2015 that damaged the center of the City, down Broadway on the Chelsea line, caused damage to store fronts, trees, utilities, etc. People were left homeless, some homes were demolished, and overall the City wasn't prepared. (Another attendee noted this occurred on July 28, 2014.) No loss of life was recorded for this incident.
  - Another vulnerability the City has is high marsh grass and phragmites. These have and can be sources of brush fires that are close to houses and can become challenging to control in high wind scenarios. The rail lines through the marsh sometimes create sparks which ignite adjacent vegetation.

- Heavy winds cause problems with trees and powerlines, which exacerbate utility companies and emergency response staff.
- One attendee observed that interior flooding seems to occur in Revere on a monthly basis now; more often than when the plan was last updated.
- Elle Baker mentioned the Route 1A study conducted by the Boston Region MPO touches upon things such as the phragmites and Route 1A flood mitigation. She also reported that Mills Avenue floods often now at king tides and sometimes even at high tide.
- Elle noted that the Beachmont area is a high priority as well, but it needs a higher rate of funding than MVP can offer. The HMP update will allow them to apply for more funding through FEMA grant programs.
- Frank noted the City has ongoing and future stormwater improvement projects to mitigate flooding such as the Eastern County Ditch drainage improvement project; as well as other projects that have been implemented since the plan was last updated.
- Frank also brought up construction in the flood plain, specifically Suffolk Downs – everything built will be planned with updated resiliency standards.
- Bob O'Brien touched on the new FEMA flood maps (2016) and what a useful tool this is moving forward for instituting resiliency during the construction phase for new developments.
- Elle brought up the progressive initiatives that have been in progress. One such initiative is the Saugus River Flood Gate Project. This project has been in the works for decades and involved collaboration between five cities/towns that will protect coastal properties. Objectives of this project include natural flood protection solutions. The towns/cities submitted an application for a feasibility study to Army Corp of Engineers, and also an application for a Regional Watershed Working Group. Progress is being made on many different fronts.
- Bob O'Brien brought up rising insurance rates in coastal areas. Noted this is a cost of not paying attention to resiliency. Bob recognized a much higher level of community awareness regarding hazard mitigation and resiliency, even in the few years since the plan was last updated.
- Aaron asked Chief Bright if there are records of past events such as brush fires. Is that something we can follow up on to retrieve documentation of? Chief Bright responded yes.
- Bob and Elle expressed a desire for wildfires to be moved into a significant hazard.

5.0 Participation Requirements (Anna Foley presented)

- Members of the HMP planning team include those who participated in the last update, community leaders, government agency representatives, elected officials, interested citizens, etc.
- Anna explained how a wide range of organizational input ensures the mitigation plan is as comprehensive as possible.
- Stakeholder engagement is important in providing feedback not only on past events, but also for their thoughts on potential future issues (the so-called "accidents waiting to happen"). Current residents possess the most comprehensive understanding of the City's vulnerabilities to natural hazards and can provide feedback that can supplement data and information that is maintained online by state and federal agencies.

6.0 Status of the 2021 Plan Update (Aaron Weieneth presented)

- So far, the following tasks have been completed or initiated:
  - Updated land use based on MassGIS.
  - Updated mitigation actions included in the 2015 HMP.
  - Initiated update of critical facilities and infrastructure lists.
  - Initiated vulnerability assessment to compare critical facilities against updated hazards.
- Aaron presented the timeline of key future activities. Next item on the timeline is the Local HMP Committee Meeting #2 in early April. The HMP update is scheduled to wrap up by the end of June 2021.

7.0 Feedback on Strategy and Action Development & Preliminary Actions for 2021 HMP

- Aaron reviewed a summary of the 43 mitigation actions included in the 2015 HMP and MVP Community Resilience Building Risk Matrix Summary Table.
- Aaron then reviewed some of the new actions that will be included in the 2021 HMP, such as an upgrade of the Point of Pines pump station and pump, increasing the City's tree canopy, beach nourishment and erosion control, and Ambrose Park drainage improvements.
- Bob O'Brien noted he would like to see the mitigation actions listed according to their state of readiness.

8.0 Group Discussion – Suggestions for additional actions?

- Elle noted that the new Point of Pines Fire Station is a huge benefit to residents along Revere Beach Boulevard with the additional future 3,500 units.
- Bob noted the City is building a new DPW facility and need to think about how new capabilities can be incorporated.
- Paul Argenzio said they are trying to make the DPW facility be net zero with its own power source. It will be protected from flooding even though the facility is along the marsh.
- Bob suggested that Suffolk Downs, the new DPW facility, and the new Point of Pines Fire Station stand as a testament to the City's ongoing commitment and dedication to hazard mitigation and resiliency.

Hazard Mitigation Stakeholders

Entity	Contact Name
State Agencies	
DCR	
MassDot	Steve Miller
MBTA	Hannah Lyons-Galante
MWRA	
ACOE	Kennelly, John R CIV USARMY CENAE (USA
MPO	Seth Asante
City of Revere	
Mayor	Brian Arrigo
Revere Office of Planning and Development	Elle Baker, Project Planner
Director of Planning and Community Development	Tech Leng
Revere Office of Planning and Development	Frank Stringi, Chief City Planner
Revere Office of Planning and Development	Julie Demauro, Transportation Coordinator
Revere Office of Engineering	Nick Rystrom, Don Ciaramella
Revere Police Department	Chief Callahan
Revere Fire Department	Chief Bright
Emergency Management -RFD	Captain Fortuna
Superintendent, Revere DPW	Paul Argenzio
Revere Housing Authority	
Revere Commission on Disabilities	Ralph Dicicco
Revere Conservation Department	TBD
311 Department	Reuben Cantor
City Clerk to Revere City Council	Ashley Melnik
Service Providers	
NGRID	Dan Cameron
RCN	
COMCAST	
Developers	
HYM	O'Brien
Redgate	Damian Szary
Gansett Ventures	
Post Road	
Hospitals	
East Boston Neighborhod Health	
Cambridge Health Alliance	
Mass General Hospital	
Neighborhood Associations	
Revere Community Council (Shirley Ave Area)	

Beachmont Improvement Committee	Kathleen Heiser
North Revere Neighborhood Group	Vanessa Biasella
Oak Island Neighborhood Group	Margo Johnson
Point of Pines Beach Association	Jack Polcari - Environmental
Riverside Association	Elaine Hurley
Point of Pines Yacht Club	Vincent Piccinni

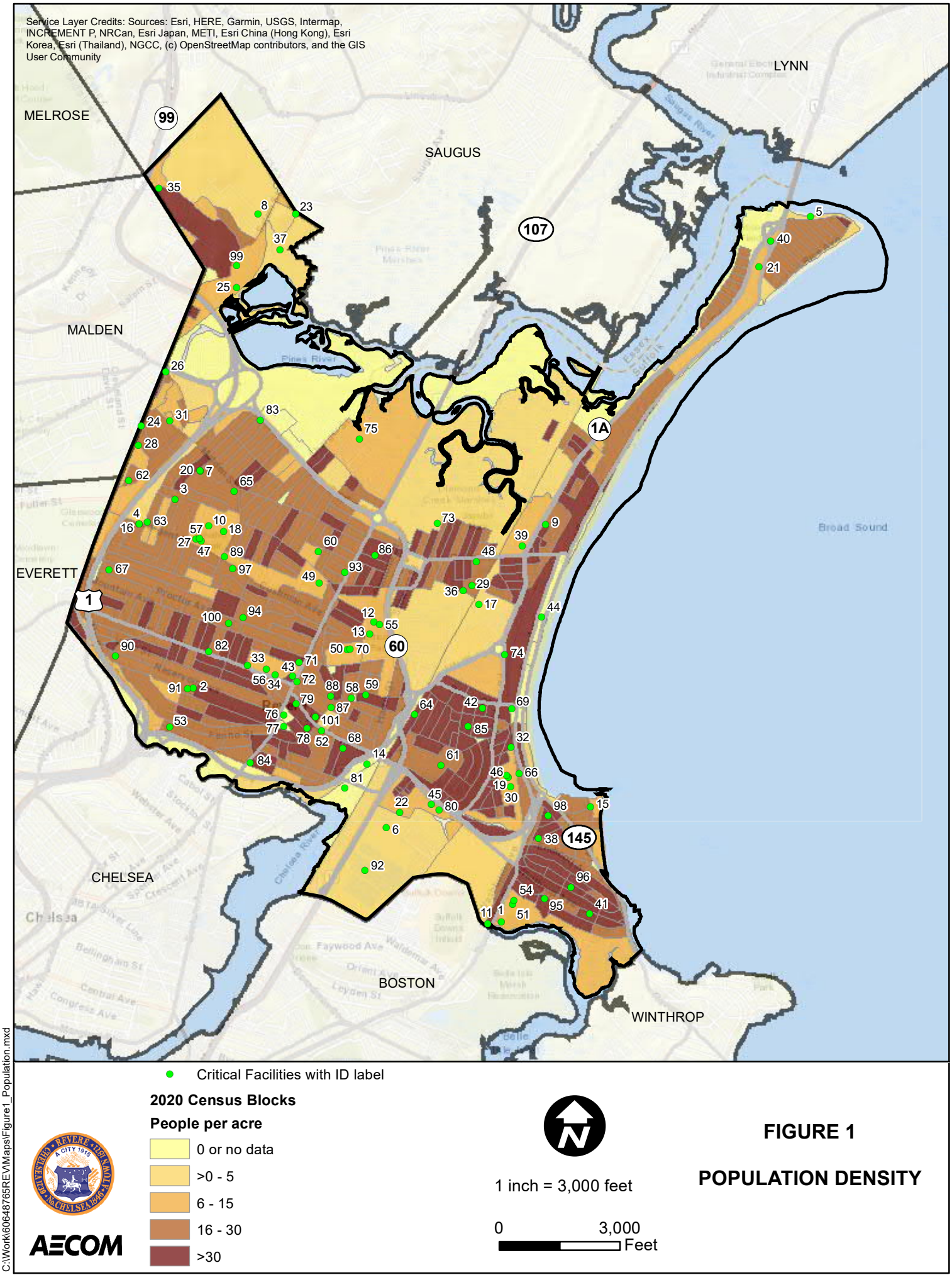
Environmental	
Conservation Commission	
Saugus River Watershed Council	Mary Lester
Resilient Mystic Collaborative	Julie Wormser
Friends of Belle Isle Marsh	Barbara Bishop
Alliance for Health and the Environment	Roselee Vincent
MVP- EOEEA	Carolyn Mekenburg

Emergency Service Providers	
Action	Mike Zacharia
Cataldo Ambulance	

Other Communities	
Chelsea	Tom Ambrosino
Chelsea	Alex Train
Winthrop	Rachel Kelly
Saugus	Scott Crabtree
Saugus	Chris Riley
Lynn	Mayor McGee
Malden	Gary Christienson
Everett	Tom Philbin
Everett	

State Legislature	
State Representative	Jessica Giannino
State Senator	Joseph Boncore

Appendix B Maps


Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community
MELROSE
LYNN
SAUGUS
MALDEN
EVERETT
CHELSEA
BOSTON
WINTHROP
Broad Sound
99
107
1A
1
60
145
Critical Facilities with ID label
2020 Census Blocks
People per acre
0 or no data
>0 - 5
6 - 15
16 - 30
>30
1 inch = 3,000 feet
0
3,000
Feet
FIGURE 1
POPULATION DENSITY
AECOM
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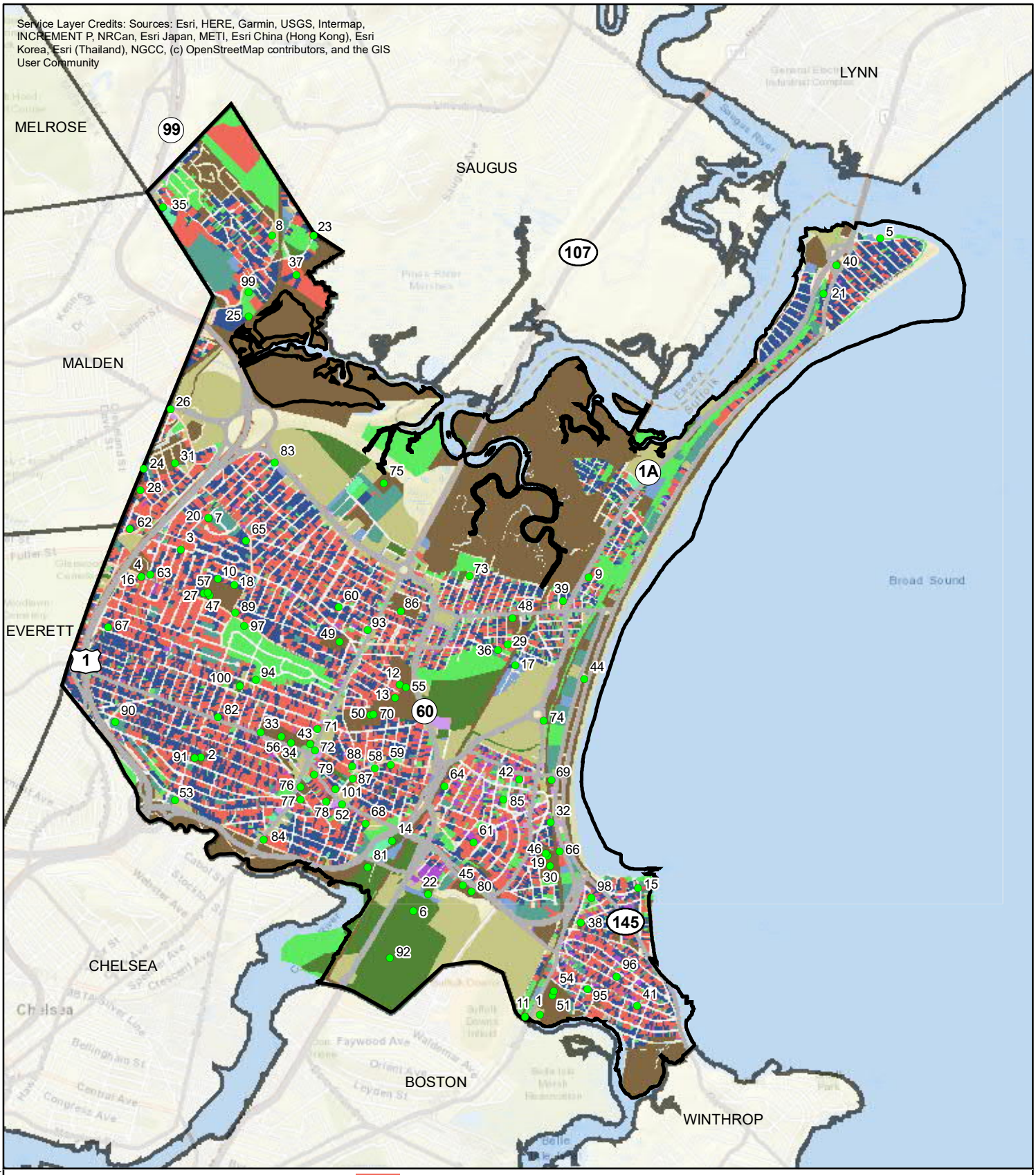
Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community
MELROSE
LYNN
SAUGUS
MALDEN
EVERETT
CHELSEA
BOSTON
WINTHROP
Broad Sound
99
107
1A
1
60
145
Critical Facilities with ID label
Land Use
0
Single Family
Educational
Industrial
Tax Exempt Property
Duplex/Triplex
Apartments (<= 8 Units)
Apartments (> 8 Units)
Mixed Use
Recreational
Commercial - Low Density
Commercial - High Density
1 inch = 3,000 feet
0
3,000
Feet
FIGURE 2
DEVELOPMENT
AECOM
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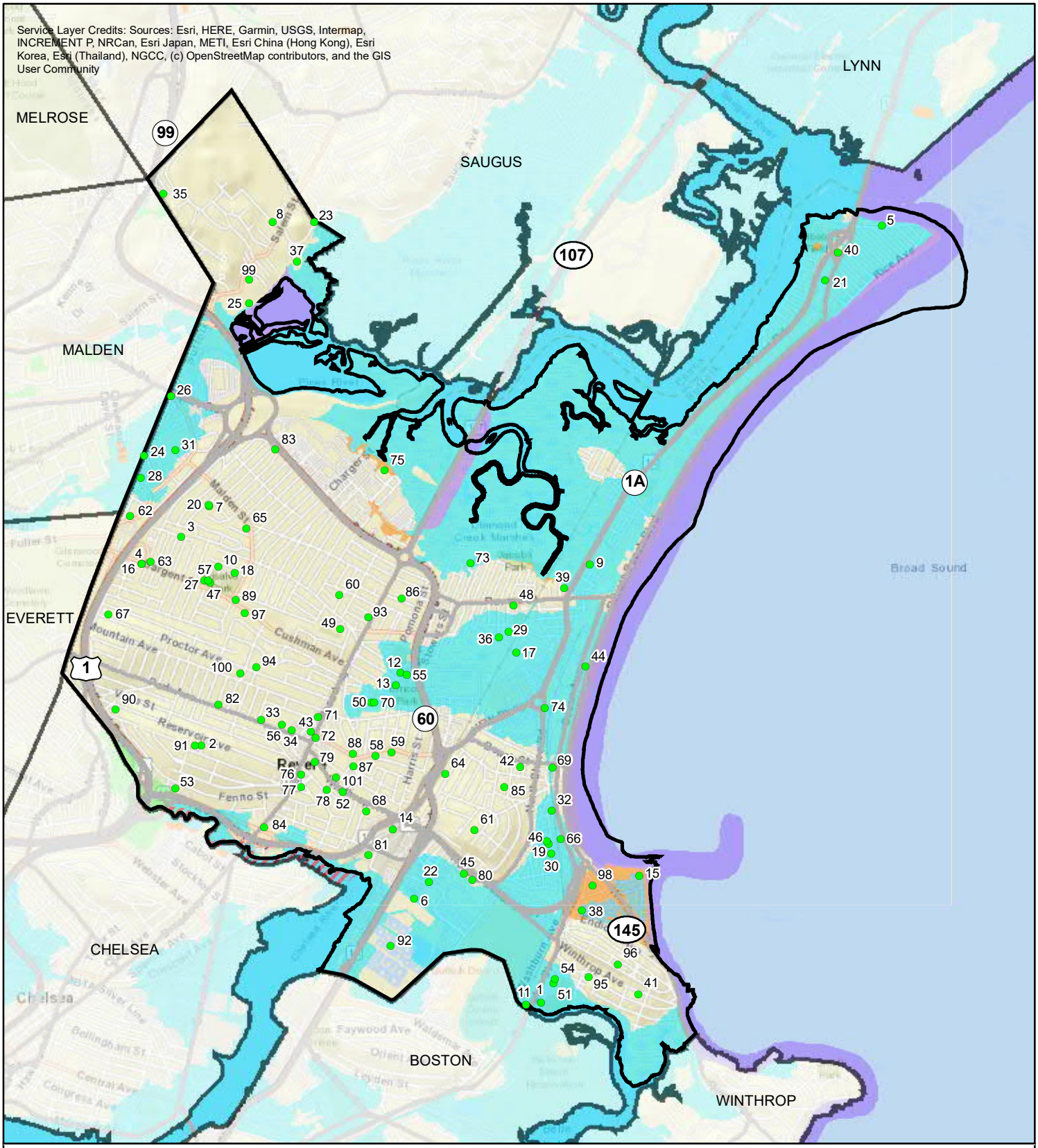

Critical Facilities with ID label

FEMA National Flood Hazard Layer

Flood Zone Designations

- A: 1% Annual Chance of Flooding, no BFE
- AE: 1% Annual Chance of Flooding, with BFE
- AE: Regulatory Floodway
- AH: 1% Annual Chance of 1-3ft Ponding, with BFE
- VE: High Risk Coastal Area
- X: 0.2% Annual Chance of Flooding

1 inch = 3,000 feet

0 3,000 Feet

FIGURE 3

FEMA FLOOD MAP

AECOM

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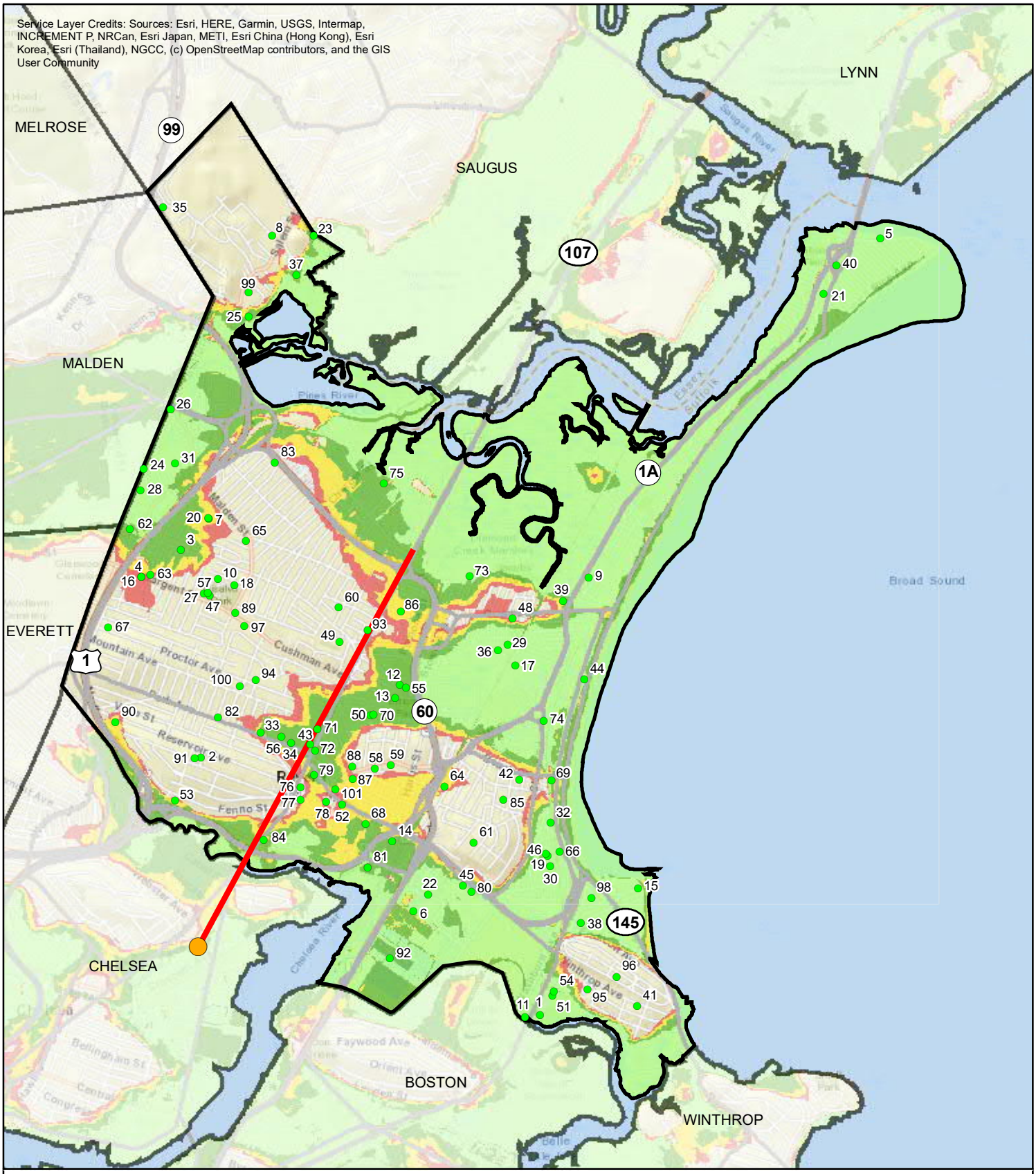

Critical Facilities with ID label

Worst-case Hurricane Surge Inundation Zones

Hurricane Category

- Category 1
- Category 2
- Category 3
- Category 4
- Tornado Origin and Path

1 inch = 3,000 feet

0 3,000 Feet

FIGURE 4

HURRICANES AND TORNADOS

AECOM

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Appendix C Plan Adoption

The City of Revere, Massachusetts Hazard Mitigation Plan – 2022 Update

Whereas natural and human-caused disasters may occur at any time, we recognize that to lessen the impacts of these disasters we will save resources, property, and lives in the City;

And whereas the creation of a Hazard Mitigation Plan is necessary for the development of a risk assessment and effective mitigation strategy;

And whereas duly-noticed public meetings were held on March 3, 2021 and October 7, 2021;

And whereas, the City is committed to the mitigation goals and measures presented in the plan;

Therefore, the City hereby adopts the Revere, Massachusetts Hazard Mitigation Plan – 2022 Update.

Authorizing Signatures

Name: _____ Title: _____ Date: _____

Name: _____ Title: _____ Date: _____

Name: _____ Title: _____ Date: _____

Name: _____ Title: _____ Date: _____

Name: _____ Title: _____ Date: _____