Collins Cove to Willows Resilience Study

Workshop #3

May 23, 2023

RESILIENT TOGETHER

Salem Sound COASTWATCH

Delivering a better world

aecom.com

WELCOME AND INTRODUCTION

Agenda

- Purpose of Workshop
- Overview of Collins Cove to Willows Resilience Study and Recap of Workshop #2
- Vulnerability and Risk Assessment Results
- Resilience Options for Priority Areas
- Emergency Response Plan Update
- Next Steps / Finalizing Study

RESILIENT TOGETHER
OUR BRIDGE TO A STRONGER TOMORROW

Salem Sound COASTWATCH

Purpose of Workshop

- Provide an update on the Study
- Share key results from coastal and inland flooding vulnerability assessment and identify priority areas
- Identify possible flood mitigation and climate adaptation options for the priority areas and seek feedback

Juniper Beach during December 23, 2022 storm

Why this Project?

Study area vulnerable to flooding:

Coastal

- Sea level rise (tides)
- Storm surge (wind)

Rainfall (aka stormwater or inland)

Coastal and rainfall together

This project is being funded in large part by a Municipal Vulnerability Preparedness (MVP) program Action Grant through the MA Executive Office of Energy and Environmental Affairs.

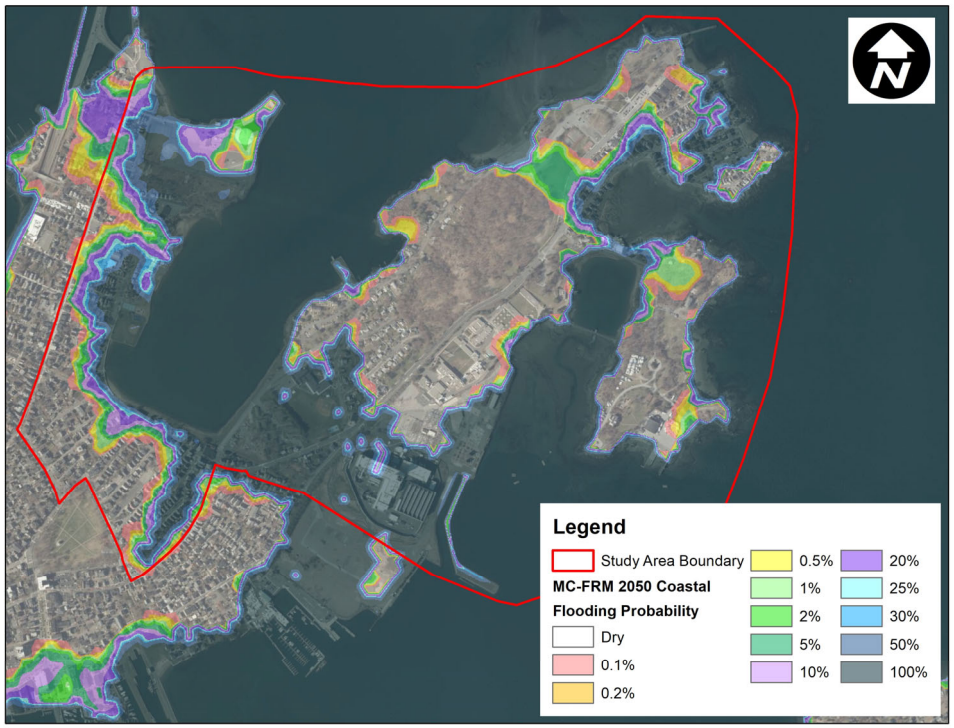
Project Objectives

- Assess flooding vulnerability and risk - now and future
- Find opportunities on city property for resilient measures
- Develop an emergency response and evacuation plan
- Create an implementation plan to increase resilience

For details, please visit Salem's Public Input page.
In your browser type "Salem Public Input" to find the **Salem, MA Engagement Hub** then scroll to Collins Cove to Willows Resilience Study

Recap of Workshop #2

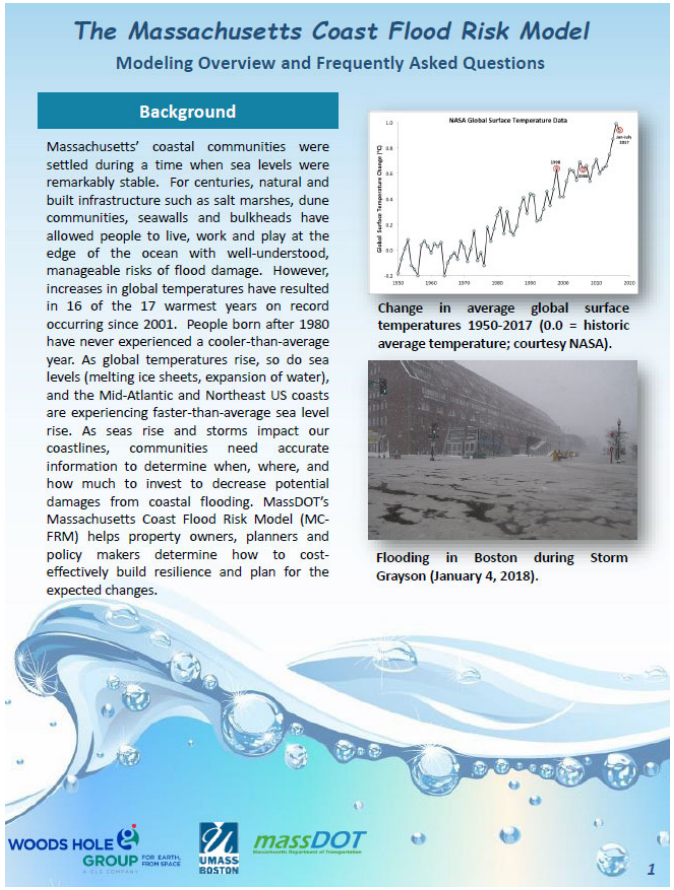
- Main objective: Share preliminary results from the coastal and inland flooding vulnerability assessment and obtain input on what stakeholders would like to see for potential flood mitigation and climate adaptation options



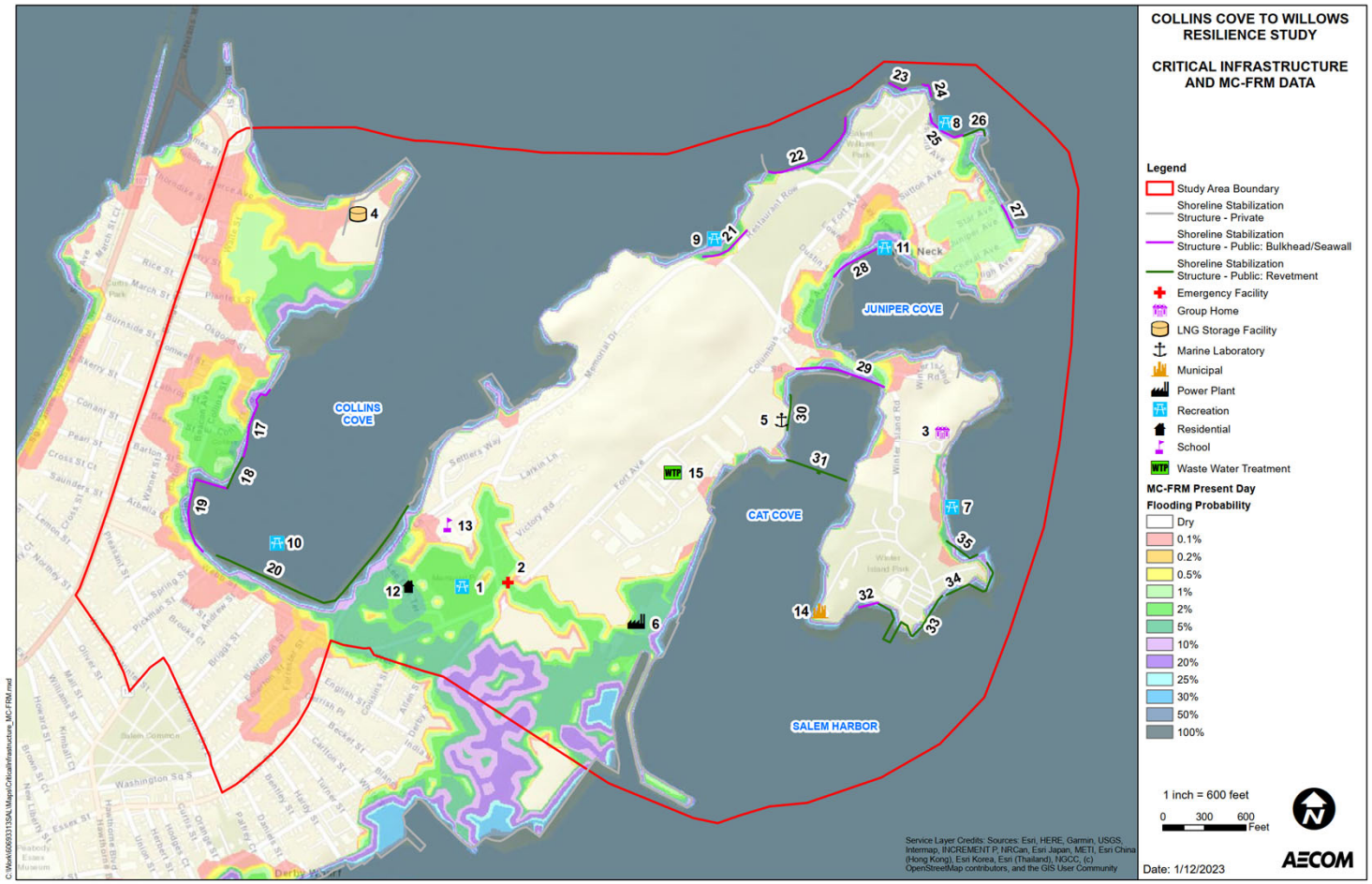
Vulnerability and Risk Assessment Results

Massachusetts Coast Flood Risk Model (MC-FRM)

- Considered the best available coastal modeling that is readily available for the entire coastline of the state
- Use of MC-FRM data for climate adaptation planning is encouraged by the State
- Probabilistic model where results are derived by simulating thousands of storms (hurricanes, nor'easters) and accounts for sea level rise
- It DOES NOT include pluvial flooding caused by rainfall that does not drain adequately to a water body
- Results available for Present Day (2008), 2030, 2050, and 2070
- Has been used for other resilience projects in Salem, and is being used for the coastal flooding analysis for this study

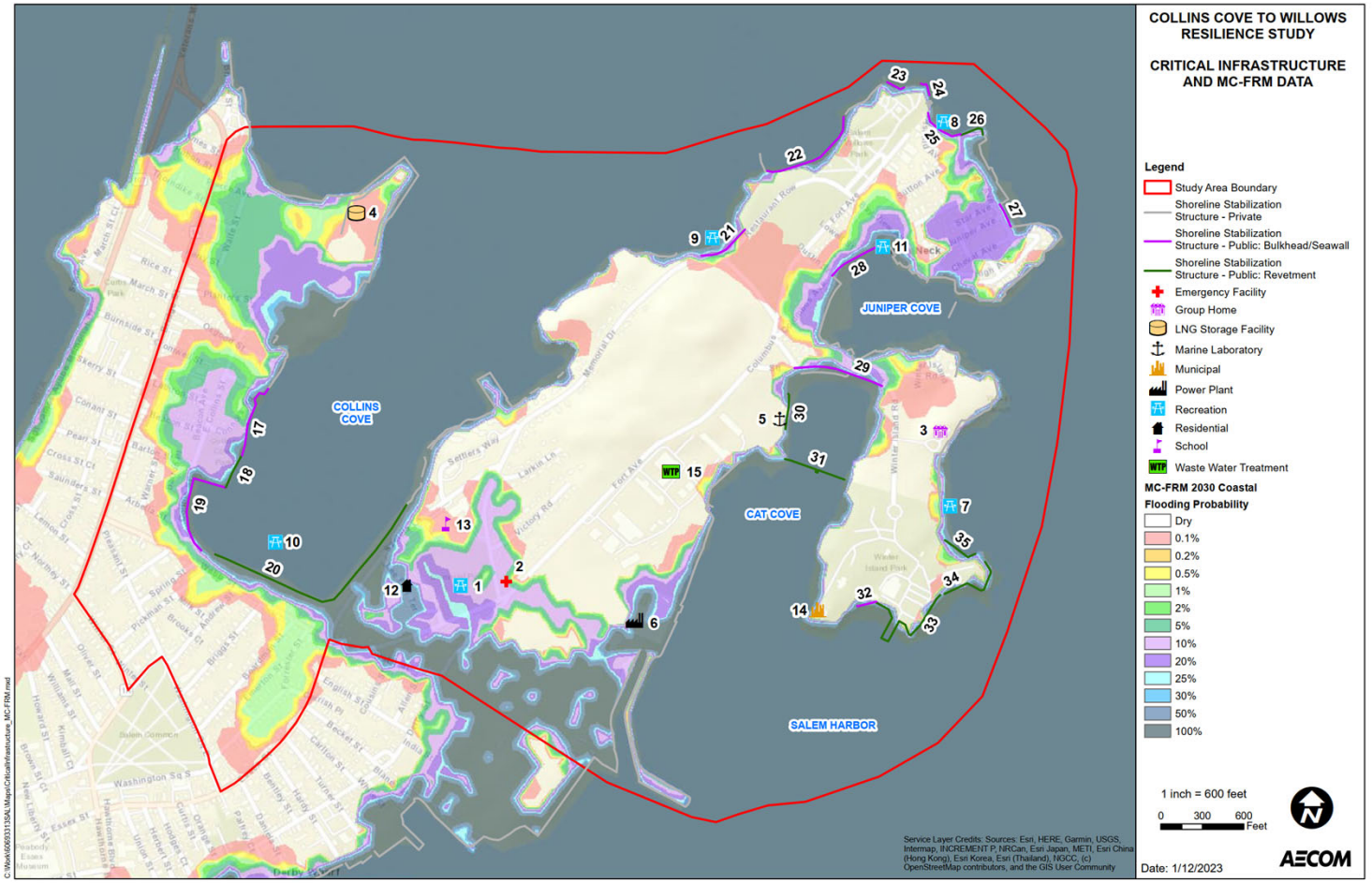


MC-FRM Present (2008) Coastal Flooding Probability



Collins Cove to Willows Resilience Study / **Collins Cove al Willows estudio de resiliencia**

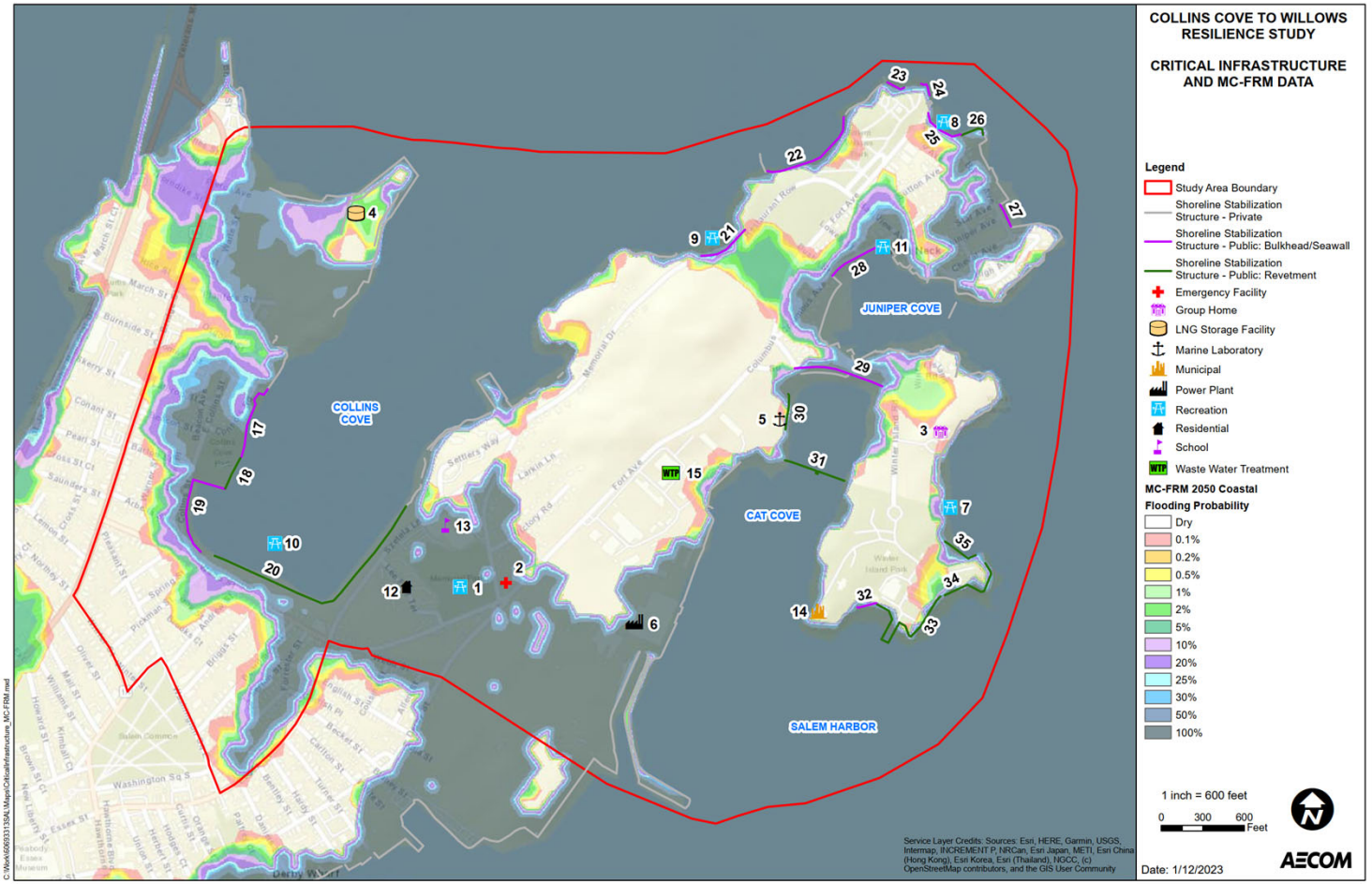
MC-FRM 2030 Coastal Flooding Probability



Collins Cove to Willows Resilience Study / **Collins Cove al Willows estudio de resiliencia**

aecom.com

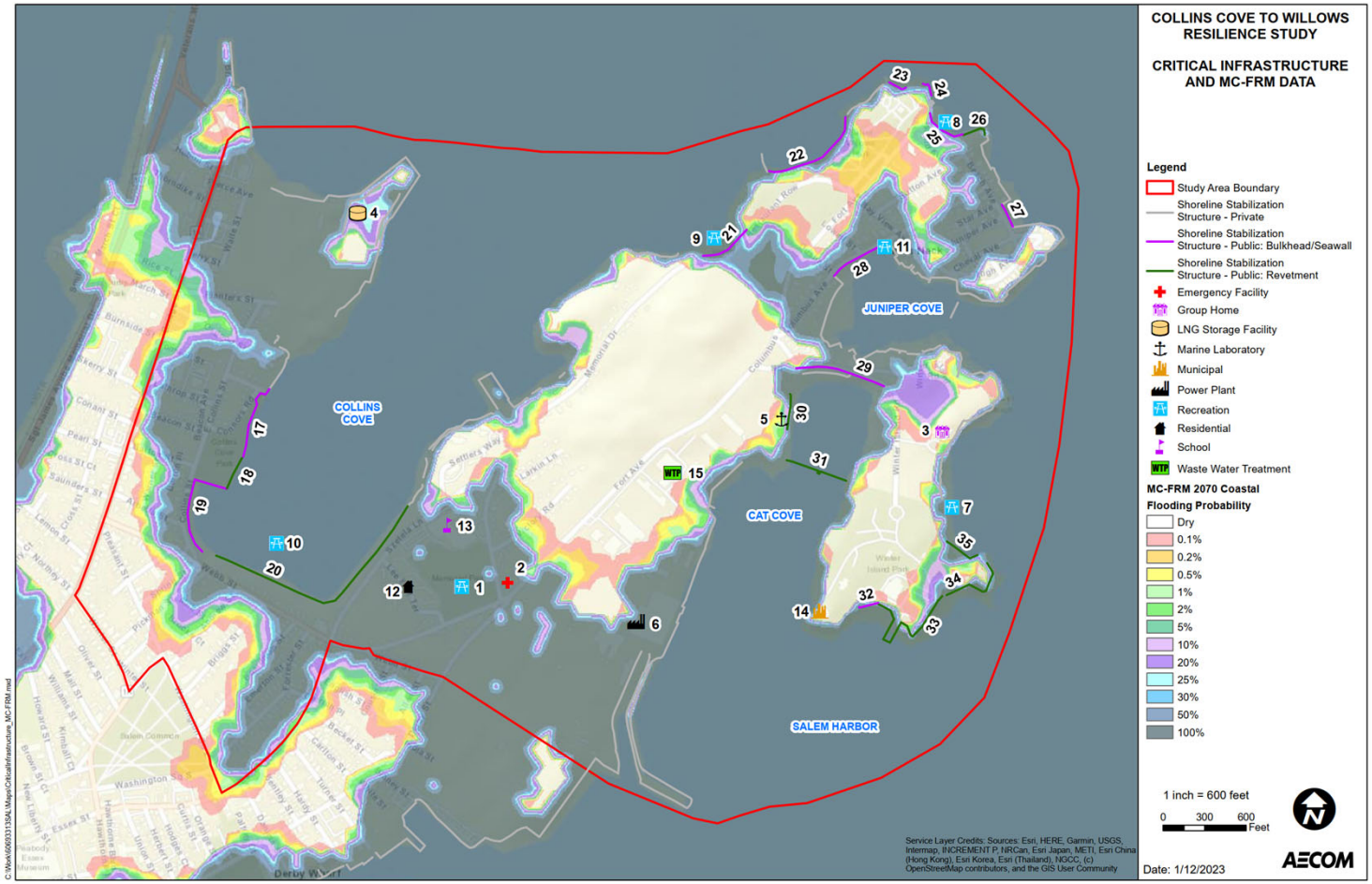
MC-FRM 2050 Coastal Flooding Probability



Collins Cove to Willows Resilience Study / **Collins Cove al Willows estudio de resiliencia**

aecom.com

MC-FRM 2070 Coastal Flooding Probability



Collins Cove to Willows Resilience Study / **Collins Cove al Willows estudio de resiliencia**

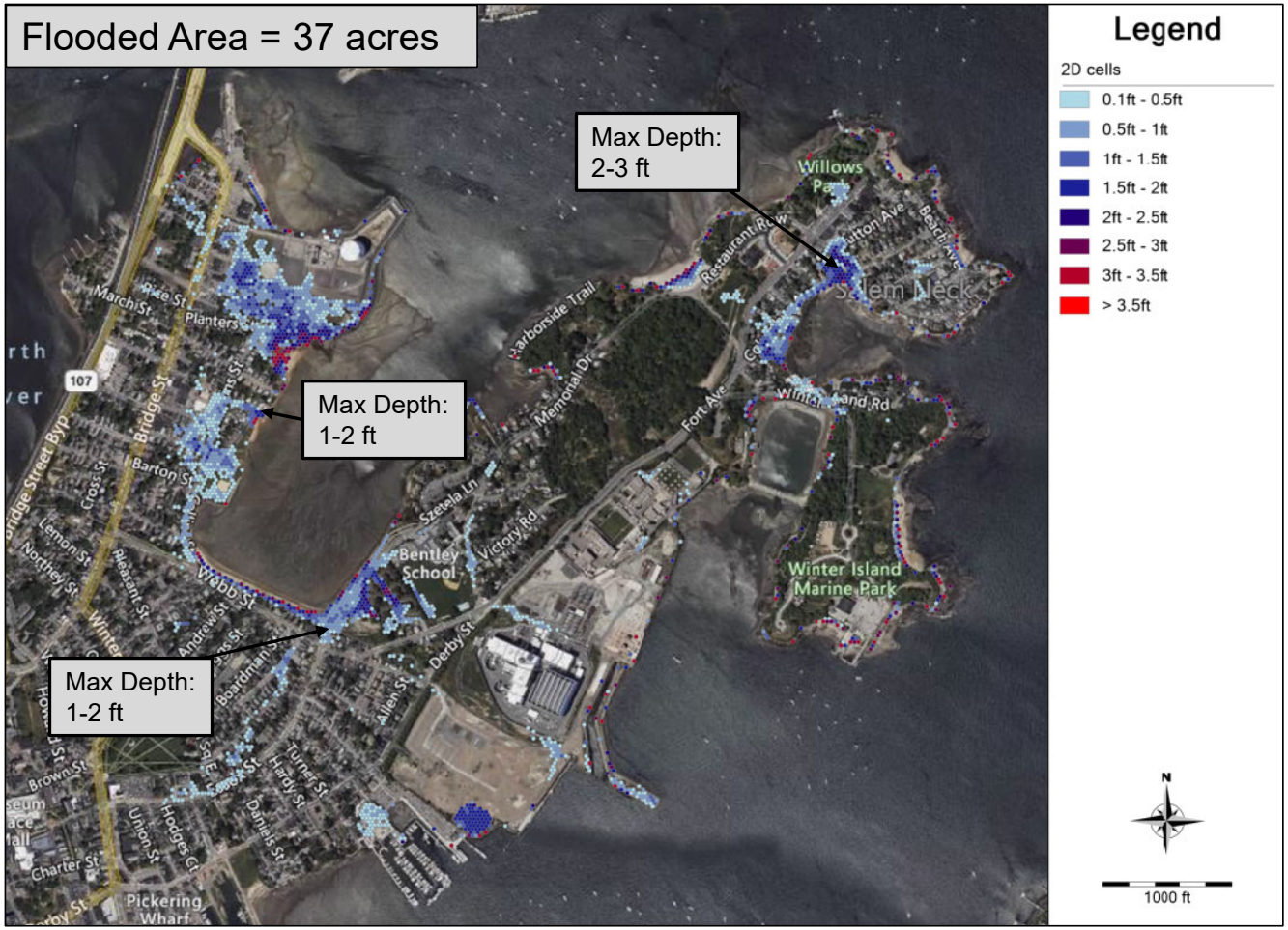
aecom.com

Vulnerability and Risk Assessment Results

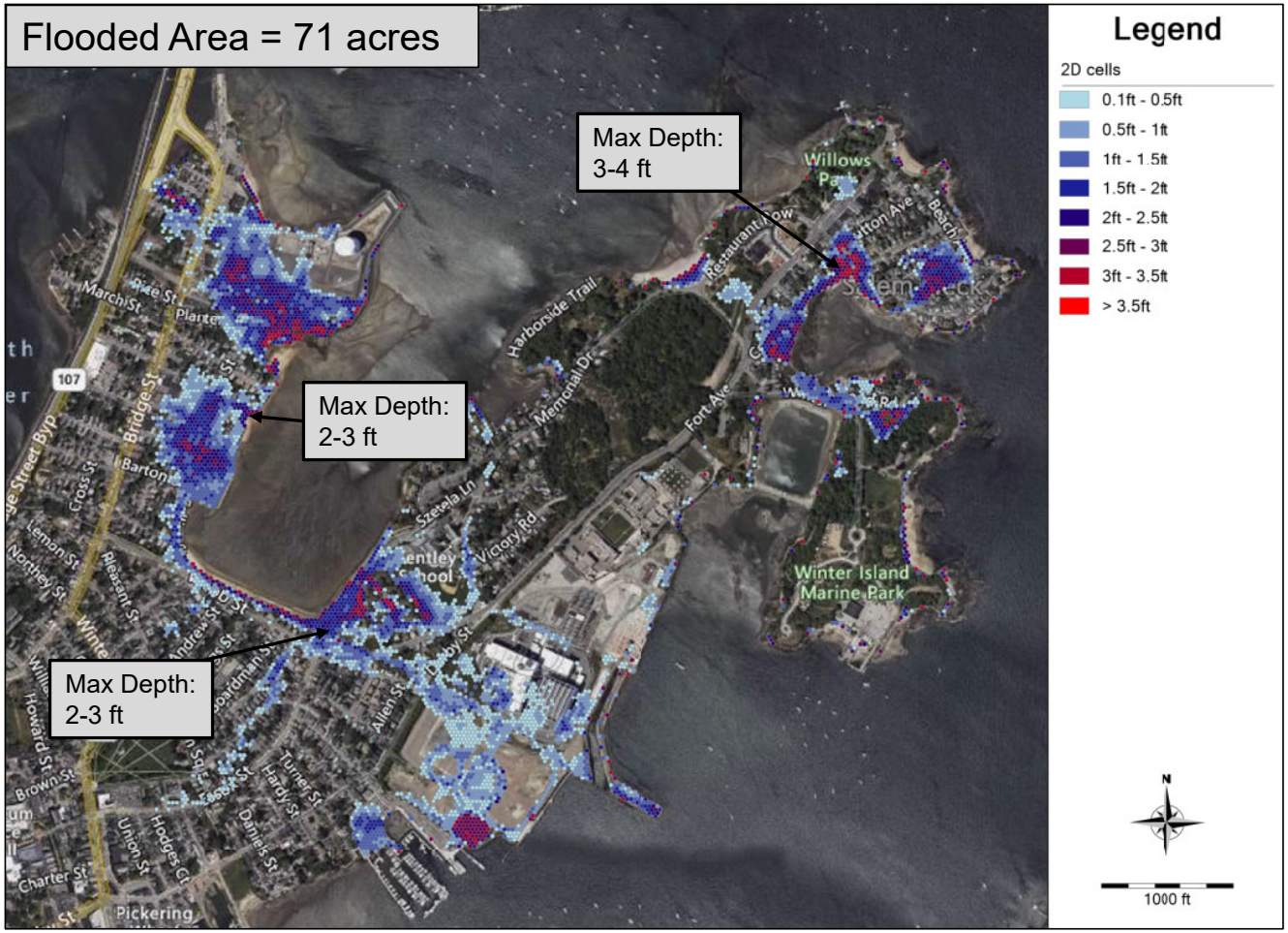
SWMM Model Development

- Created with the goal of predicting current day and future flooding due to precipitation, astronomical high tides, and storm surge through mathematical equations which calculate a hydrologic (water on land) and hydraulic (flow through pipes) responses
- Represents the City's existing drainage infrastructure (manholes, pipes, outfalls), and topography
- Model verification was completed based on the December 2022 storm event and public insight from public workshops 1 and 2 to identify areas that are susceptible to flooding
- Model inputs (rainfall, tides) for future conditions were obtained from Woods Hole Group through the Massachusetts Coastal Flood Risk Model (MC-FRM) and Cornell projected rainfall depths for the 2030, 2050, and 2070 planning horizons

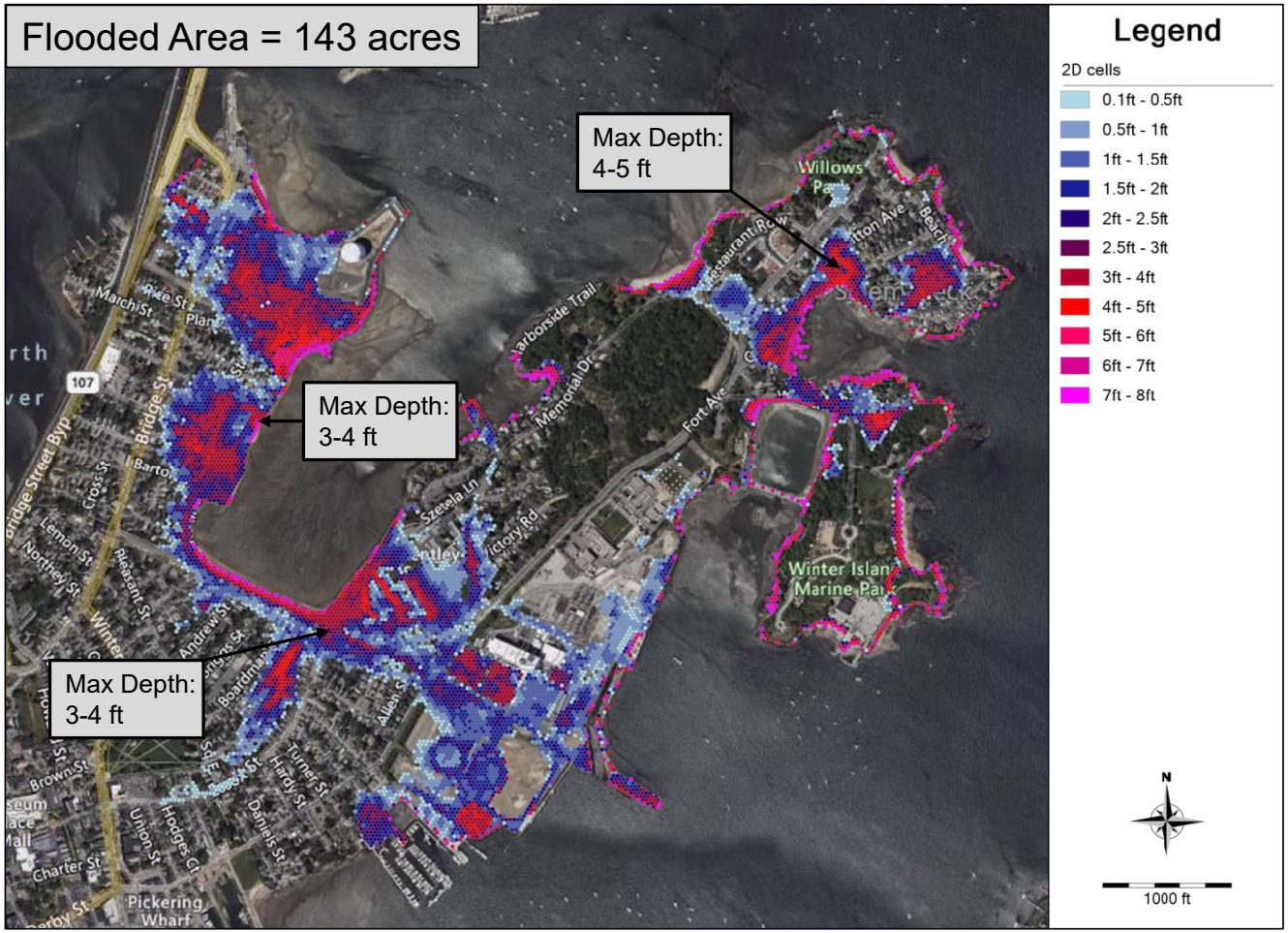
Model Predicted Present (2008) Storm Surge + Present 5-Year Rainfall Flooding



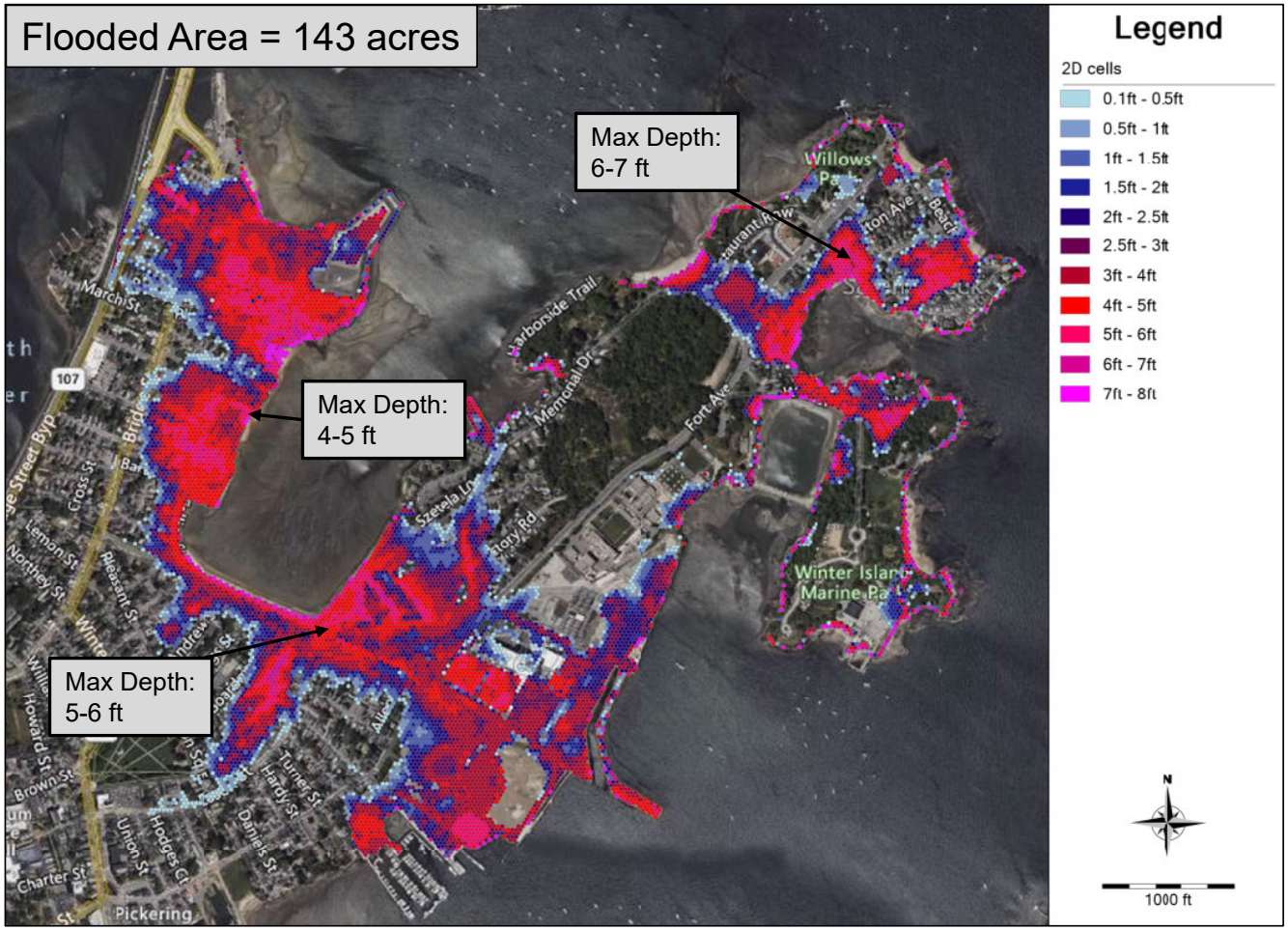
Model Predicted 2030 Storm Surge + 2030 5-Year Rainfall Flooding



Model Predicted 2050 Storm Surge + 2050 5-Year Rainfall Flooding



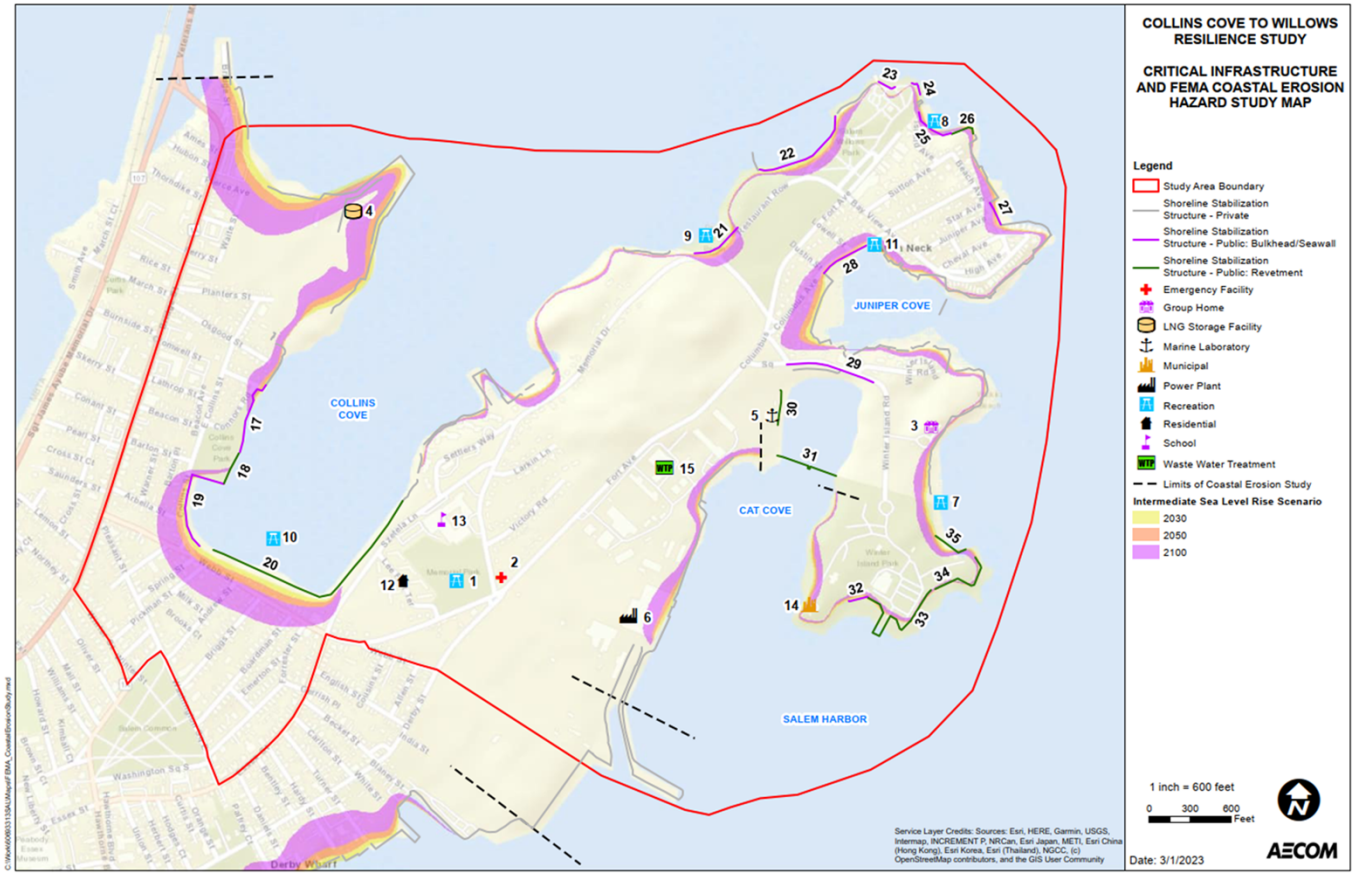
Model Predicted 2070 Storm Surge + 2070 5-Year Rainfall Flooding



Vulnerability and Risk Assessment Results

Erosion

- CZM Shoreline Assessment (Existing Conditions)
- FEMA Region I Erosion Hazard (Future Conditions)
- Erosion for an intermediate sea level rise scenario is shown on the right



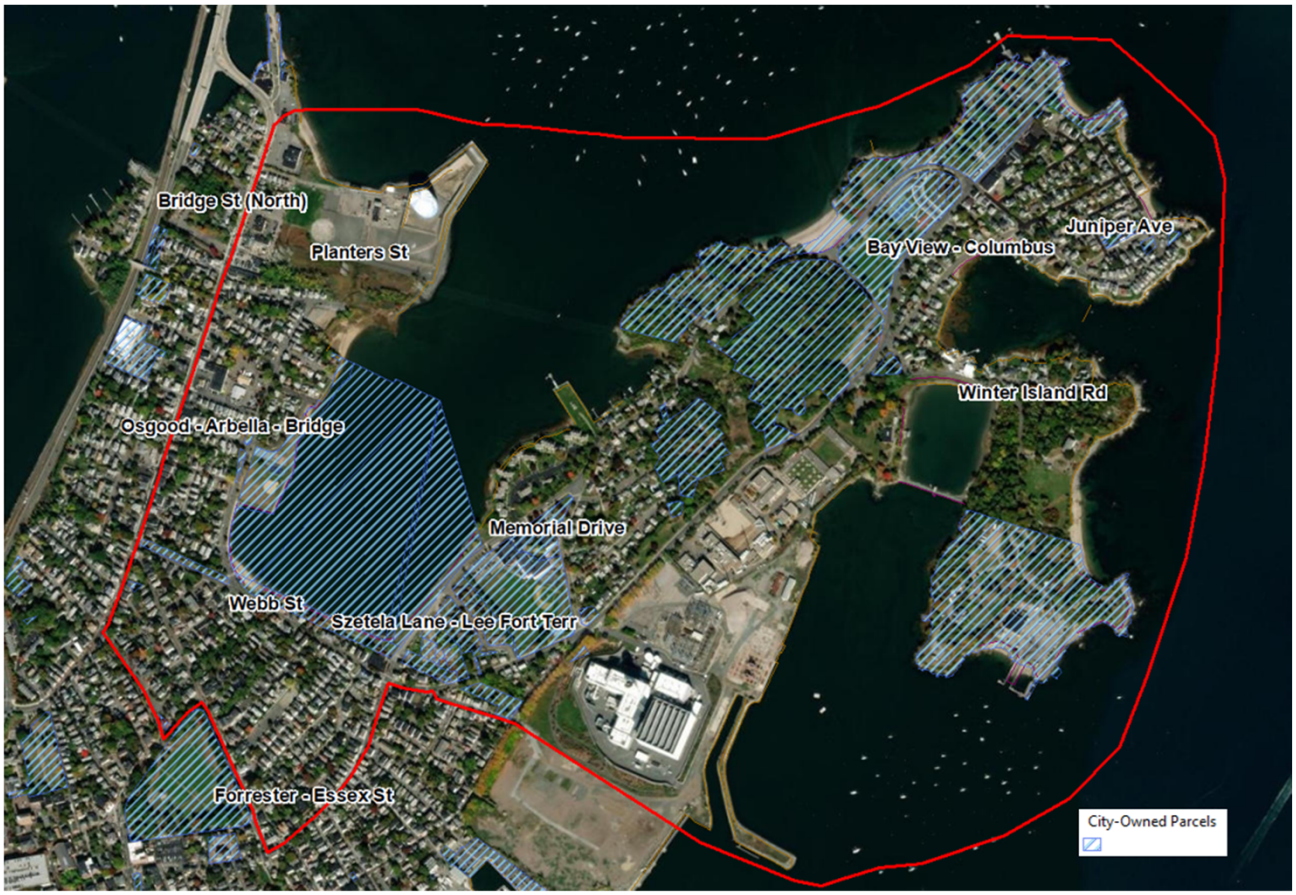
Vulnerability and Risk Assessment Results

Identification of Priority Areas

- Goal: Identify the most vulnerable areas based on the results of the Vulnerability and Risk Assessment
- Considered areas with most severe flooding from both Pluvial/Stormwater and Coastal sources
- Used flooding scenarios from 2050
- Residential areas, critical roadways, and areas with critical infrastructure identified by the City of Salem were prioritized

Priority Areas

- Forrester - Essex St
- Webb St
- Szetela Lane - Lee Fort Terrace
- Bay View - Columbus
- Bridge St (North)
- Osgood - Arbella - Bridge
- Juniper Ave
- Memorial Drive
- Planters St
- Winter Island Rd

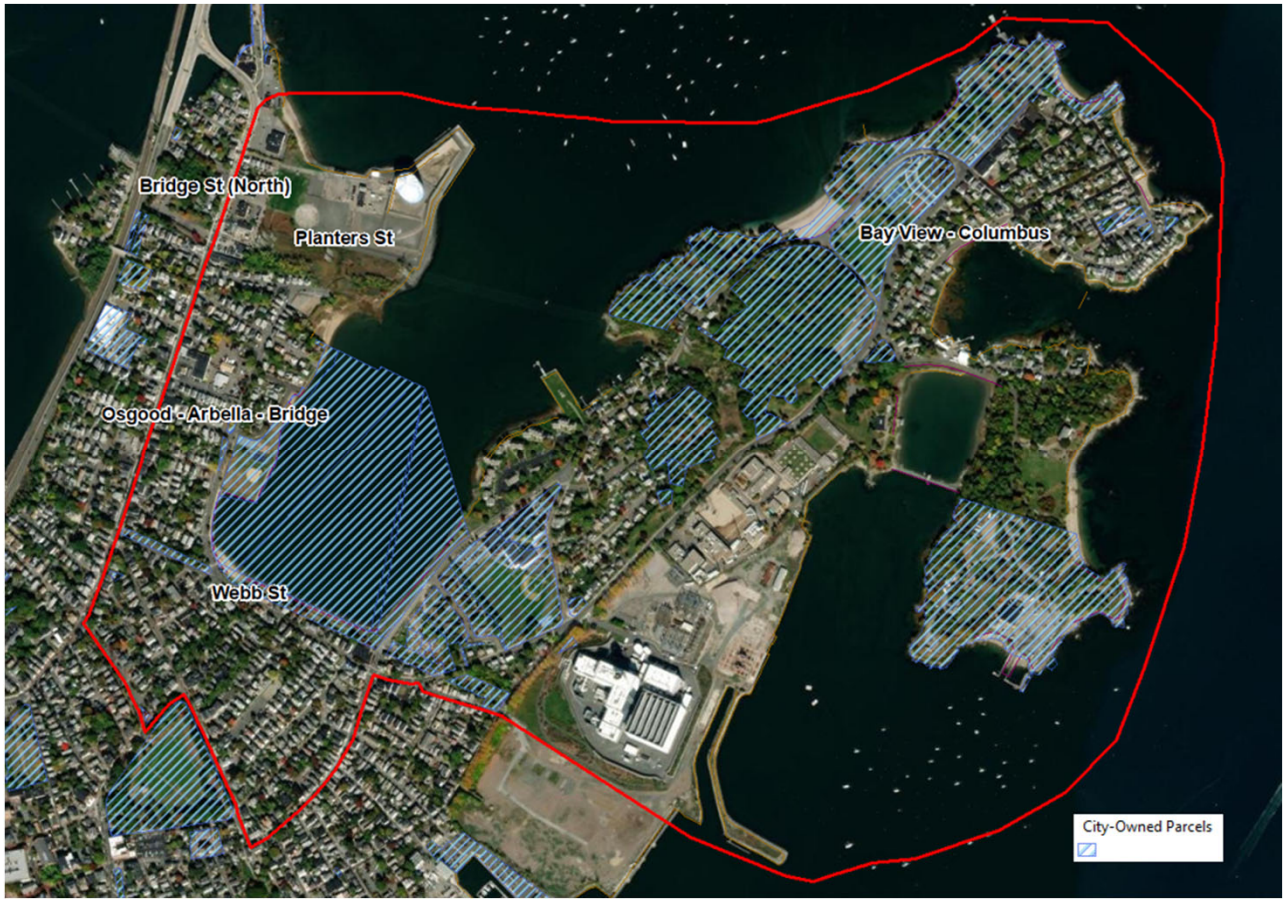


Preliminary Draft Results

Impacted Areas	Pluvial Flood Vulnerability		Coastal Flood Vulnerability		Erosion Vulnerability	Community Vulnerability		Score
	Stormwater Flooded Area (2050 5-yr)	*Stormwater Flood Depth (2050 5-yr)*	*MC-FRM Annual Coastal Flood Probability (2050)*	*Spring Tide Coastal Flooded Area (2050)*	*2050 Intermediate Erosion*	*Evacuation Route / Major Road*	*Environmental Justice*	
Bridge St (North)	3	2	2	2	3	3	3	18
Bay View - Columbus	2	2	3	3	3	3	0	16
Osgood - Arbella - Bridge	3	2	3	2	3	0	3	16
Webb St	1	1	3	1	3	3	3	15
Planters St	1	2	3	3	3	0	3	15
Szetela Lane - Lee Fort Terr	2	2	3	3	0	0	3	13
Winter Island Rd	1	2	3	1	3	3	0	13
Juniper Ave	2	2	3	1	3	0	0	11
Forrester - Essex St	3	2	3	1	0	0	0	9
Memorial Drive	2	2	3	1	0	0	0	8

Highest Scores (15+) – Priority Areas to Focus On

- Bridge St (North): 18
- Osgood - Arbella – Bridge: 16
- Bay View – Columbus: 16
- Webb St: 15
- Planters St: 15



Resilience Options for Priority Areas

- Developed a toolkit of resilience options that can be implemented for coastal parks
- Will serve as a resource for future climate resilience projects for Salem and other coastal municipalities
- Identifies key design components for each option and a case study
- Organized into four sections:
  1. Non-structural measures
  2. Stormwater management
  3. Nature-based shoreline protection
  4. Structural flood risk reduction measures
- Resilience options for buildings and roads are not included, but identified separately as needed for the priority areas

Resilience Options for Priority Areas

- Included in Toolkit

NON-STRUCTURAL MEASURES

PUBLIC EDUCATION

OPEN SPACE PRESERVATION

LAND ACQUISITION

DEVELOPING A TOOLKIT:

No single solution will address the many needs and issues of coastal parks located throughout the Collins Cove to Willows study area. To enable a sustainable, resilient future for these spaces, a multitude of approaches is necessary. This toolkit is a resource for future adaptation measures within the City of Salem's coastal parks. Due to the general nature of these strategies, this toolkit also has the potential to be applied in coastal parks in other communities. Potential non-structural measures, stormwater management strategies, nature-based shoreline protection, and flood risk reduction measures are provided herein and discussed in the accompanying memorandum. Although there are some buildings and roads within and adjacent to the coastal parks in the study area, adaptation measures for these structures are not included in the Coastal Parks Resilience Toolkit since the focus of the toolkit is on open spaces and coastal resources. However, adaptation measures for buildings and roads will be discussed in the project report. Each of the measures included in this toolkit has a particular way of performing, addressing a need, and relating to other components, and thus deserve site-specific considerations. For this reason, a range of solutions and combinations will likely be used to protect these parks.

AECOM

STORMWATER MANAGEMENT

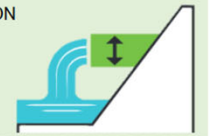
ONSITE FLOOD STORAGE (ABOVE GROUND)

CULTEC, Inc.

ONSITE FLOOD STORAGE (BELOW GROUND)

PERMEABLE SURFACES

BIORETENTION BASIN



INCREASED STORMWATER PIPE CAPACITY

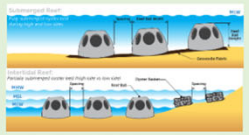
Red Valve Company, Inc.

BACKFLOW PREVENTION

RAIN GARDENS

NATURE-BASED SHORELINE PROTECTION

VEGETATED LIVING SHORELINES

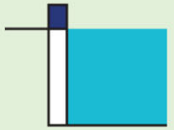


OYSTER REEF ENHANCEMENT

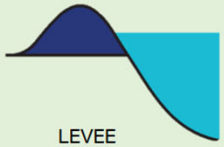
BEACH/DUNE RESTORATION

STRUCTURAL FLOOD RISK REDUCTION MEASURES

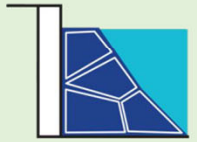
DEPLOYABLE BARRIERS



BULKHEAD OR SEAWALL: CONSTRUCTION OR RAISING



LEVEE



REVETMENT

COASTAL PARKS RESILIENCE TOOLKIT

Resilience Options for Priority Areas

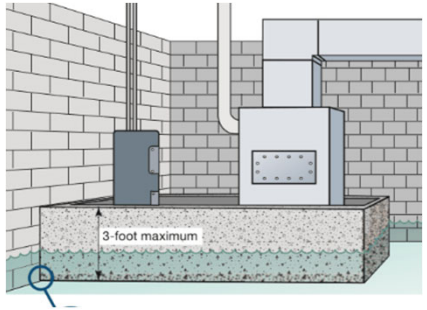
Applicable Resilient Coastal Parks Toolkit Options:

- Stormwater Outfall Backflow Prevention
- Living Shorelines
- Bioretention Basin/Rain Gardens
- Stormwater System Improvements
- Stormwater Storage/Subsurface Infiltration Basin
- Elevate Existing Seawalls
- Impervious Surface Reduction/Removal
- New Levee/Berm

Additional Resilience Options:

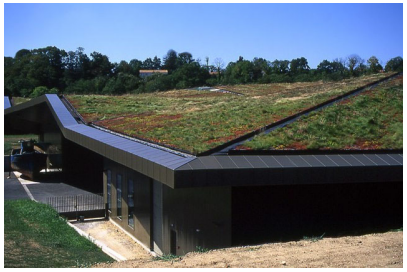
Alternative Access Route (Island Ave.)

Road Elevation



Floodproofing

Juniper Ave Breakwater (rebuilding)



Green Roofs

Resilience Options for Priority Areas

Resilience Option	Priority Areas				
	Bridge St North	Planters St	Osgood-Arbella-Bridge	Webb St	Bay View - Columbus
Stormwater Outfall Backflow Prevention	X		X	X	X
Living Shorelines		X		X	X
Bioretention Basin/Rain Garden	X				X
Stormwater System Improvements	X		X	X	X
Additional Temporary Stormwater Storage/Subsurface Infiltration Basin				X	X
Alternative Access Route					X
Elevate Existing Seawall/Shoreline			X		X
Impervious Surface Removal/Reduction	X				X
New Levee/Berm	X	X	X	X	
Juniper Ave Breakwater					X
Flood Gates		X	X	X	X
Road Elevation	X			X	X
Green Roofs	X	X	X	X	X
Floodproofing Buildings	X	X	X	X	X
Building Elevation			X	X	

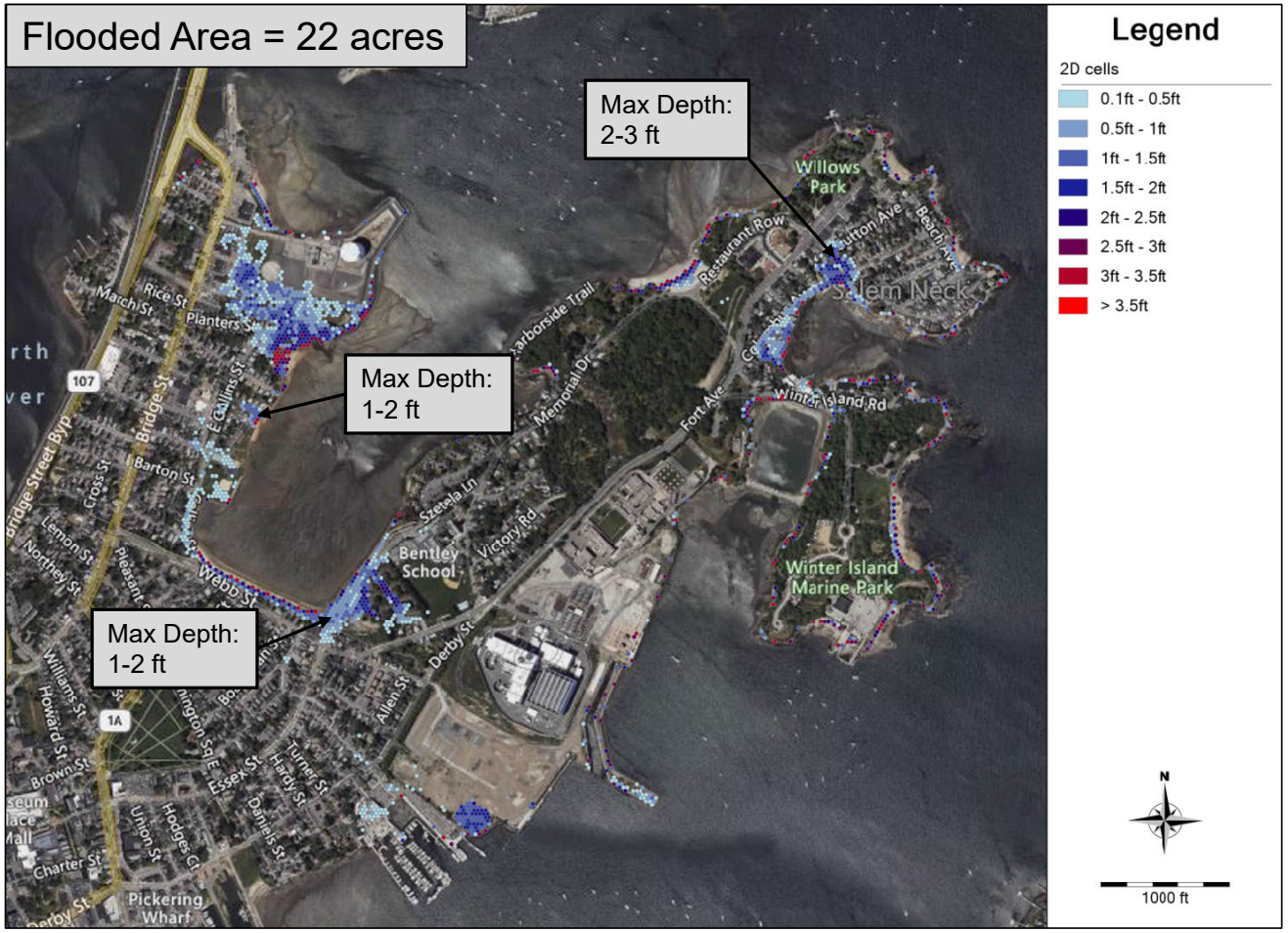
Resilience Options Feasibility Scoring

- Relative Cost
  - **High Cost**
  - **Moderate Cost**
  - **Low Cost**
- Funding Opportunities
  - **Unknown**
  - **Possible**
  - **Known**
- Ownership
  - **Private/Other**
  - **City of Salem**
- Community Acceptance
  - **Low**
  - **Medium**
  - **High**
- Permitting Complexity
  - **High**
  - **Medium**
  - **Low**
- Effectiveness
  - **Not Effective / Minimally Effective**
  - **Somewhat Effective**
  - **Effective / Very Effective**

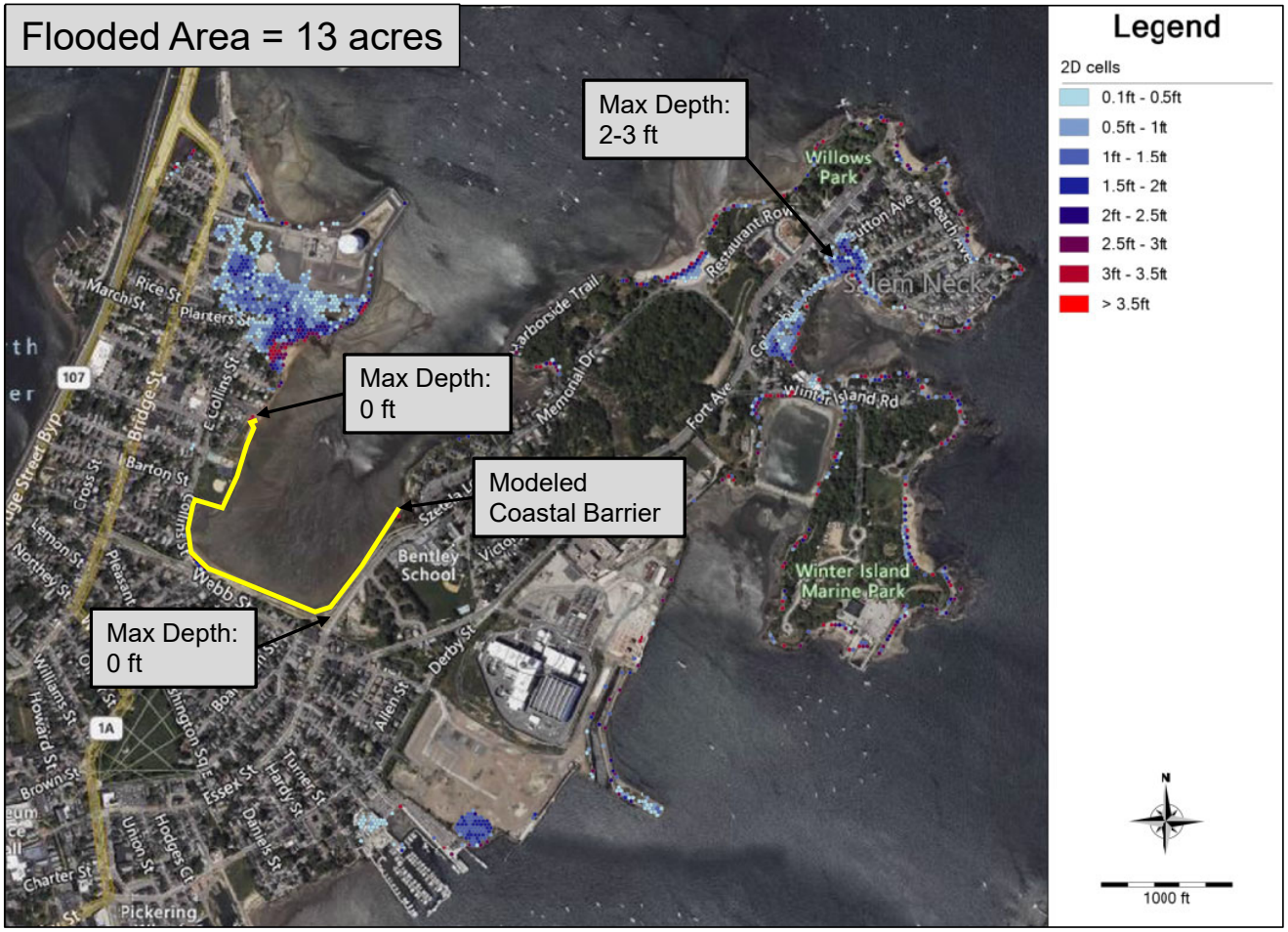
Resilience Options – Preliminary Draft Feasibility Results

Resilience Option	Feasibility Criteria					
	Relative Cost	Funding Opportunities	Ownership	Community Acceptance	Permitting complexity	Effectiveness
Stormwater Outfall Backflow Prevention						
Impervious Surface Removal/Reduction						
Bioretention Basin/Rain Garden						
Stormwater System Improvements						
Alternative Access Route						
Additional Temporary Stormwater Storage/Subsurface Infiltration Basin						
Living Shorelines						
Elevate Existing Seawall/Shoreline Height Increase						
Building Elevation						
Building Acquisition						
New Levee/Berm						
Green Roofs						
Flood Gates						
Floodproofing Buildings						
Road Elevation						
Juniper Ave Breakwater						

Preliminary Model Results for Illustrative Resilience Option – 2050 Spring Tide



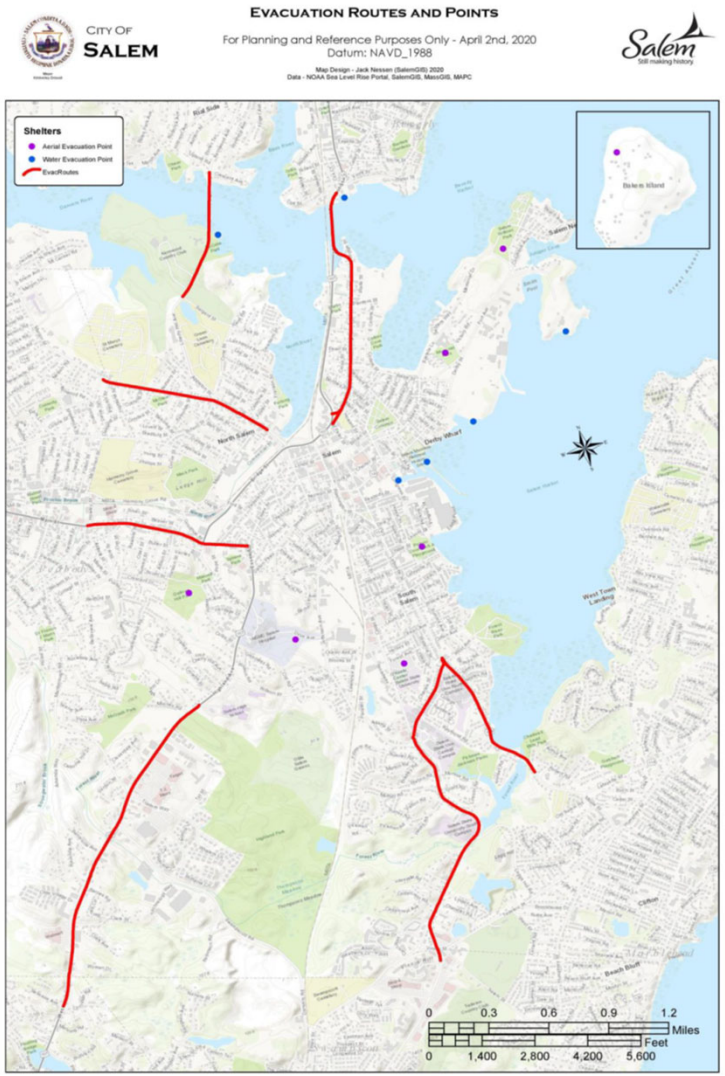
Preliminary Model Results for Illustrative Resilience Option – 2050 Spring Tide



Collins Cove to Willows Resilience Study / **Collins Cove al Willows estudio de resiliencia**

Emergency Response Plan Update

- Salem has Comprehensive Emergency Management Plan (CEMP) that is at a citywide-scale
- Emergency Response Plan (ERP) tailored to the study area will be incorporated as an annex to the CEMP
- ERP provides specific alternative routes for responders during coastal and precipitation-based flooding events



Next Steps / Finalizing Study

- Revise findings and possible resilience options for priority areas based on Workshop #3 feedback
- Finalize MVP Action Grant deliverables by June 30, 2023 *(possible extension)*
- Collins Cove to Willows interactive StoryMap website will go live in June
- Continue to provide comments using the project website: publicinput.com/CollinsCove2Willows

Planting effort at Collins Cove Living Shoreline

THANK YOU FOR YOUR PARTICIPATION!

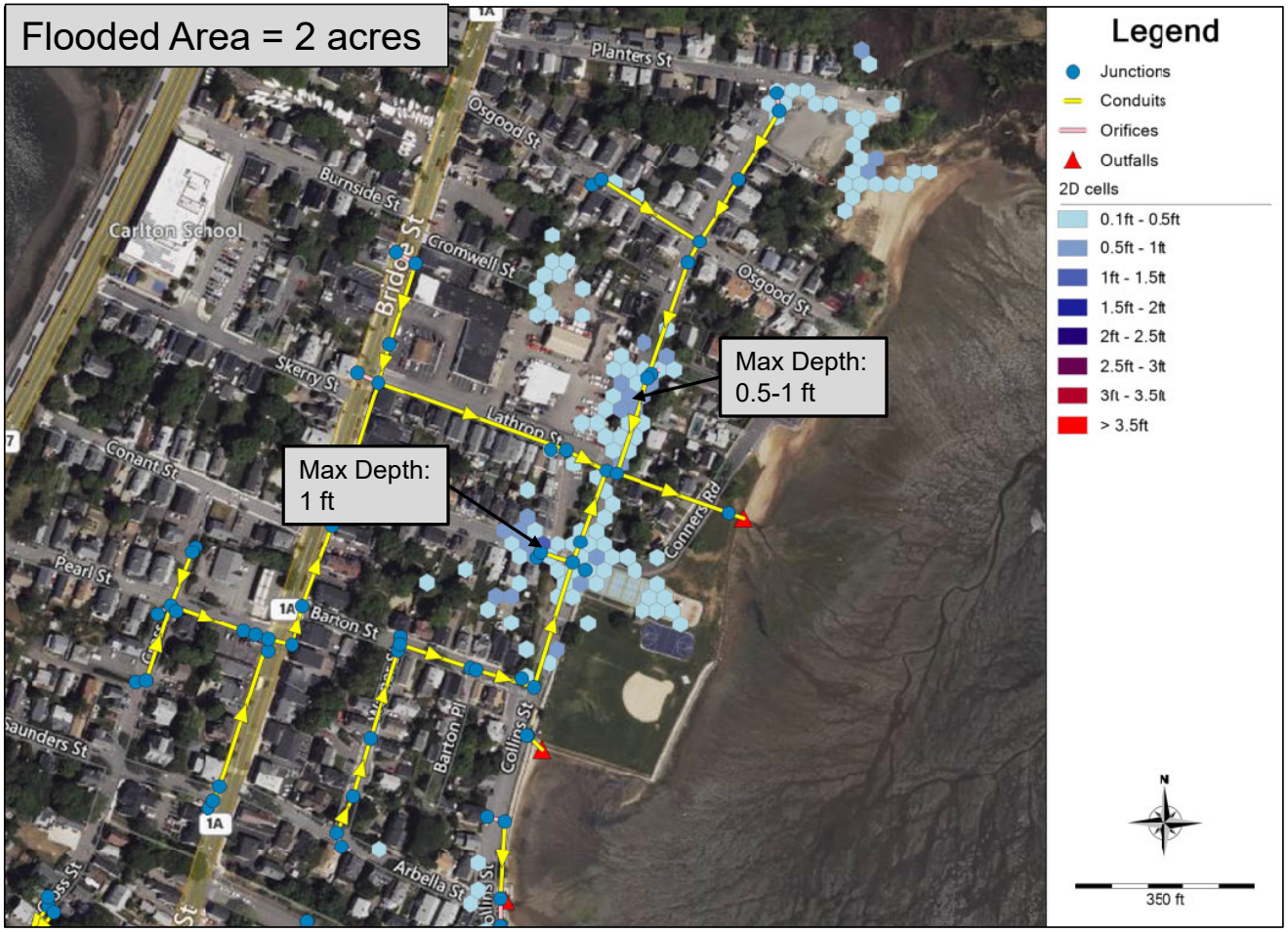
Please post questions in the Q&A

Remember to share comments & photos on:

publicinput.com/CollinsCove2Willows

2050 5-year Precipitation Storm Event – Bridge Street (North)

2050 5-year Precipitation Storm Event – Osgood – Arbella – Bridge Street



2050 5-year Precipitation Storm Event – Bay View and Columbus Ave