RESILIENCE ACTION PLAN

APRIL 2025

RESILIENT SALEM

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION

BRS inc

PRINCETON HYDRO

NEW JERSEY FUTURE

The NJDEP Resilient NJ Municipal Assistance Program is aimed at helping municipalities in New Jersey become more resilient in the face of natural disasters and other climate-related challenges. It provides technical assistance and funding to help local governments develop and implement plans to mitigate the risks associated with flooding, storm surge, and sea level rise. As part of the State of New Jersey's commitment to addressing resilience and climate change impacts, Salem has been provided with technical assistance to develop a Vulnerability Assessment and Resilience Action Plan.

New Jersey defines "climate resilience" as "the ability of social and ecological systems to absorb and adapt to shocks and stresses resulting from a changing climate, while becoming better positioned to respond in the future."

Resilience is not an end-state, but a dynamic state-of-being that will grow more difficult to attain as the climate continues to change. Resilience is not solely about the physical ability to change and adapt, but about people and their quality of life. It is perseverance with grace, strength in the face of adversity and hardship, resourcefulness to leverage what is available, and faith in the road that lies ahead. To view the Statewide Climate Change Resilience Strategy in its entirety, visit https://nj.gov/dep/climatechange/resilience-strategy.

This work was made possible with financial assistance from the Coastal Zone Management Act of 1972, as amended, administered by the Office for Coastal Management, National Oceanic and Atmospheric Administration (NOAA) through the New Jersey Department of Environmental Protection, Coastal Management Program.

City of Salem
Jody Veler, Mayor
Charles Bailey, Director, City Commerce & Economic Development

Consultant Team:

Thank you to the many residents, municipal leaders, agencies, and regional stakeholders that have contributed their time and knowledge to the project. The environmental assessments, data, and actions in this plan do not represent guidance or policy of the New Jersey Department of Environmental Protection and does not replace the need for regulatory review by the appropriate local, state, and federal agencies.

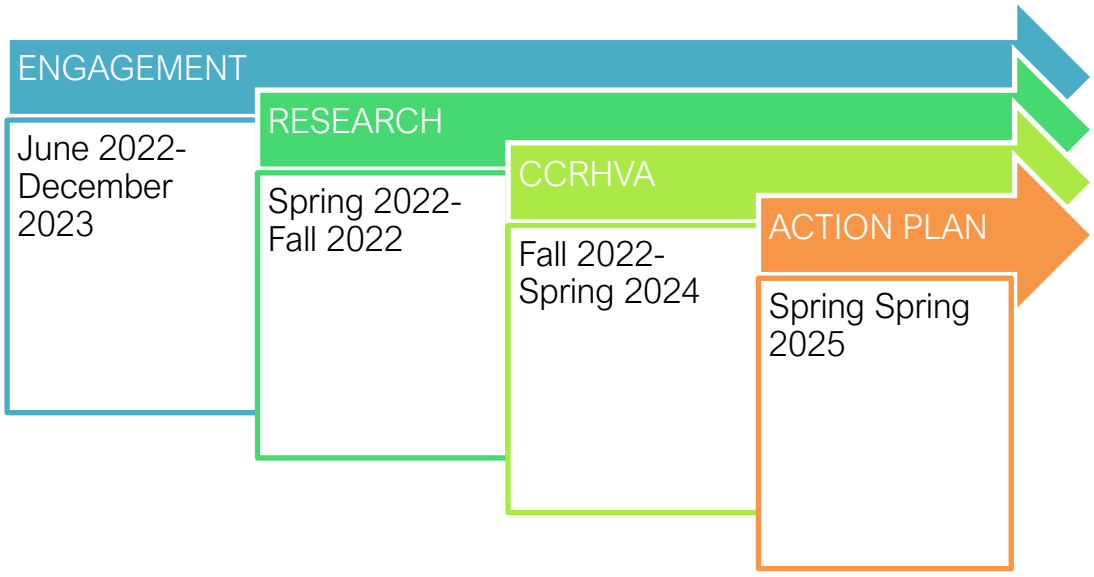
Contents

1. About This Report

Plan Development and Project Timeline

The Resilience Action Plan is a detailed guide for the city, non-governmental organizations, residents, and other stakeholders to chart a path toward a resilient future. This document not only categorizes risks and outlines a strategic plan of action but also summarizes the steps undertaken as part of this planning process. By integrating community feedback and expert analysis, Salem demonstrates its dedication to fostering a sustainable and equitable environment.

The Resilient Salem Action Plan was developed over a period of 21 months, which included preliminary research and development of City of Salem Climate Change- Related Hazards Vulnerability Assessment (CCRHVA), with public engagement throughout plan creation.



Resilient Salem Vision

The community vision statement for Salem, based on the 1974 Comprehensive Plan, involved public outreach and continues to capture the vision that residents and leaders communicated throughout the project process:

"…making Salem a good place in which to live, to work, and to raise a family by providing the best possible physical, social, and economic environment… preserving the good qualities of Salem, correcting existing deficiencies and problems, and preparing for changes which will affect City development."

This vision emphasizes making Salem an ideal place for residents in terms of physical, social, and economic parameters, while preserving its inherent qualities, addressing existing issues, and preparing for future changes.

Resilient Salem Principles

Central to this project was obtaining input from the community, as discussed in Section 3: Community Engagement. The 1974 Community Vision and how it relates to resiliency was discussed in the initial public meeting, and resiliency principles and goals were developed through discussions with city officials and residents throughout the course of the project. These principles and goals are summarized as follows:

Quality of Life and Infrastructure Resilience

Goal: Ensure that climate resilience measures enhance the overall quality of life for Salem residents, making it a better place to live, work, and raise a family. This includes fortifying the city's physical infrastructure against the impacts of climate change to ensure safety and continuous functionality.

Economic and Social Cohesion

Goal: Foster a sense of community, enhance social networks, and protect Salem's economic sectors vulnerable to climate change, ensuring job security, a thriving local economy, and community adaptability.

Heritage Preservation and Proactive Problem-solving

Goal: Safeguard historical, cultural, and natural landmarks from climate change threats while proactively identifying and addressing existing environmental and infrastructure deficiencies.

Future Preparedness and Engagement

Goal: Incorporate forward-thinking strategies to ensure Salem's long-term resilience to climate change, coupled with community engagement and education to foster a sense of collective responsibility.

2. Context: Salem City, New Jersey

The City of Salem, NJ (Population: 4,811) is the county seat of Salem County, the state's most rural county. It is located in southern New Jersey along the Salem River, a primary tributary of the Delaware River. During the 17th and 18th centuries, Salem was an important port city whose residents were primarily employed in the shipbuilding industry and trade. Later, it transitioned to heavy commercial and industrial uses related to the port and railroad, such as glassworks, chemical manufacturing and bulk fuel storage. As with many port cities around the country, Salem experienced a precipitous decline in industrial and manufacturing operations, leading to the deterioration of this once-thriving community. The decline in the city's industrial and commercial port operations – and the related loss of jobs – has also led to a significant decline in population over the past 50 years.

Image 1: Welcome to Salem Sign

Challenges facing Salem stem from the poverty which impacts nearly half the population, limited job opportunities, and disinvestment in housing that has led to vacancy and abandonment. The New Jersey Department of Community Affairs (NJ DCA) has designated Salem City as a "Distressed City" and an "Urban Aid Municipality" because of its extreme poverty. The percentage of individuals living below poverty is 41.3% (quadruple the rate for the state of NJ at 10.4%) with a median household income of just $24,841 a year (less than 1/3 of the state's median household income of $79,363) (2018 ACS). Poverty has been persistent and increasing in Salem for several decades, tied largely to industrial decline and widespread disinvestment.

The US Environmental Protection Agency's (EPA) study, *Climate Change and Social Vulnerability in the United States,* shows that the most severe harms from climate change fall disproportionately upon underserved communities, such as Salem, who are least able to prepare for, and recover from, heat waves, poor air quality, flooding, and other impacts. EPA's analysis indicates that racial and ethnic minority communities are particularly vulnerable to the greatest impacts of climate change.

Despite these challenges, the City of Salem is a special place with many wonderful qualities that make it unique. One of the most striking features of Salem is its rich history, which is evidenced by its numerous historic sites and landmarks. Visitors can experience the city's past by visiting the Old Salem County Courthouse and the downtown historic district.

What truly sets Salem apart is its strong sense of community. The city has a tight-knit community of friendly and welcoming residents who are passionate about preserving Salem's unique character. Throughout the year, there are many events and activities that bring people together, such as the annual Salem Christmas Parade, the Salem Tomato Festival, Movie Nights, and the Salem City Market. These events showcase the city's vibrant culture and foster a sense of pride and togetherness among residents.

The City of Salem has a lot to offer. Its rich history, beautiful natural surroundings, strong sense of

community, and diverse culture make it a truly special place to live, work, and visit.

Research Context Report

The "Existing Planning Documents: Context Report" (Appendix A) serves as a foundational pillar of the City of Salem's Resilience Action Plan. It summarizes a systematic review of various existing planning documents, maps, and strategies related to Salem's vulnerability to climate-induced natural disasters and other environmental hazards. The primary aim of this report is to consolidate our understanding of the city's current preparedness levels, identify key vulnerabilities, and to inform the development of targeted, effective resilience-building strategies. By understanding the city's past and present, Salem can better plan for a resilient and sustainable future.

Objectives

- To compile a comprehensive overview of existing conditions, including land use and infrastructure.
- To assess the city's current stance and strategies toward climate change and environmental risks.
- To identify gaps and opportunities in existing planning documents that can be addressed in the Resilience Action Plan.

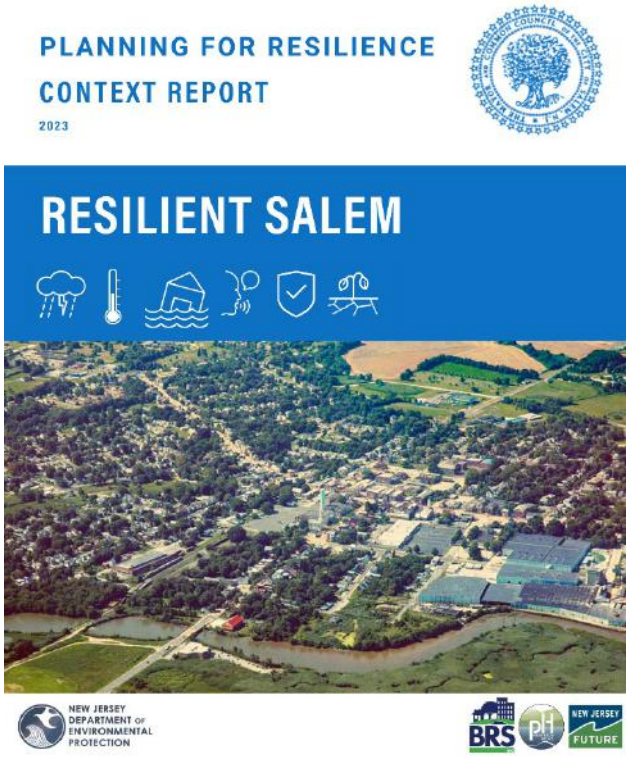


Image 2: Cover of Context Report

Key Findings

- Limited Emphasis on Climate Change: Despite updates for economic adaptation, Salem's current planning documents show a notable lack of integration of climate change considerations. This gap underscores the need for incorporating climate change more comprehensively in future urban and environmental planning.
- Vulnerability to Environmental Hazards: The reports identified vulnerabilities in Salem's infrastructure and land-use policies. These vulnerabilities are crucial in understanding the city's risk profile regarding natural disasters and climate-related challenges.
- Data and Research Gaps: The analysis reveals significant gaps in existing data about Salem's preparedness for environmental challenges. This finding opens opportunities for targeted research and informed policy-making to address these gaps effectively.
- Inadequacy of Current Resilience Strategies: The existing strategies and approaches toward climate change and environmental risks in Salem are insufficient. There is a clear need for developing more robust, targeted, and effective resilience-building strategies.
- Community Engagement and Environmental Justice: A key finding from the review is the critical role of community engagement and the integration of environmental justice into Salem's resilience planning. This aspect is vital for ensuring that future strategies are inclusive and effectively address the needs of all community members.
- Integration with City's Long-Term Goals: The report emphasizes the importance of aligning the Resilience Action Plan with the city's broader long-term goals, ensuring that climate resilience is a central component of Salem's future development and planning initiatives.

Relevance to Resilience Action Plan

The insights gained from the "Existing Planning Documents: Context Report" are instrumental in shaping the foundation of the Resilience Action Plan for Salem. The report provides a crucial understanding of the city's historical and current planning priorities, revealing how these priorities have evolved and where they might be redirected toward greater climate resilience.

1. Historical and Current Planning Priorities: The report maps out Salem's developmental trajectory, highlighting how past and present planning decisions have been shaped by economic, social, and environmental factors. This historic perspective is vital for understanding the city's resilience planning needs.
2. Planning Capabilities and Limitations: An essential aspect of the report is its analysis of Salem's capabilities and limitations in urban planning, influenced by existing zoning, codes, and regulations. This understanding is key to identifying feasible areas for intervention and improvement in the Resilience Action Plan.
3. Informing Future Planning Directions: By outlining the city's existing planning framework, the report sets the stage for future planning efforts to be more climate-focused. It underscores the importance of integrating climate resilience into every aspect of urban development and planning.
4. Guidance for Policy Adjustments: The insights from the report offer guidance on necessary policy adjustments. It identifies areas where existing policies may be strengthened or new policies introduced to foster a more resilient Salem, particularly in response to environmental challenges.
5. Basis for Comprehensive Resilience Strategy: The comprehensive overview provided by the report is crucial for developing a Resilience Action Plan that is both realistic and ambitious. It ensures that the strategies devised are well-informed, practical, and tailored to Salem's unique urban context.

By understanding the city's past and present, Salem can better plan for a resilient and sustainable future.

Additional Research

Literature Review

Community resilience is becoming increasingly important as societies face multiple challenges, from climate change and natural disasters to social and economic issues. A resilient community can absorb disturbances, adapt, and recover quickly, all while still functioning at an acceptable level. Understanding how to foster resilience at the community level has never been more critical. To contribute meaningful insights into this important area, our project team reviewed the existing literature to identify best practices in community resilience to inform not only recommendations for building community resilience in Salem, but also effective engagement strategies and robust vulnerability assessments.

Research highlights the importance of local involvement and social networks in building a resilient community. An adaptive and integrated approach to resilience planning is also advocated, where social, economic, and environmental factors are considered holistically. Studies recommend frameworks that are adjustable based on new data and ongoing monitoring, emphasizing that static plans can become outdated.

For community engagement, traditional methods such as public consultations and workshops remain valuable, but there is a growing shift toward using digital platforms like social media for wider reach and continuous dialogue. Multi-stakeholder partnerships are also cited as essential for pooling resources and knowledge.

In the area of vulnerability assessments, the review noted the significance of a comprehensive approach that considers exposure, sensitivity, and adaptive capacity. The necessity of participatory approaches in vulnerability assessments was also emphasized, as they offer more accurate data and empower the community to take ownership of their resilience plans.

Best practices include involving local communities in resilience planning, adopting adaptive strategies, and conducting thorough vulnerability assessments. Effective community engagement can be achieved through traditional consultation methods and increasingly, through digital platforms. As resilience planning continues to evolve, ongoing research will be essential in refining these practices and strategies.

New Jersey Context

New Jersey has implemented a robust set of policies, laws, and executive orders aimed at addressing climate change and its impacts. Recognizing its vulnerability to rising sea levels, extreme weather, and other climate-related challenges, the state has been proactive in building resilience at both the state and local levels. Additional measures include the appointment of a Chief Resilience Officer, the creation of various task forces and alliances, and setting deadlines for regulatory changes. These comprehensive approaches aim to ensure a sustainable and resilient future for New Jersey, mitigating the economic, social, and environmental impacts of climate change. Through the development of this Resiliency Plan, we evaluated how Salem could build upon and / or make use of these State initiatives, including:

Adapting New Jersey's Policies to Salem: Analyze how key measures like the Global Warming Response Act (GWRA) and the Clean Energy Act could be adapted to Salem's context. This includes setting ambitious yet achievable targets for reducing greenhouse gas emissions and increasing the use of renewable energy sources.

Executive Leadership and Legislation in Salem: Consider the impact of executive orders and state-level legislation on Salem's climate resilience strategies. Explore the feasibility of enacting similar orders or local ordinances to promote climate adaptation and resilience.

Customizing NJPACT and CARA for Salem: Discuss how policies like New Jersey Protecting Against Climate Threats (NJPACT) and the Climate Adaptation and Resilience Act (CARA) could inform Salem's resilience planning, emphasizing the need for comprehensive climate change adaptation.

Incorporating Environmental Justice: Reflect on the New Jersey Environmental Justice Bill's relevance to Salem, focusing on how environmental justice can be integrated into local policies, especially in vulnerable, low-income, and minority communities.

Local Climate Vulnerability Assessments: Inspired by New Jersey Assembly Bill A2785 Aca (1R), assess the need for mandatory climate vulnerability assessments in Salem's municipal planning processes.

Leadership and Collaborative Efforts: Explore the possibility of appointing a Chief Resilience Officer in Salem, similar to New Jersey's approach, and forming task forces to address specific climate-related challenges.

Setting Regulatory Timelines: Discuss the importance of setting clear deadlines for regulatory

changes and policy implementations in Salem, drawing on New Jersey's approach to ensuring timely progress.

Customized Approaches for Local Challenges: Identify specific climate-related challenges in Salem and propose tailored strategies, considering Salem's geography, demographics, and economic context.

Community Engagement Plan

With guidance and support from the NJDEP's Resilient NJ Program, a comprehensive Engagement Plan (Appendix C) was developed to ensure the voices of the community were captured in documenting the lived experiences to climate challenges, goal, and priorities. The engagement plan served as a living document to allow for processes and approaches to evolve to meet the needs of the community. To ensure an effective and inclusive public involvement process in shaping this plan, the project team actively engaged a broad range of stakeholders. These stakeholders included City Departments, community-based organizations, and key individuals who contributed diverse perspectives and critical information. The inclusion of stakeholders facilitated a conversation and back and forth process to understand and plan for challenges currently experienced and potential future challenges.

A multi-pronged approach was used to facilitate communication and collect data. This involved:

- Focused Interviews
- Community Groups
- City Departments
- Neighborhood Tour
- Presentations and Public Meetings, virtual and in-person
- Surveys

Channels for Public Outreach

Several digital and physical platforms were used to ensure broad and timely dissemination of information. These include:

- City Website and Facebook: For official announcements and project status.
- Newspapers/Publications: For wide-reaching public announcements.
- Email Blasts and Community-Led Social Media Groups: For targeted messaging and updates.
- Public Meeting Flyers: To inform residents about meetings and other ways they could participate in the process, including the project website.

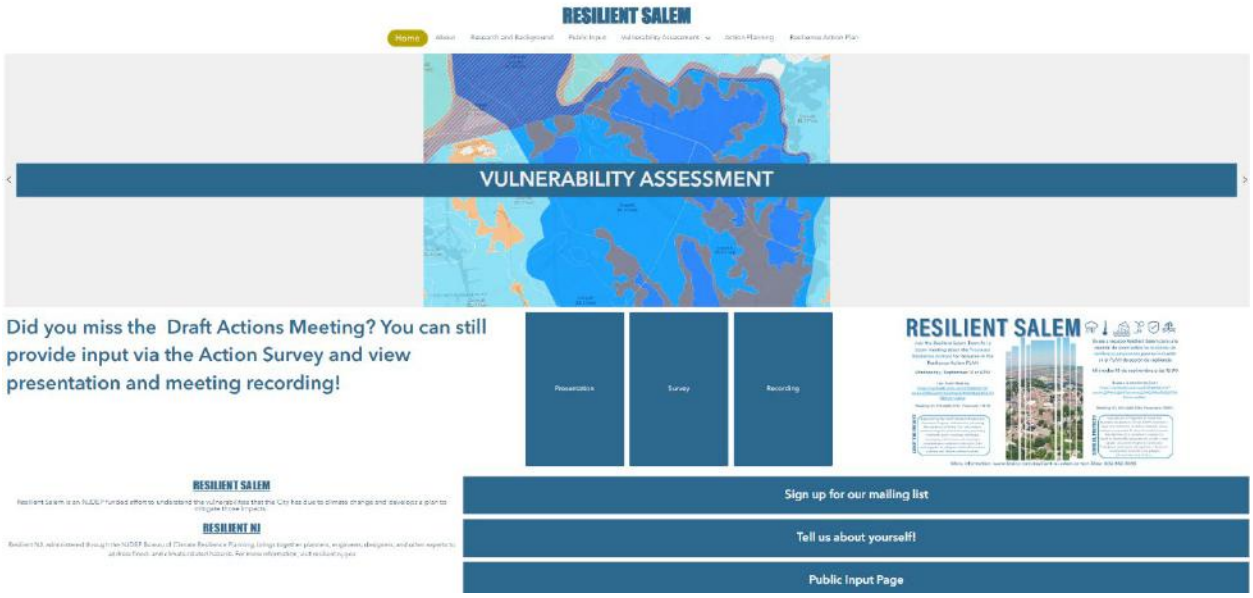


Image 3: Screenshot of Project Website: www.brsinc.com/Resilient-NJ-Salem

Meeting Formats and Material

A variety of meeting formats were implemented to make participation accessible and convenient, ranging from on-site walking tours to fully virtual meetings. Originally conceived as an ArcGIS StoryMap, the project format was expanded into a comprehensive website featuring meeting materials, climate change education resources, project reports, and interactive mapping tools. This expanded format, available in both English and Spanish, provided greater access to information and supported an engaging outreach process by allowing the community to explore materials at their own pace.

Accessibility

The public involvement strategy was designed to be inclusive and accessible. A range of communication methods was used, including video calls, surveys, and bilingual print flyers, to maximize participation and ensure community members could engage in the process in their preferred format and language.

Timeline and Continued Involvement

The public engagement strategy was structured around a clear timeline, targeting critical decision points in the project. The strategy was designed for long-term engagement, with periodic re-evaluations and updates to keep the community involved and the plan relevant.

By employing such a comprehensive and diverse public involvement strategy, the project aims to construct a Resilience Strategy that is reflective of Salem's community needs and aspirations, thus enhancing its effectiveness and long-term sustainability.

It's crucial to address the challenges faced in community outreach within a small community, especially considering the conflict with other concurrent meetings and planning efforts. This limited participation at outreach meetings, providing an opportunity for the project team to make meeting recordings available as well as opportunities for participation through online surveys.

Key Findings Memo

The Key Findings Memo (Appendix B) summarizes the foundational public meetings for the Resilient Salem project. These meetings, held in July 2022, and February 2023, were pivotal in setting the direction and goals for Salem's resilience initiatives. The July 2022 meeting served as the inaugural public engagement of the project, and provided a vital opportunity to establish the foundation for the Salem Resilience Vision. It was an occasion for participants from various sectors and backgrounds to come together and collaboratively contribute to forming the Resilient Salem Vision. This vision aims to encompass enhanced physical infrastructure, social cohesion, and economic prosperity, reflecting the aspirations and needs of the Salem community as a whole.

The information garnered in these meetings were bolstered by a community walking tour and a series of key informant interviews. A third public meeting was held in September, 2023, to present the findings.

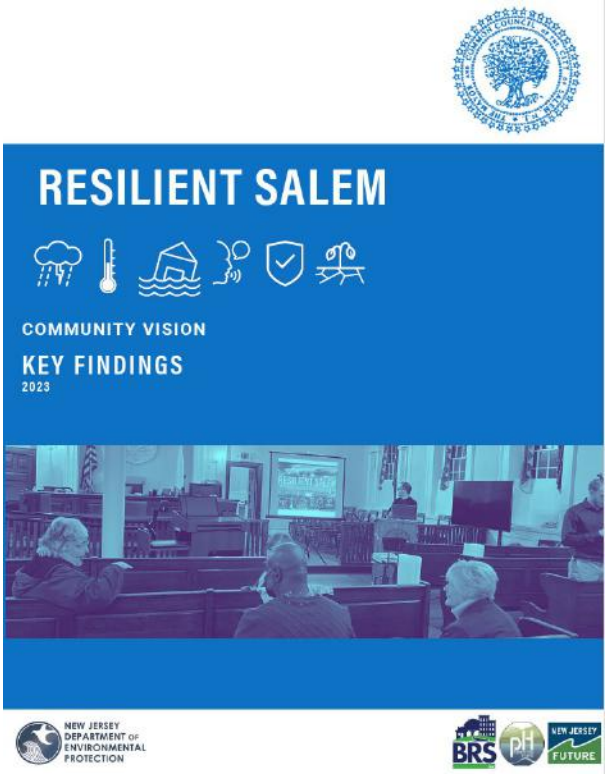


Image 4: Cover of Key Findings Report

Objectives:

Specific objectives delineated during the session included increasing climate resilience, economic sustainability, social equity, public safety, and community engagement. These objectives emanated from a process where participants discussed Salem's intrinsic strengths and identified opportunities for improvement. They were then further refined by the project team to form the foundation of the Resilient Action Plan, including: Quality of Life and Infrastructure Resilience, Economic and Social Cohesion, Heritage Preservation and Proactive Problem-solving, Future Preparedness and Engagement.

Community Insights:

The terms "Historical," "Diverse," "Thriving," and "Transformative" were recurrent, encapsulating the multifaceted identity of Salem. The process underscored a commitment to preserving the historical essence of Salem whilst embracing and facilitating innovative transformations. Participants emphasized priorities such as effective governance structures, job creation, enriched mental health services, and comprehensive climate adaptation strategies.

Addressed Concerns:

Several concerns surfaced during the discussion, including the necessity for strategies to mitigate climate change impacts, enhanced engagement with marginalized communities, effective flood management, enriched educational frameworks, and expansive employment opportunities. The project team delineated the systematic approach to incorporate these insights into the Resilient Salem project's strategic framework.

Strategic Integration:

These community insights were woven into the final Resilience Action Plan. Each actionable item is designated to specific departments and individuals, ensuring accountability. The ongoing community engagement was underscored as a cornerstone for the project's success, establishing a continuous feedback loop to ensure the initiatives align with the evolving needs and aspirations of Salem's residents.

The vision and goal setting meetings emphasized the pivotal role of community participation in constructing a resilient Salem, laying a robust foundation for subsequent planning phases, with a commitment to a participatory approach that ensures the project is both reflective of and responsive to the collective aspirations and concerns of the Salem community. Every aspect of the strategy is geared toward an integrative, dynamic, and sustainable transformation, securing Salem's resilience amidst evolving climatic, social, and economic landscapes.

Public Meeting Summaries

The Resilient Salem project included multiple engagement points designed to harness both expert opinions and community input in shaping the city's resilience plan.

Public Meeting #1: Project Kick-off - July 2022

This introductory meeting aimed to familiarize the community with the Resilient Salem project, its goals, and the team behind it. Conducted virtually, it focused on setting the vision for community priorities, risks, solutions, and values, thereby laying the groundwork for the implementation phase.

Key Informant Interviews – January through December 2023

Interviews were conducted with various stakeholders from Salem City Departments that intersect with climate change impacts. Virtual meetings involved discussions with the Salem Mayor, Police Department, Salem Housing and Economic Director, two council members, the County OEM Director, Water Treatment Facility representatives, and heads of various other city departments. In addition, bi-weekly calls were held with Salem representatives, and topic specific meetings and tours were conducted with officials around the topics of affordable housing, brownfields, and stormwater.

Public Meeting #2: Vulnerability Assessment - February 2023

This workshop offered an in-depth analysis of the risks posed by climate change and other potential hazards. The team used visuals and maps to present an assessment of the city's vulnerabilities, focusing particularly on high-risk flood zones. The in-person recorded meeting aimed to integrate these vulnerabilities with the project's overall vision with additional conversations addressing community objectives.

Walking Tour – July 2023

The walking tour was designed to gather firsthand experiences from residents about flooding issues in Salem, both in their neighborhoods and along their daily routes. This event provided valuable community insights, aiding the engineering team in devising feasible solutions to combat climate change impacts.

Public Meeting #3: Resilience Action Items – September 2023

Draft Resilience Actions were presented to the public in this meeting, with a focus on aligning action items with residents' values and concerns. The session included interactive exercises to help the community prioritize these actions. Due to limited participation, the meeting materials and a survey were made available on the project website for additional community input.

Planning Board Meeting with Plan (Date To Be Announced)

A future meeting to be conducted by City Staff with the Planning Board is planned, where the final Resilience Action Plan will be presented and discussed.

3. Vulnerability Assessment

The Climate Change-Related Hazard Vulnerability Assessment (CCRHVA) undertaken for Salem provides a comprehensive evaluation of the city's risks associated with climate-induced changes. This technical assessment measures Salem's vulnerabilities across multiple facets, from natural ecosystems to infrastructure and public health. A complete CCRHVA is included in Appendix D.

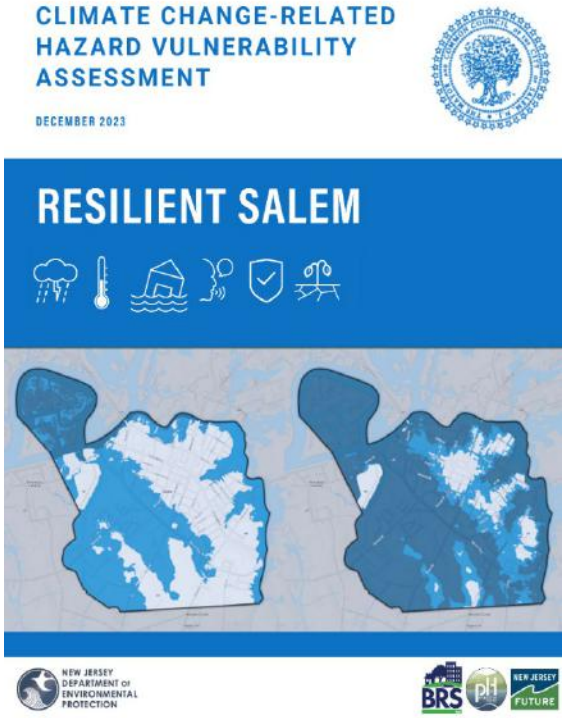


Image 5: Cover of CCRHVA

The CCRHVA provides compelling evidence of the pressing need to integrate climate adaptation and resilience measures across planning, environmental conservation, and community development efforts in Salem. Protecting vulnerable populations, safeguarding ecological resources, and ensuring sustainable urban growth are identified as critical priorities. This necessitates a collaborative, multisectoral approach to resilience planning, emphasizing the importance of data-driven strategies and inclusive policy-making to effectively navigate the challenges posed by climate change.

Flooding and Sea-Level Rise Risks:

To understand the climate change-related hazards, the assessment analyzes several flooding scenarios, detailed in Table 1, on community assets, critical assets, vulnerable populations, historic resources, ecological resources, and land use and zoning.

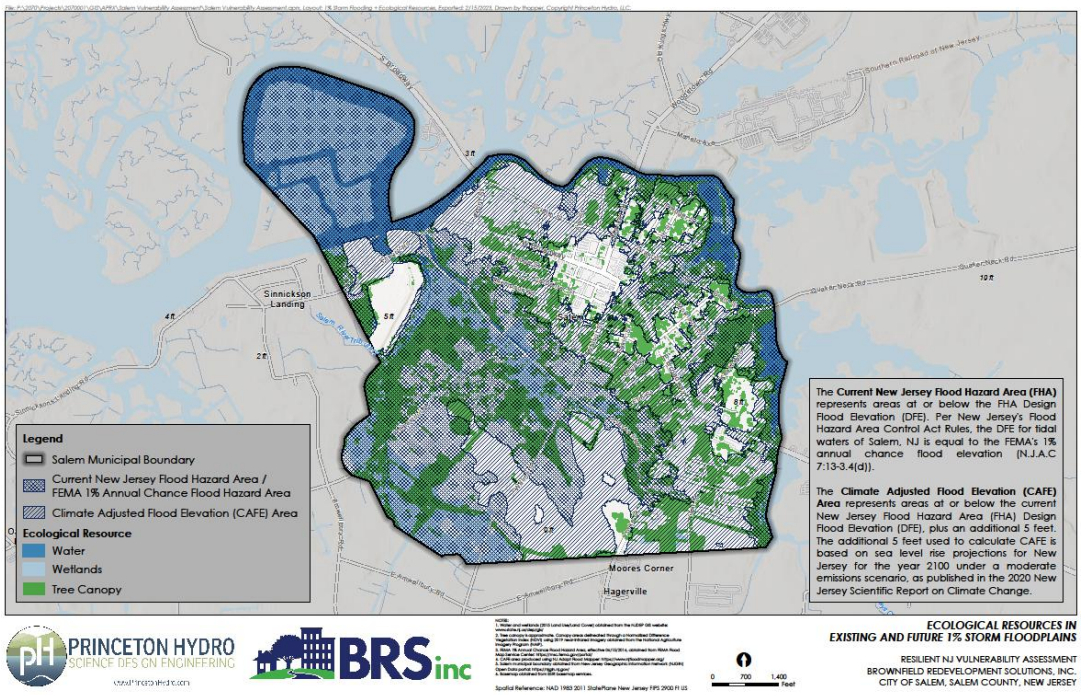
Table 1: Flood Scenarios in CCRHVA

Flood Area Type	Description	Implications
FEMA Flood Zone AE / NJ Tidal Flood Hazard Area	Designated as having a 1% annual chance of flooding. Tied to tidal events and storm surges. The focus is on the probability of a significant flood occurring in any given year due to tidal events and storm surges. This zone doesn't account for future conditions such as sea-level rise.	High risk of property damage and disruption during significant storm events. Potential loss of life if proper evacuation measures are not followed.
NJ Tidal CAFE Area	Adjusts for 5 feet of anticipated sea-level rise by 2100, indicating future flood risks. CAFE area is a forward-looking scenario that anticipates future sea-level rise and its impact on flood extents. It is a proactive measure to prepare for long-term changes in flood risk due to climate change.	Increases the likelihood of frequent and severe coastal flooding, leading to potential chronic inundation of low-lying areas.
MHHW & Inundation Risk Zone (IRZ)	Accounts for areas at or below the average higher high water mark plus an additional 5 feet. accounts for the current highest average high tides and adds a projection for sea-level rise, which makes it more specific to the incremental impact of sea-level rise on areas already affected by high tides.	Current coastal zones may become regularly inundated, affecting ecosystems and potentially causing saltwater intrusion into freshwater sources.

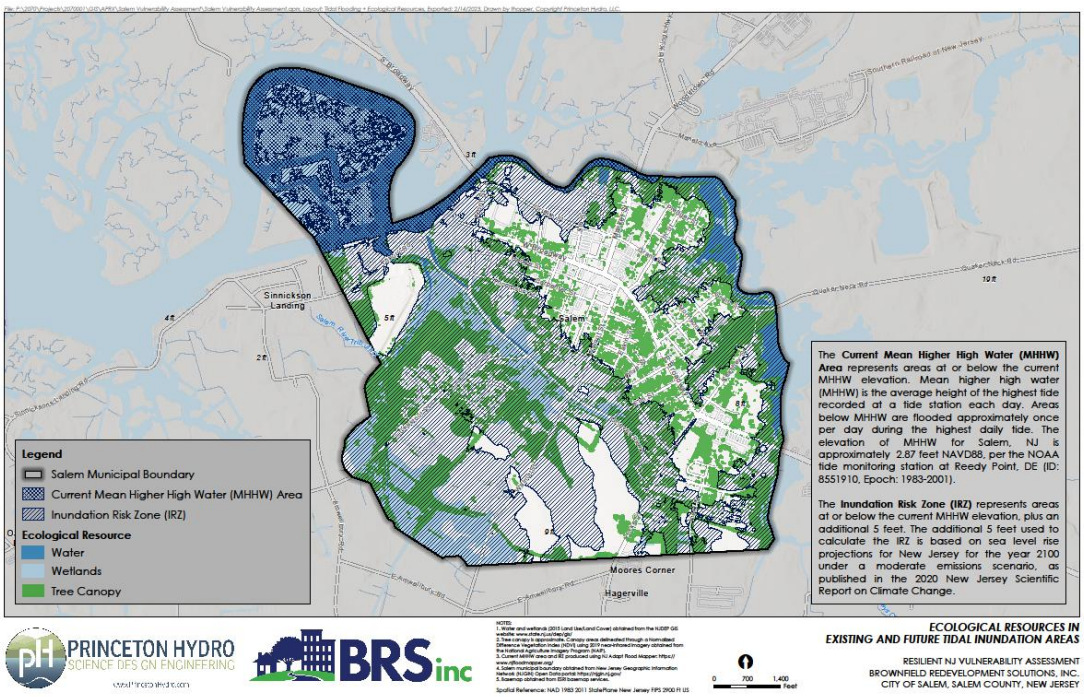
Climate change increases the risk of individual flooding events. The FEMA Flood Zone AE shows the area that currently has a 1% annual chance of flooding. The CAFE Zone then accounts for climate change by projecting areas that would have an 1% annual chance of flooding given five feet of sea-level rise. While these two zones focus on the risks from individual large flood events, the Inundation Risk Zone examines the increasing risk that parts of Salem will be routinely flooded, without a storm. While these are all flooding, the risks from a major flood event and from inundation are two separate hazards with separate impacts; they are therefor examined separately for each community category.

Ecological Resources:

62% of the city's forested area, as indicated by maps 1 and 2 below, covering about 64 acres, is susceptible to flooding.



Map 1: Ecological Resources in Existing and Future 1% Storm Floodplains

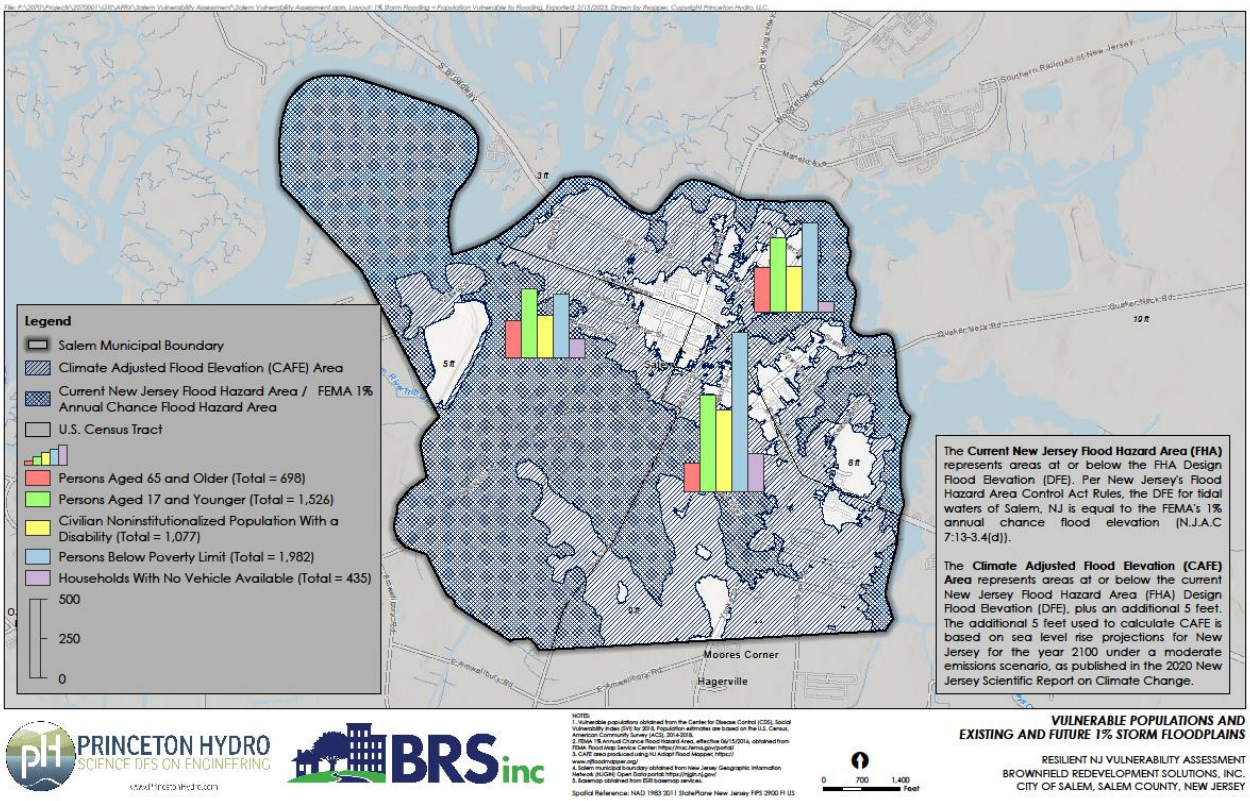


Map 2: Ecological Resources in Existing and Future 1% Storm Floodplains

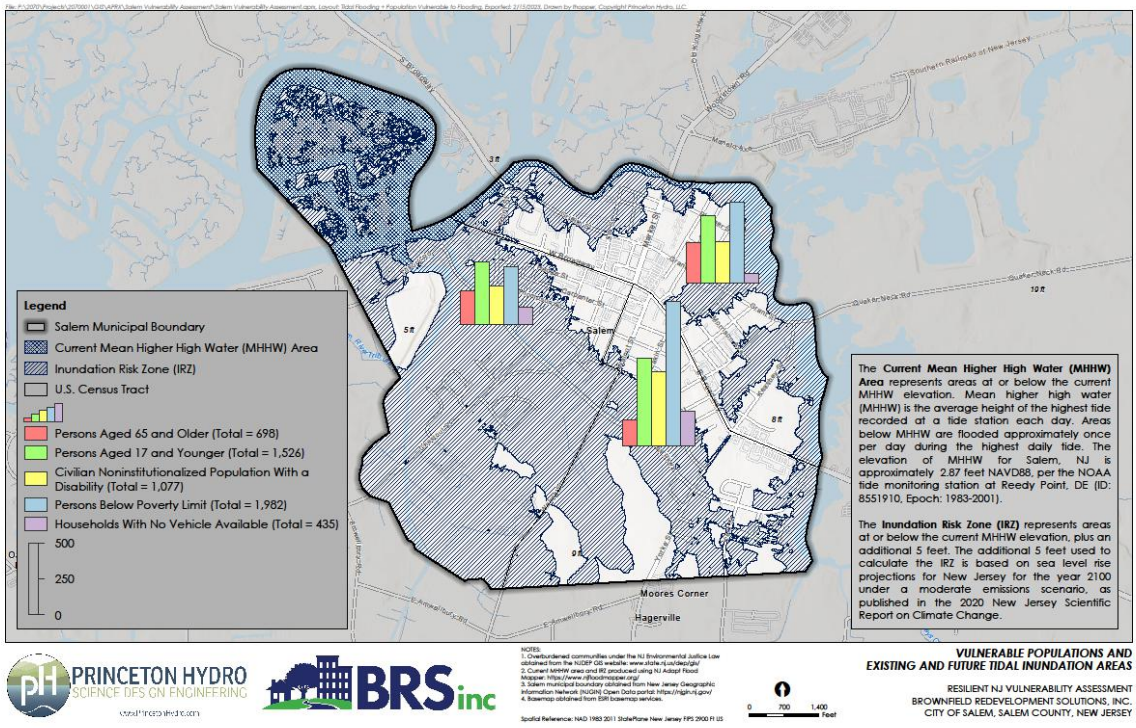
Flooding events in these regions may damage tree canopies and increase erosion. Meanwhile, inundation may compromise the ability of wetlands to absorb and store floodwaters, filter pollutants, and provide wildlife habitat.

Vulnerable Populations and Overburdened Communities:

Salem's vulnerable groups, including individuals aged 17 or younger (32%), people with disabilities (22%), and seniors aged 65 or older (15%), live in areas prone to flooding, as depicted in map 3. There are also significant numbers of vulnerable people living in areas at risk of inundation, as shown in map 4.



Map 3: Vulnerable Populations in Existing and Future 1% Storm Floodplains

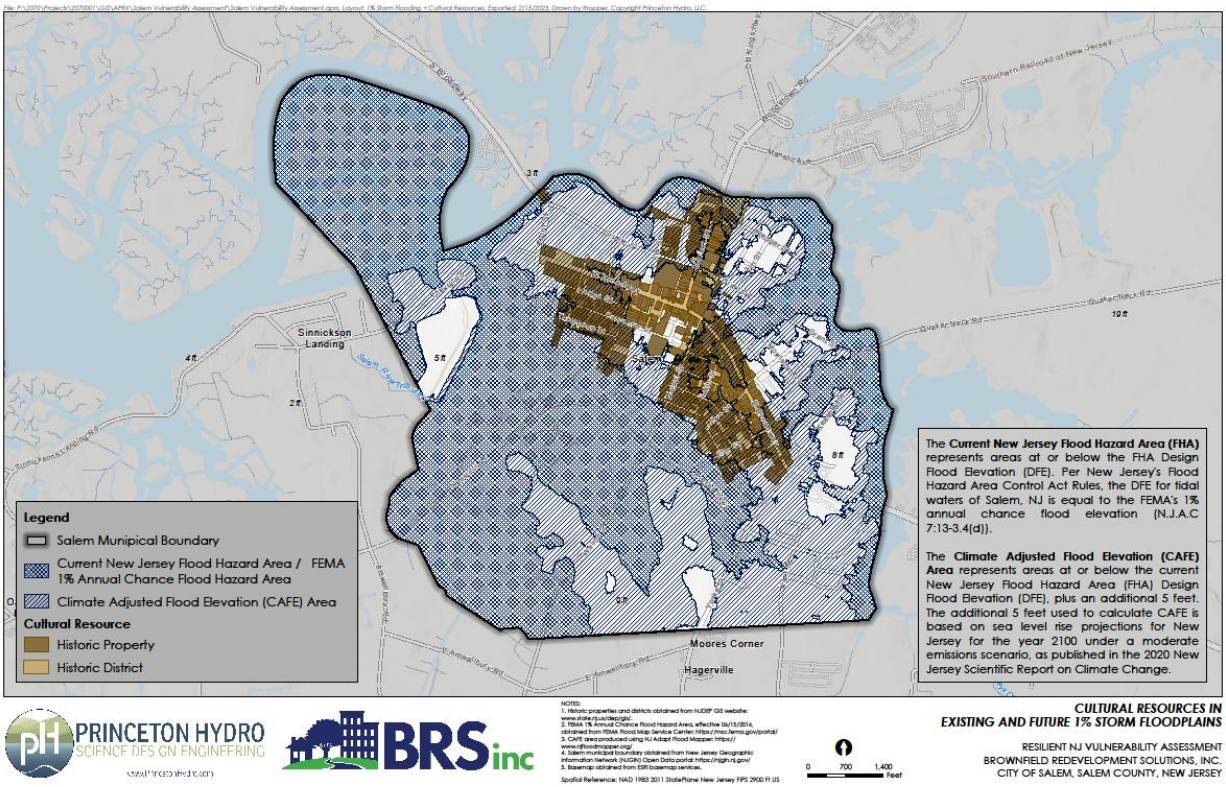


Map 4: Vulnerable Populations in Existing and Future Tidal Inundation Areas

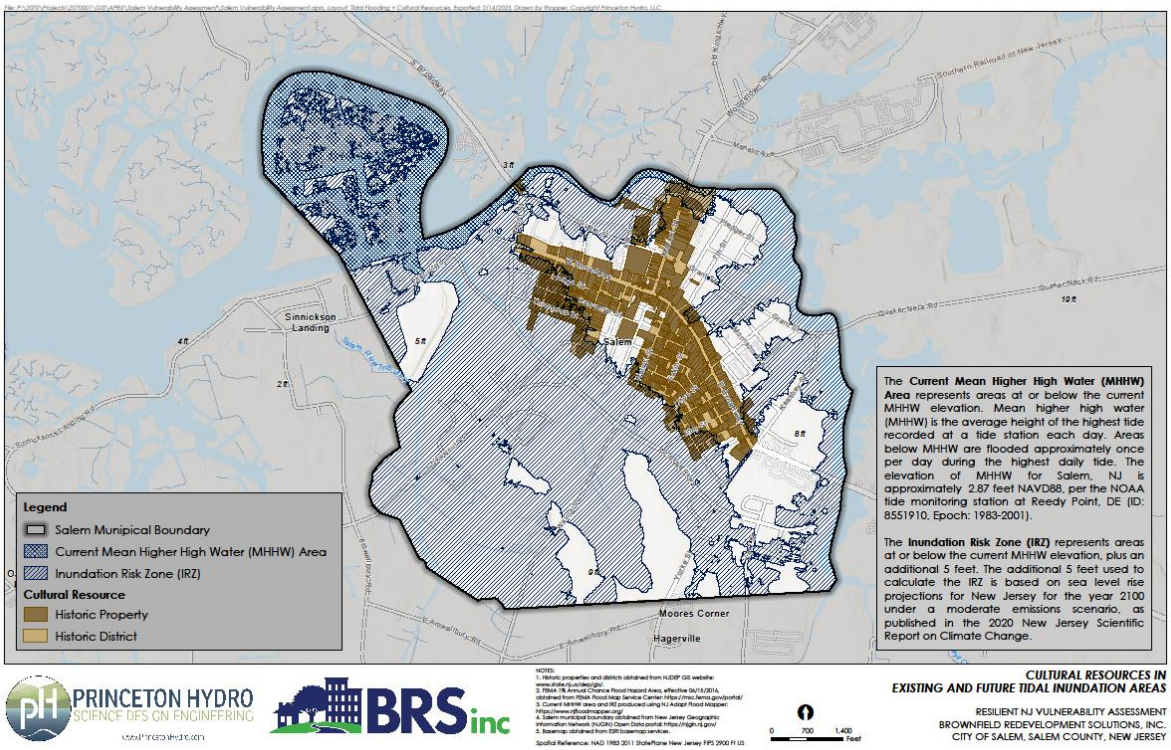
This indicates a significant need for targeted efforts to safeguard these populations from health risks during flooding events. These populations will also not have the resources to respond to repond to the threat of permanent inundation; either to adapt in place or move somewhere else.

Historical and Cultural Resources:

A significant portion of Salem's historic district falls within the CAFE zone as indicated in map 5, but the bulk of these resources are out of the existing and future tidal inundation areas, as indicated in map 6.



Map 5: Cultural Resources in Existing and Future 1% Storm Floodplains

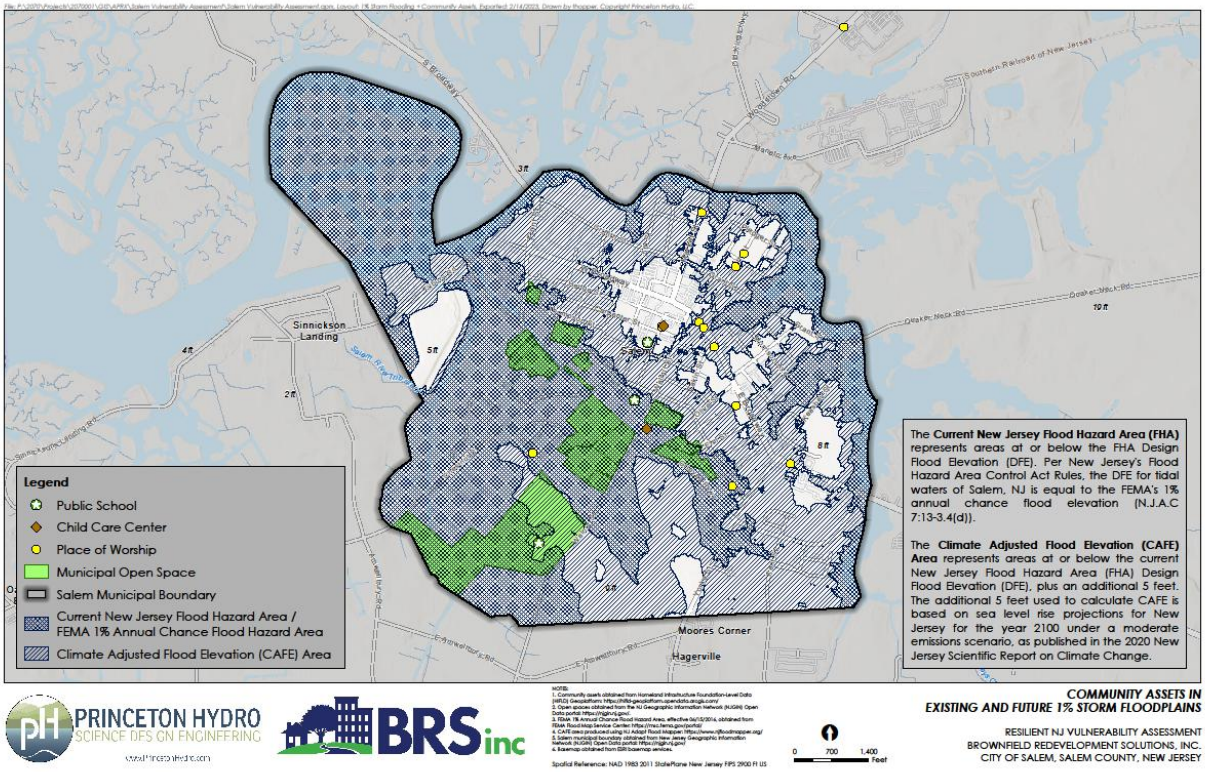


Map 6: Cultural Resources in Existing and Future Tidal Inundation Areas

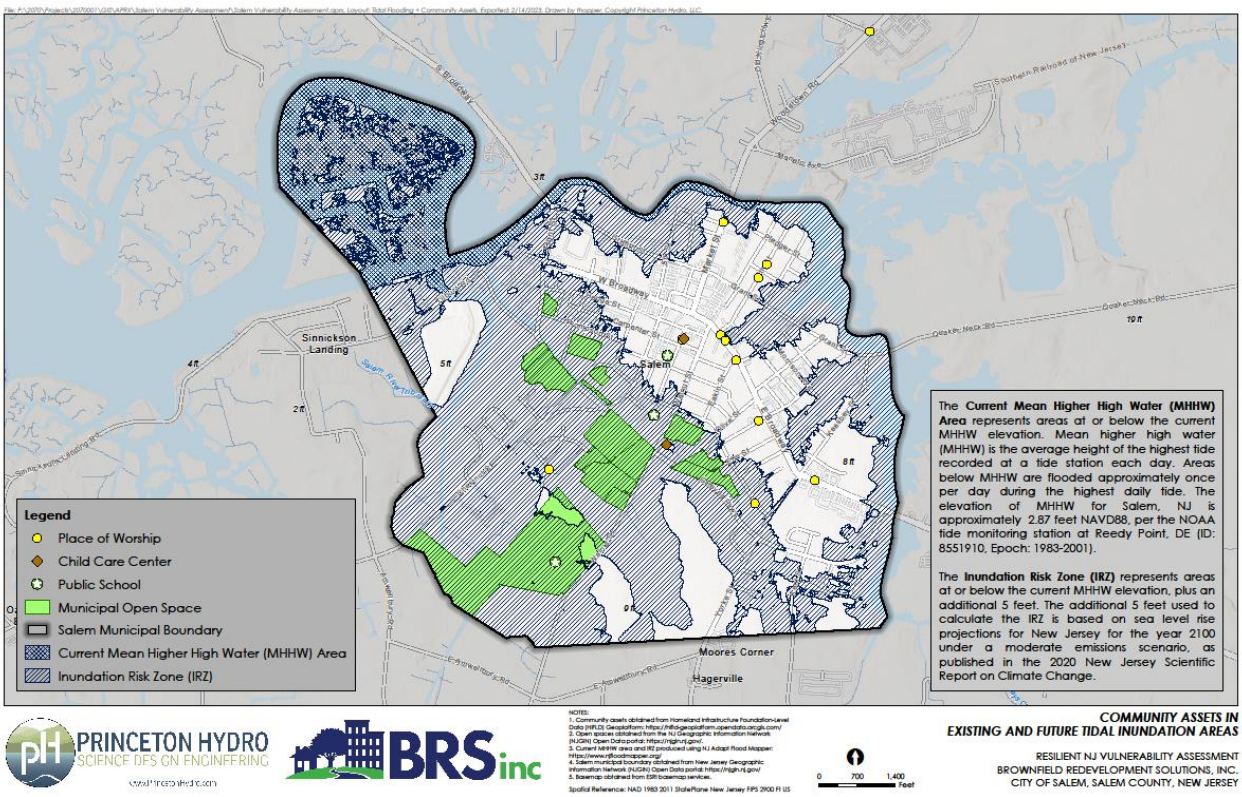
Because of the extent of cultural resources that will likely be in the future floodplain, there is high potential for damage or loss of invaluable cultural and historical assets, highlighting the need for preservation efforts.

Community Assets:

Eleven places of worship, the John Fenwick Elementary School, and United Way of Salem County Early Learning Academy, which is a critical childcare center, are within current or future flood zones, as depicted in map 7 . Two places of worship, along with the John Fenwick Elementary School, are in the Flood Inundation Zone, shown in map 8.



Map 7: Community Assets in Existing and Future 1% Storm Floodplains

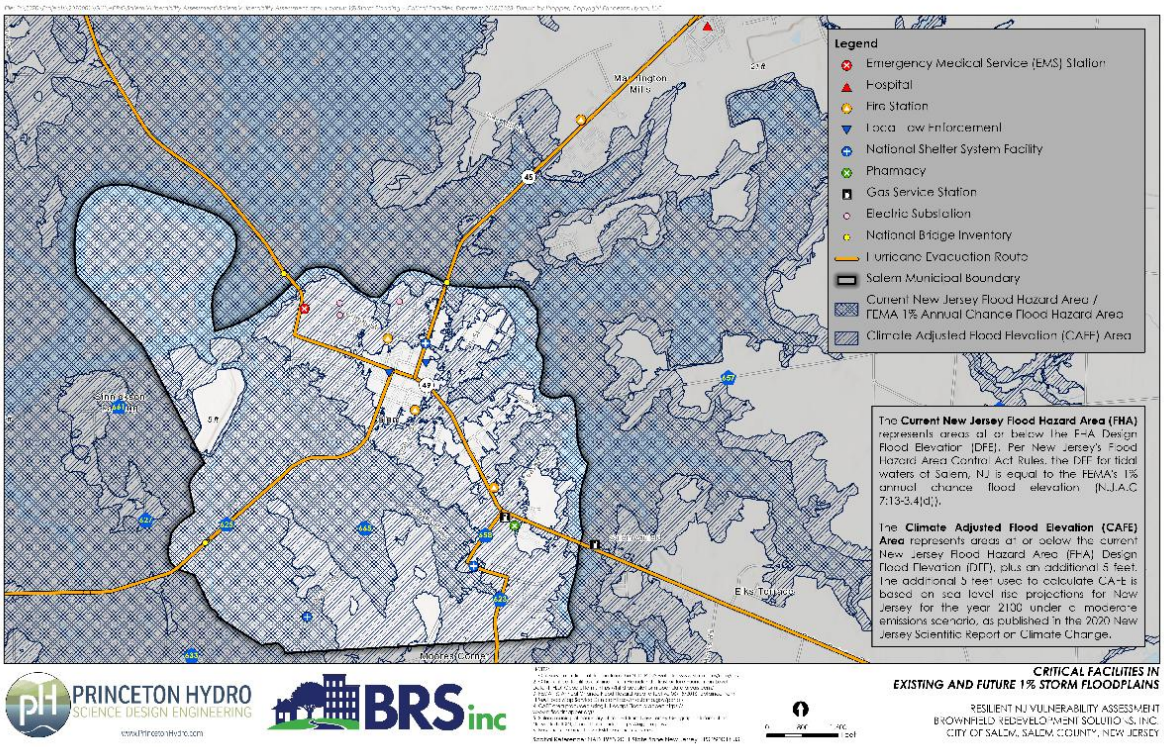


Map 8: Community Assets in Existing and Future Tidal Inundation Areas

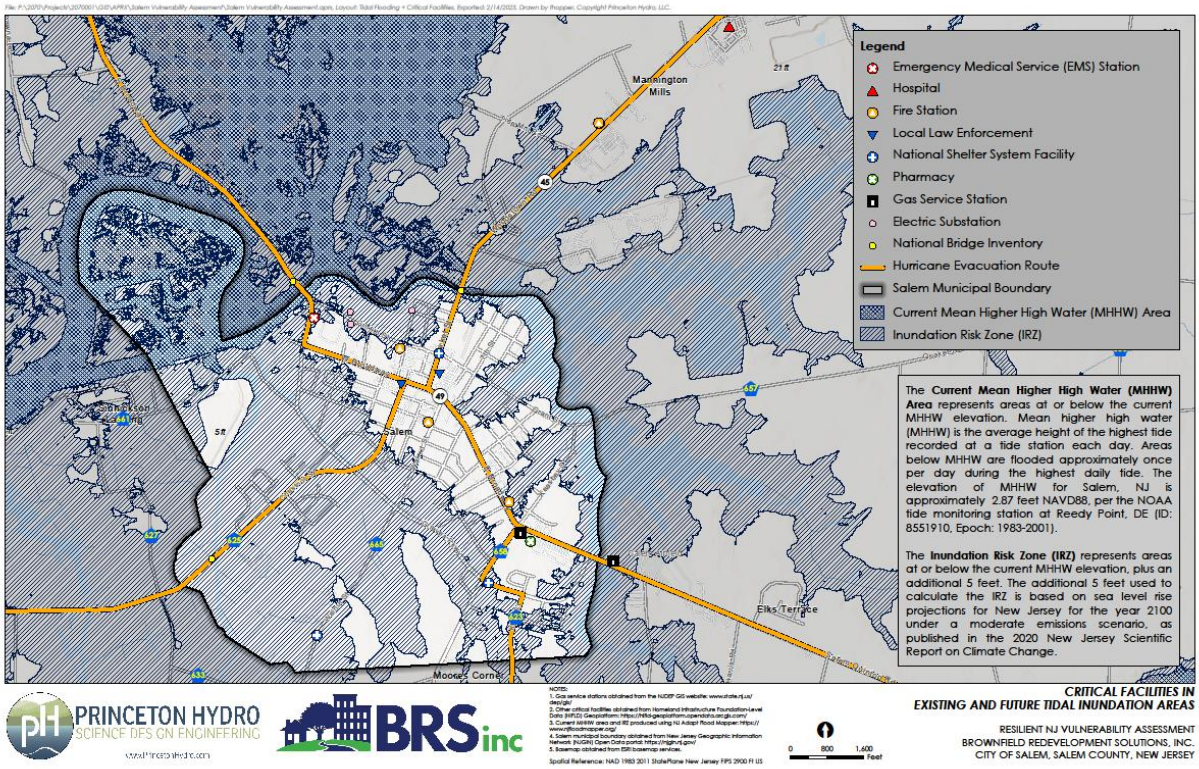
Flooding risks could disrupt communal and childcare services, causing significant social disruptions. Inundation would make it difficult if not impossible for these assets to continue to provide services at their current locations.

Critical Facilities:

Four facilities, including two bridges, Washington Fire Station, and Salem High School, which is also a designated National Shelter System Facility, are within the current flood hazard area. They are each at risk of inundation as well. All hurricane evacuation routes are also at risk from both major flooding events and inundation. See maps 9 and 10.



Map 9: Critical Facilities in Existing and Future 1% Storm Floodplains



Map 10: Critical Facilities in Existing and Future Tidal Inundation Areas

Flood risks are likely to hamper evacuation and emergency response capabilities, risking lives and assets. Inundation would mean that bridges could become totally inoperable, cutting off routes that Salem residents depend on for daily life.

Flooding Assessment Summary

Table 2 below summarizes those assets that are most vulnerable to flooding risks in Salem in the FEMA 1% annual chance area, the Inundation Risk Zone, and the CAFE Zone.

Table 2: Summary of vulnerability assessment findings

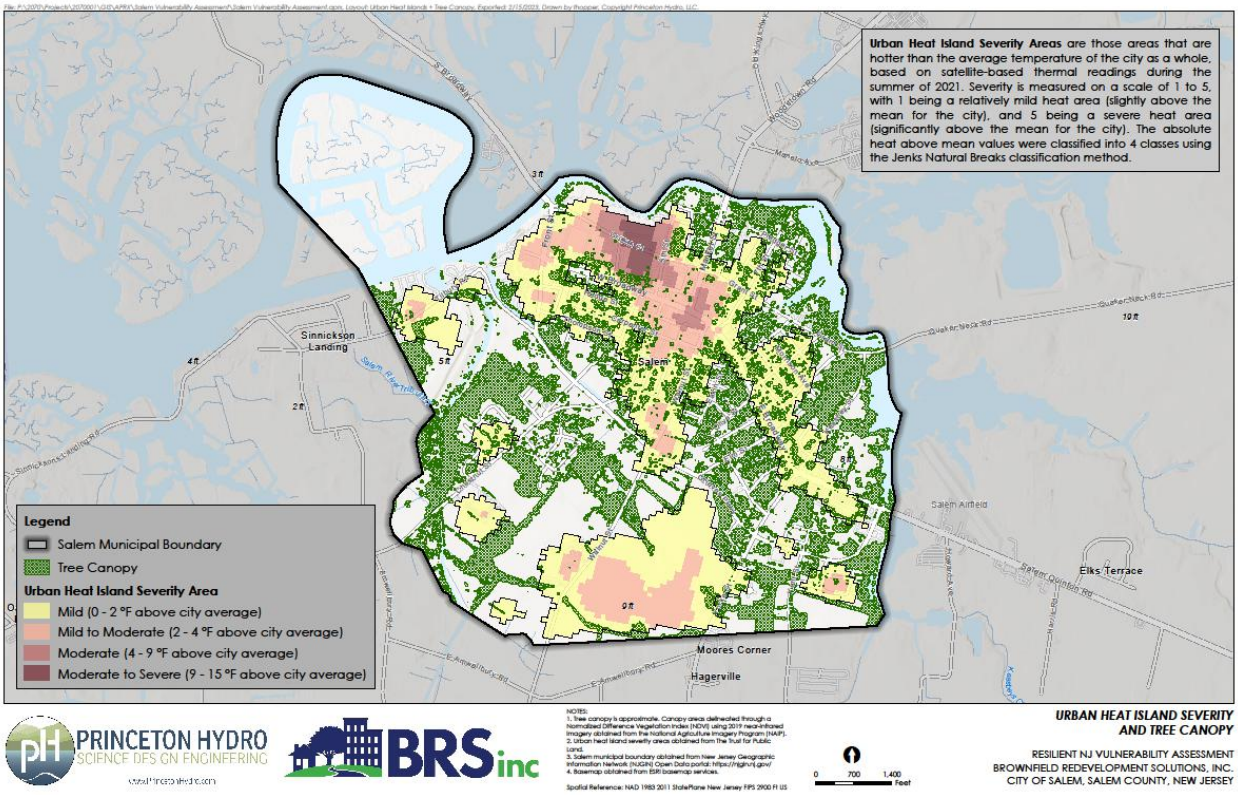
Vulnerability Category	FEMA 1% Annual Chance Flood Hazard / Existing NJ Flood Hazard Area	Inundation Risk Zone	Climate Adjusted Flood Elevation (CAFE) Zone
Open Space	83% within the flood hazard area.	98% within IRZ.	100% within CAFE zone.
Community Assets	- Harvest-Time Worship Center - United Way of Salem County Early Learning Academy - Salem High School	- Harvest Time and United Way ELA risk at 1ft SLR -Salem High School risk at 2ft SLR	- Childcare centers and places of worship vulnerable to future conditions.
Critical Facilities	- Chestnut Street bridge over Salem River tributary/ditch - NJ 45 bridge over	- All hurricane evacuation routes - 26 Front Street (EMS Station)	- Most critical facilities, including EMS and Fire Stations, and all bridges are within the CAFE zone.

	Fenwick Creek - NJ 49 bridge over Salem River - Salem High School (Shelter)		
Historical and Cultural Resources	- Historic districts and properties within the current hazard area.	-Hedge-Carpenter-Thompson district notably at risk.	- 100% of the Hedge-Carpenter-Thompson district within CAFE.
Ecological Resources	- 98% of wetlands and 56% of tree canopies are within the current FHA.	- Almost all open spaces and wetlands within IRZ.	- Ecological resources like wetlands and forested areas (62% of the city's forests covering about 64 acres) will be within CAFE zone.
Land Use / Land Cover (LULC) and Zoning	- Wetlands, residential, commercial, agricultural zones are within the hazard areas.	- Industrial and residential areas notably threatened with inundation.	- Increasing likelihood of flooding affecting parts of the Salem downtown.

Temperature and Urban Heat Island (UHI) Effect:

Ecological Resources:

About 21% of Salem City is covered by tree canopy, and 83% of canopy-covered areas are outside of urban heat areas. 89% of urban heat areas, which largely correspond with Salem's downtown, are not covered by tree canopy, as illustrated in map 11.



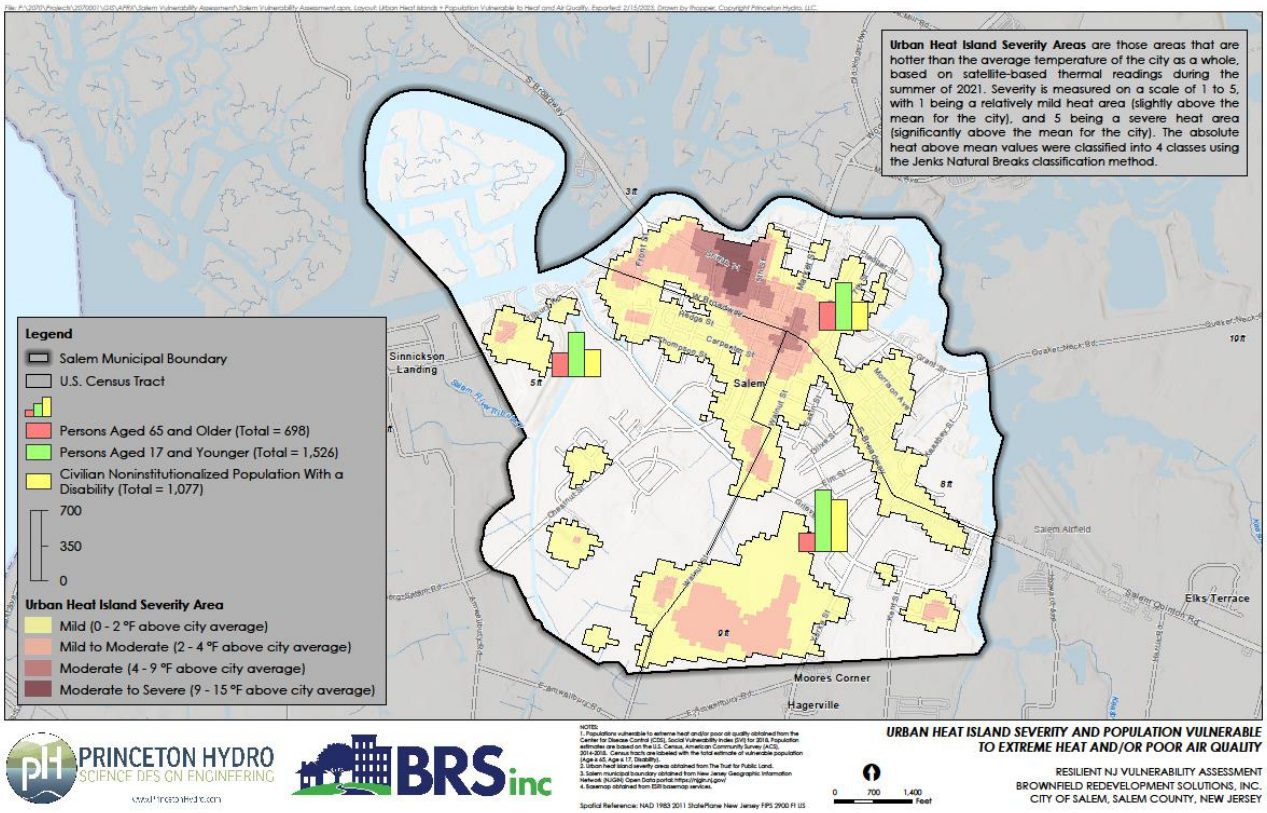
Map 11: Urban Heat Island Severity and Tree Canopy

This drives home the importance of tree planting in areas most vulnerable to urban heat island as an effective mitigation strategy.

Wetlands, forests, water, or recreational areas are rare within urban heat areas, while residential and agricultural areas were about equally likely to be within or outside of an urban heat area. In Salem, 43% of residential areas and 59% of agricultural areas are within an urban heat area, whereas 68% of industrial lands and 82% of commercial lands are within an urban heat area. Thus, a mix of forested and wetland areas is best for addressing urban heat island; with agriculture mitigating much less heat despite the perception of this land use as "green."

Vulnerable Populations and Overburdened Communities:

33% of Salem's 4,811 residents live in areas classified from mild to severe heat areas, increasing the risk of negative health implications during heatwaves, especially for vulnerable populations. Map 12 illustrates the areas most susceptible to heat, and the makeup of the vulnerable populations in each of Salen's census tracts. There is a high number of children under the age of 17 located proximate to Salem's downtown which has the most severe level of heat island effect.



Map 12: Vulnerable Populations with Exposure to Extreme Heat and Poor Air Quality

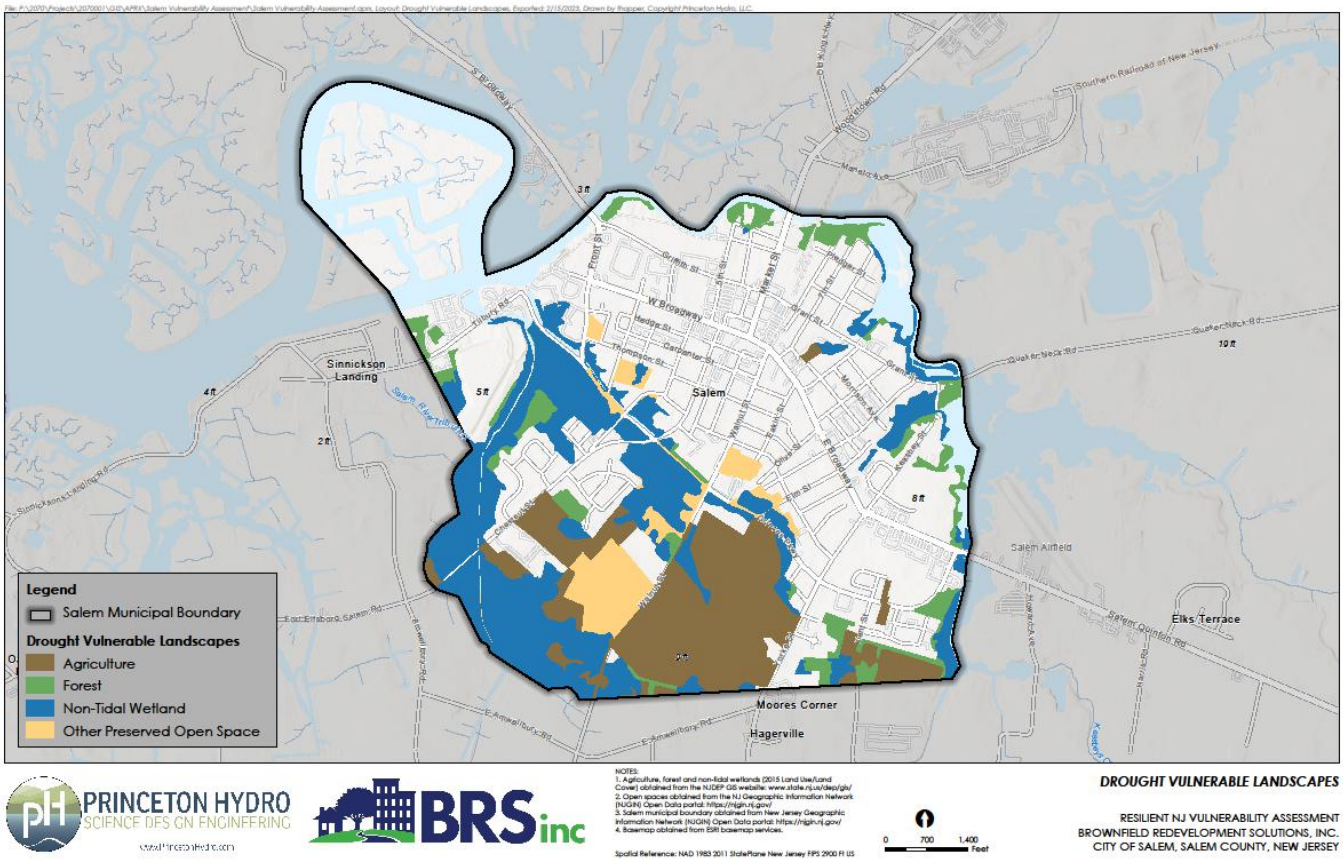
Commercial and industrial areas are significantly affected by the UHI effect, with temperatures rising up to 9-15 degrees Fahrenheit above average. This can lead to increased energy consumption, worsening air quality, and aggravated heat-related illnesses.

Historical and Cultural Resources, Community Assets, and Critical Facilities:

The bulk of the Historical and Cultural Resources, Community Assets, and Critical Facilities are located in the downtown area, which also has the greatest risk for Urban Heat Island. Ensuring adequate cooling in these areas is particularly important to maintaining the safety and cultural identity of Salem.

Drought Vulnerable Landscapes

Map 13 below indicates the areas in Salem most vulnerable to the effects of drought. The southern portion of the city would be particularly vulnerable due to large swaths of agricultural land, as well as non-tidal wetlands.



Map 13: Drought Vulnerable Landscapes

Ecological Resources:

Non-tidal wetlands spanning 256 acres, or 15% of city area of Salem, are vulnerable to drought conditions. Prolonged drought can lead to a decrease in water levels, affecting the biodiversity and the ecological services they provide, such as water purification and habitat for wildlife. In addition, forests make up 127 acres, or 4% of the city area. Drought conditions can dry out trees, leaving them vulnerable to diseases and pests.

Critical Facilities:

Salem's drinking water is treated at the Salem City water treatment plant serving approximately 8,000 customers in the area. Decreased flow in the Delaware can lead to increased salinity and contaminant concentration, making the treatment process more complex and costly. Water infrastructure is stressed in these conditions, leading to increased repair costs.

Vulnerable Populations and Overburdened Communities:

100% of Salem is identified as low income and minority, making them less able to bear the burden of increased costs to treat drinking water.

Historical and Cultural Resources:

Drought vulnerable landscapes are generally located away from the historic districts and historic properties of Salem. While Salem's historic areas are located primarily in the downtown, and away from landscapes considered vulnerable to droughts; droughts increase the rise of wildfire, which would pose a threat to these historic resources.

Community Assets:

Agricultural land accounts for 208 acres, or 12% of the city area. Drought can reduce crop yields and damage soils, impacting the economic health of the community.

4. Action Items

The Resilience Action Plan for Salem is designed as a comprehensive and strategic framework to guide the city, NGOs, residents, and other stakeholders toward building a resilient future. This plan is developed based on community insights, key informant interviews, public meetings, and expert analysis. It aims to address specific climate resilience issues identified in Salem and outlines a clear pathway for action.

Systems Based Approach

A systems approach perceives a community not just as a sum of its parts but also how these parts interact, influence, and depend on each other. It recognizes the need to shift away from isolated efforts that target specific risks and moves toward an interconnected strategy that enhances community sustainability and function. By focusing on Salem's key features categorized into systems based on their function, this approach facilitates a more connected assessment of vulnerabilities and fosters a nuanced understanding of dynamic relationships within the community.

These systems - NATURAL, ECONOMIC, SOCIAL, BUILT, and GOVERNANCE- are not silos but a complex web of interactions that sustain Salem. They provide an organizational framework, helping the city and its stakeholders to perceive climate vulnerabilities in holistic ways that resonate deeply with their day-to-day governance and planning.

Why This Framework?

The inherent interconnection of environmental, economic, social, and infrastructural systems requires a holistic approach. This framework adopts a systems perspective, focusing on the key pillars that sustain our community. It not only highlights specific areas of concern but illuminates the synergies between them. By focusing on overarching strategies and metrics, we encourage initiatives that serve multiple goals, maximizing efficiency and impact.

Framework Overview

System: A specific category representing a major aspect of our community, e.g., Natural or Economic
Goal: A broad primary outcome or result we aim to achieve, indicative of our commitment to resilience and sustainability.
Strategy: A method or plan chosen to manifest our goals, addressing root causes and creating lasting impact.
Metric: A standard of measurement to quantify progress and assess the effectiveness of our strategies.
Indicator: Data-driven markers providing insight into the state or level of progress, assisting in timely decision-making.

At the heart of this approach lies the ethos of Equity and Participation. While climate change is indiscriminate in its onslaught, its impacts are not uniform. The systems approach recognizes the disproportionate burdens borne by socially vulnerable populations. Factors like age, race, ethnicity, and income can amplify the vulnerabilities faced by individuals and communities, making them less equipped to navigate the challenges posed by climate change. Thus, ensuring an equitable process where every voice is heard, becomes paramount.

Only by centering the resilience journey around equitable participation and decision-making can Salem achieve a higher level of resiliency. A series of four principles, as detailed in the *Research Context Report* (Appendix A), emerged from the outreach activities completed. Building on these principles detailed below, and the vision based on community input, the principles and their goals align with the Systems approach.

Resiliency Principles

Heritage Preservation and Proactive Problem-solving:

- Objective: To protect Salem's historical, cultural, and natural assets from climate threats, while proactively addressing environmental and infrastructural issues.
- Actions: Implementing preservation strategies for historical landmarks, enhancing natural conservation efforts, and developing proactive solutions for identified environmental challenges.
- System: The NATURAL system's focus on the environment and preservation intertwines with this goal. By safeguarding historical and natural landmarks, the heritage of Salem remains intact for future generations. Simultaneously, by proactively addressing environmental and infrastructure issues, Salem ensures that its natural resources remain viable and abundant.

Economic and Social Cohesion:

- Objective: To build a cohesive community with strong social networks and a resilient local economy that can withstand the impacts of climate change.
- Actions: Supporting local businesses in adapting to climate risks, promoting job

creation in sustainable sectors, and fostering community initiatives that enhance social resilience.

- **System:** This goal is a confluence of the ECONOMIC and SOCIAL systems. By focusing on economic sectors vulnerable to climate change, Salem ensures economic stability and job security. The SOCIAL system then ensures that this economic stability translates to community cohesiveness, adaptability, and a reinforced sense of belonging.

Quality of Life and Infrastructure Resilience:

- **Objective:** To enhance the city's resilience against climate change impacts while improving the quality of life for all residents. This goal focuses on strengthening Salem's infrastructure to ensure its safety and functionality under changing climate conditions.
- **Actions:** Upgrading physical infrastructure, including roads, bridges, and public buildings, to withstand extreme weather events. Implementing green infrastructure solutions for sustainable urban living.
- **System:** The BUILT system directly correlates with this goal. By ensuring that physical infrastructures are adaptive and robust, Salem ensures not only the safety of its residents but also enhances the quality of life by ensuring continuity in essential services and facilities.

Future Preparedness and Engagement:

- **Objective:** To ensure that Salem is well-prepared for the long-term impacts of climate change, with a strong emphasis on community engagement and collective responsibility.
- **Actions:** Developing and integrating forward-looking resilience strategies into city planning, enhancing public education on climate change, and encouraging community participation in resilience efforts.
- **System:** The GOVERNANCE system anchors this goal. By fostering forward-thinking strategies, the governance mechanisms ensure that Salem is equipped for long-term challenges. This preparedness is supplemented by actively involving the community, ensuring that resilience is not just a top-down initiative but a collective endeavor.

Action Items Matrix

The Resilience Actions Matrix may be viewed in **Appendix E** and provides actions based on the systems and guiding principles described above. The actions proposed in each system are further built out to facilitate implementation by action area.

The attached Resilience Actions Matrix framework breaks down these aspects to provide Salem with implementation tools. Below is a list of the information provided for each action.

> ***System****: The fundamental category, identifying which of the five core systems (Built, Natural, Social, Economic, Governance) the action falls under.*
> ***Goal****: This specifies the overarching goal addressed by the recommended action.*
> ***Hazard Vulnerability:*** *This indicates which vulnerability: Flooding, Droughts, Extreme Temperatures, Hurricanes and Other Extreme Weather Events, and Sea Level Rise, is addressed by the recommended action.*
> ***Identified Problem****: A clear articulation of the challenge at hand.*
> **Recommended Action**: Offers a potential solution to counter the problem, *and details specific steps or*

initiatives to implement the proposed solution.

***Geography**: Pinpoints where the action would take place, whether city-wide, specific neighborhoods, or zones.*

***Prioritization**: Indicates the urgency or importance of the action based on severity, feasibility, and impact, and informed by discussions with municipal officials. Prioritization categories are recommended based upon anticipated impact and interest during public interviews.*

***Estimated Cost**: Provides a rough budgetary requirement for the action. Cost categories are estimates, using the following scale: $ = $0 to $300,000; $$ = $300,000 to $1,000,000; $$$ = $1,000,000 to $5,000,000; $$$$ = over $5,000,000*

***Lead Organization/Department/Division**: Designates the primary entity(ies) responsible for spearheading the action.*

***Supporting Organizations or Departments**: Lists entities that would assist or collaborate with the lead organization.*

***Potential Funding Sources**: Identifies potential financial resources, such as grants, municipal budgets, or partnerships.*

***Critical Next Steps**: Lays out immediate steps to set the action in motion.*

This matrix provides a comprehensive, transparent, and systematic approach to Salem's climate adaptation journey. Such a framework not only provides clarity but also ensures accountability, collaboration, and a strategic path forward in making Salem a resilient, sustainable, and equitable city for all its residents.

Monitoring and Evaluation

Monitoring and evaluation (M&E) are critical to ensuring that the city remains agile and prepared in an ever-changing climatic landscape. Effectively executed, they offer not just an assessment of where we stand but also guide our forward trajectory, refining our path and allowing us to be both proactive and reactive.

The essence of resilience lies not just in infrastructure fortification but in the strength of community. Hence, the role of community engagement in the M&E process necessitates regular feedback sessions, workshops, and open forums as avenues for the community to voice their observations and concerns, granting a perspective for on-the-ground realities and the effectiveness of resilience measures.

Community resilience metrics serve as the backbone for this process. Whether qualitative or quantitative, these metrics are designed to capture a holistic picture of the community's adaptability across diverse sectors. These indicators not only shine a light on a community's strengths but also on areas that may require more attention.

Understanding Resilience Levels: By regularly monitoring these metrics, community leaders can discern the resilience levels within their communities. This continuous assessment allows for real-time insights into areas of strength and potential vulnerabilities, ensuring that the community remains well-prepared for any challenges.

Evaluating the Impact: Beyond just understanding resilience levels, the metrics also offer an opportunity to evaluate the tangible impact of specific actions and investments. This evaluative approach ensures that the community gets a clear return on investment from its resilience initiatives.

Using the Framework:

City Departments: Use this as a guiding document for policy formation, program development, and resource allocation. Identify areas within your jurisdiction that align with the outlined strategies and measure progress using the provided metrics and indicators.

NGOs: Collaborate with city departments and the community to champion initiatives that resonate with your mission and the goals of this plan. Use the metrics and indicators to assess the impact and recalibrate efforts as needed.

Residents: This framework is your insight into Salem's resilience vision. Advocate for its implementation, participate in community consultations, and hold decision-makers accountable using the metrics and indicators as benchmarks.

Overview of Action Items Matrix

System Area	Action Area	Recommended Action	Lead Organization/ Department/Division	Critical Next Steps
Natural System	Green Infrastructure	Determine where green infrastructure can be utilized in development projects. Construct rain gardens, bioswales, and subsurface stormwater retention/detention in roadway right-of-ways and within public parks, schools, housing, or other properties.	City Engineer, Streets Department and County Department of Public Works	Develop a comprehensive plan for the construction and integration of green infrastructure practices across the city.
Natural System	Open Space Stormwater Management	Develop a comprehensive stormwater management plan that incorporates existing open space for stormwater storage, utilizes green infrastructure features and promotes resilience in parks and open spaces. Develop design guidelines for flood-prone areas that incorporate green infrastructure features and promote resilience.	City Engineer, Streets Department	Conduct a feasibility study to identify specific existing open spaces that could benefit from stormwater management projects. Identify and prioritize areas most vulnerable to flooding for immediate drainage system improvements. Survey flood prone areas, and work with city engineers to identify opportunities to install green infrastructure.
Natural System	Tree Planting Programs	Reactivate the shade tree commission to expand tree planting initiatives in parks and recreational areas. Identify suitable locations and plan tree planting events.	City Engineer, Streets Department	Conduct an inventory of available planting locations; Plan tree planting events, engage the community, and establish maintenance practices for planted trees.
Natural System	Heat-Resilient Landscaping	Implement heat-resilient landscaping in parks and recreational areas. Plant native, heat-tolerant trees, install shade structures, and provide comfortable seating in parks.	City Engineer, Streets Department, City Council, City Planning Board	Using the heat island map develop priority areas for tree planting and shade areas.
Natural System	Gardening and Local Food Growing	Identify locations that can become community gardens; establish community gardens in recreation areas. Create a demonstration garden. Provide garden plots, gardening education, and support for community-led initiatives.	Streets Department	Prepare garden areas, allocate plots, and provide educational resources for gardeners.
Natural System	Stormwater Capture	Install rain barrels and stormwater capture systems in recreation facilities.	Environmental Commission	Identify priority sites for installation, procure equipment, and initiate community awareness campaigns.
Economic System	Infrastructure Improvements	Infrastructure quality index	Salem Infrastructure and Public Safety	Identify city-owned infrastructure and develop a system to evaluate.

Economic System	Services	Continuity of essential services	Salem Economic Development Department	Develop a plan to ensure businesses are able to reopen in a timely fashion following a storm event.
Social System	Community Education and Workshops	Organize educational workshops and community events focused on climate change and resilience. Promote awareness about climate change and resilience strategies in schools and through City policies.	City Board of Education, City Council	Develop and deliver educational programs, outreach to community organizations, and ensure accessibility.
Built System	Infrastructure Improvements	Identify and evaluate viable locations in the city for emergency shelters. Determine the feasibility and timeline to establish these locations as alternate shelters.	City Engineer, County Department of Facilities	Plan and execute the establishment of emergency shelters in locations outside flood hazard areas.
Built System	Infrastructure Improvements	Site- or building-level adaptation may include: •Elevating critical mechanical systems, •Dry floodproofing •Retrofitting pump stations •Relocating critical facilities	City Engineer, Streets Department, Economic Development, Fire Department, Water & Sewer	Conduct asset-specific studies to determine the best risk reduction strategies for each priority asset. Design and develop a detailed database of all utilities including age, capacity, location and annual maintenance requirements.
Built System	Infrastructure Improvements	Update and maintain the stormwater infrastructure, including pumps, and selective dredging.	Public Works	Develop a stormwater mapping and needs assessment
Built System	Asset Protection	Identify resources for residents to develop appropriate strategies for their homes, including: Home Acquisition or Relocation; Structure Elevation; Floodproofing	Permit and Inspections	Map impacted properties and develop a decision tree-type tool along with resource information so that homeowners can determine the best steps for protection.
Built System	Critical Maintenance and Upgrades	Ensure timely repair of City's water facilities and explore flood mitigation measures for the pumps.	City Engineering Department, Water and Sewer Department	Conduct a safety audit, and establish regular maintenance protocols. Implement flood mitigation measures.
Built System	Critical Maintenance and Upgrades	Partner with County and State Inspection program to implement annual maintenance. Mapping of up to date flooding for long term drainage solutions	City Engineering, Streets Department	Prioritize funding to areas most vulnerable to flooding for immediate drainage improvements.
Built System	Cooling Centers	Identify suitable facilities, equip them with cooling equipment, establish protocols for opening them during heatwaves	Police, Fire, EMS; Housing Authority; Economic Development	Ensure facilities are ready for use during heatwaves, and establish a protocol for when they will be open, what transportation will be provided, and how this will be communicated.
Built System	Programing for Vulnerable Populations	Offer indoor recreational and educational programs in air-conditioned facilities during heatwaves; Reopen the pool and/or provide a spray park for youth; Develop programming for children and seniors in Air-Conditioned Spaces	Local Senior Centers, Youth Organizations, Schools	Develop and publicize program schedules, and engage with local organizations for program delivery.
Built System	Renewable Energy Installations	Install renewable energy systems in municipal buildings and facilities. Identify suitable sites for solar panels or wind turbines, conduct energy audits, and implement renewable energy installations.	City Engineer, County Department of Facilities Management, Streets Department	Assess energy needs, select suitable sites, and install renewable energy systems.

Built System	Infrastructure Improvements	Implement site- or building-level adaptations such as: •Elevate critical mechanical systems, including emergency and backup generators •Dry floodproof (flood barriers and/or shields) around critical equipment, systems, or areas • Retrofit pump stations • Relocate critical facilities	Streets Department, Economic Development	Design and develop a detailed database of all utilities including age, capacity, location and annual maintenance requirements. Conduct asset-specific studies to determine the best risk reduction strategies for each priority asset.
Built System	Flooding on contaminated sites	Identify brownfield sites vulnerable to flooding and prioritize them for remediation and redevelopment.	Economic Development, City Engineer	Review city-owned brownfield sites within the flood risk areas and apply for HDSRF funding to better understand the risks.
Governance	Create Resilient Building Guidelines	Develop Resilient Building Guidelines to support residents and developers in incorporating more resilient practices into buildings during construction or renovations / retrofits.	City Engineer, Economic Development	Review best practices and evaluate what guidelines would work in Salem; adopt the guidelines and promote them to residents and builders.
Governance	Lack of Training and staffing	Develop database to track personnel, training needs, and continuing education requirements. Ensure all staff receive adequate training and refresher courses.	OEM, Business Administrator, Police, Fire	Ensure training is included in personnel job descriptions / performance reviews, and funds are budgeted to cover costs.
Governance	Lack of Training and staffing	Inventory equipment needs for the next five years across departments responding to climate related disasters. Develop a plan to acquire necessary equipment for City Departments.	Office of Emergency Management, Economic Development, Streets Department	Create a database of all equipment needs for the City. Consider sharing equipment.
Governance	Adopt requirements for heat mitigation	Adopt a Heat Mitigation ordinance. Investigate the possibility of implementing a requirement for public properties to incorporate heat mitigation features into any new design.	Planning Board, City Engineer, Streets Department	Explore implementing a requirement for public properties to incorporate heat mitigation features into any new design. Partner with County.
Governance	Adopt policies to protect Historic Resources	Include resilient design guidelines and post disaster planning for historic properties Historic Element of Master Plan	Planning Board, Economic Development	Coordinate with County and local Historic Preservation Groups to research guidelines
Governance	Mitigation options for Repetitive Flood loss properties	Identify properties susceptible to repetitive flood damage. Conduct risk assessments to determine best course of action for each property (mitigation or relocation: **Mitigation:** -Elevating buildings -Floodproofing structures -Sealing basements -Relocating utilities -Improve stormwater mgt -Implement green infrastructure -Construct flood barriers **Relocation:** -Buyout programs -Zoning and land use changes -Community relocation initiatives -Establish building setbacks from waterways -Transfer of development rights programs	Economic Development, City Engineer	Identify landowners within areas of repetitive flooding and partner with State to create program for mitigation and/or relocation

Appendices

Appendix A: Planning for Resilience Context Report

Appendix B: Community Vision: Key Findings

Appendix C: Community Engagement Plan

Appendix D: Climate Change-Related Hazard Vulnerability Assessment (CCRHVA)

Appendix E: Resilience Action Matrix

Appendix F: Resilience Action Resources

Appendix G: Climate Change Curriculum

Appendix A:

PLANNING FOR RESILIENCE

CONTEXT REPORT

2023

RESILIENT SALEM

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION

BRS inc

PRINCETON HYDRO

NEW JERSEY FUTURE

About this Document

This Planning for Resilience, Salem Context Report presents the findings of a review of existing plans and documents related to Salem City's vulnerability to natural disasters and other climate-related hazards. The purpose of this review is to gather information on the city's existing conditions, including infrastructure, land use, and other relevant data that could impact its vulnerability to such hazards. The review will focus on a range of plans and documents, including maps and planning documents, with the goal of developing a more comprehensive understanding of the city's vulnerabilities.

The findings of this review will inform the development of a Vulnerability Assessment and Resilience Action Plan for Salem City, which will outline strategies for mitigating the risks associated with natural disasters and other climate-related hazards. By reviewing existing plans and documents, it is hoped to identify key vulnerabilities and develop targeted strategies to address them, ultimately helping to build a more resilient, sustainable, and safer future for citizens and businesses.

The City of Salem was a recipient of a grant from the NJDEP Resilient NJ Municipal Assistance Program, administered by the New Jersey Department of Environmental Protection (NJDEP) and is part of a broader state-wide effort to build more resilient communities and reduce the risks of natural disasters and other climate-related hazards. This grant program aims to assist municipalities in New Jersey to become more resilient in the face of natural disasters and other climate-related challenges. The program offers technical assistance and funding to help local governments develop and implement plans to mitigate the risks associated with flooding, storm surge, and sea level rise.

This work was made possible with financial assistance from the Coastal Zone Management Act of 1972, as amended, administered by the Office for Coastal Management, National Oceanic and Atmospheric Administration (NOAA) through the New Jersey Department of Environmental Protection, Coastal Management Program.

Project Team:

The environmental assessments, data, and actions in this plan do not represent guidance or policy of the New Jersey Department of Environmental Protection or the National Oceanic and Atmospheric Administration and does not replace the need for regulatory review by the appropriate local, state, and federal agencies.

Table of Contents

Cover Image City of Salem

Introduction

This document aims to provide an overview of the city of Salem and its vulnerability to the impacts of climate change. The first part of the document provides a brief background of the city, including geographic and demographic information. The demographics section will highlight the populations that are most vulnerable to the impacts of climate change. Finally, the document will include a review of existing city planning documents to understand the extent of existing work in the realm of climate adaptation and resiliency.

Background

The City of Salem, NJ (Population: 4,811) is the county seat of Salem County, the state's most rural county. It is located in southern New Jersey along the Salem River, a primary tributary of the Delaware River. During the 17th and 18th centuries, Salem was an important port city whose residents were primarily employed in the shipbuilding industry and trade. Later, it transitioned to heavy commercial and industrial uses related to the port and railroad, such as glassworks, chemical manufacturing and bulk fuel storage. As with many port cities around the country, Salem experienced a precipitous decline in industrial and manufacturing operations, leading to the deterioration of this once-thriving community. The decline in the city's industrial and commercial port operations – and the related loss of jobs – has also led to a significant decline in population over the past 50 years.

Challenges facing Salem stem from poverty, which afflicts nearly half the population, limited nearby job opportunities, and disinvestment in housing that has led to vacancy and abandonment. The New Jersey Department of Community Affairs (NJ DCA) has designated Salem City as a "Distressed City" and an "Urban Aid Municipality" because of its extreme poverty. The percentage of individuals living below poverty is 41.3% (quadruple the rate for the state of NJ at 10.4%) with a median household income of just $24,841/year (less than 1/3 of the state's median household income of $79,363) (2018 ACS). Poverty has been persistent and increasing in Salem for several decades, tied largely to industrial decline and widespread disinvestment.

Furthermore, the US Environmental Protection Agency's (EPA) study, *Climate Change and Social Vulnerability in the United States,* shows that the most severe harms from climate change fall disproportionately upon underserved communities, such as Salem, who are least able to prepare for, and recover from, heat waves, poor air quality, flooding, and other impacts. EPA's analysis indicates that racial and ethnic minority communities are particularly vulnerable to the greatest impacts of climate change.

Despite these challenges, City of Salem is a special place with many wonderful qualities that make it unique. One of the most striking features of Salem is its rich history, which is evidenced by its numerous historic sites and landmarks. Visitors can experience the city's past by visiting the Old Salem County Courthouse and the downtown historic district.

What truly sets Salem apart is its strong sense of community. The city has a tight-knit community of friendly and welcoming residents who are passionate about preserving Salem's unique character. Throughout the year, there are many events and activities that bring people together, such as the annual Salem Christmas Parade, the Salem Tomato Festival, Movie Nights, and the Salem City Market. These events showcase the city's vibrant culture and foster a sense of pride and togetherness among residents.

The City of Salem has a lot to offer. Its rich history, beautiful natural surroundings, strong sense of community, and diverse culture make it a truly special place to live, work, and visit.

Planning for Resilience

In this section we discuss municipal zoning regulations and both municipal and county planning documents as they relate to:

- **Challenges** presented by current and future impacts of climate change on the municipality including increased temperatures, drought, flooding, hurricanes, and sea-level rise;
- **Analysis** of future residential, commercial, industrial, and other development in the municipality;
- **Assessment** of the climate change threats and vulnerabilities identified above related to that development based on current zoning regulations; and
- **Impacts** on critical facilities, utilities, roadways, and infrastructure necessary for evacuation purposes and sustaining quality of life during a natural disaster.

Salem's neighborhoods have benefitted from being the subject of extensive planning studies over the past five years, ranging from the City-wide Comprehensive Master Plan and Comprehensive Economic Development Report to neighborhood-level plans and redevelopment reports. However, very little planning for climate change risks has taken place to date.

New Jersey Initiatives for Resilience

The State of New Jersey has taken several actions to prepare for the impacts of climate change, recognizing that the state is vulnerable to the effects of rising sea levels, flooding, more frequent and severe extreme weather events, changes in precipitation patterns, impacts on human health, biodiversity, and ecosystems, as well as infrastructure damage in New Jersey. These actions are critical because climate change is expected to have significant economic, social, and environmental impacts, and the state must be prepared to adapt to these changes. New Jersey has encouraged municipalities to act to prepare for the impacts of climate change, including funding and technical assistance to help communities develop climate action plans, assess their vulnerability to climate change, and implement measures to reduce greenhouse gas emissions and improve resilience. This support is critical because many of the impacts of climate change, such as flooding and extreme heat, are felt at the local level, and municipalities need to be prepared to respond.

The **NJDEP Resilient NJ Municipal Assistance Program** is a grant program that is aimed at helping municipalities in New Jersey to become more resilient in the face of natural disasters and other climate-related challenges. The program provides technical assistance and funding to help local governments develop and implement plans to mitigate the risks associated with flooding, storm surge, and sea level rise. The Resilient NJ program is designed to help municipalities identify and address vulnerabilities in their infrastructure, buildings, and communities. It provides funding for a range of activities, including climate-related impact vulnerability assessment, community outreach and education. The program is administered by the New Jersey Department of Environmental Protection (NJDEP) and is part of a broader state-wide effort to build more resilient communities and reduce the risks of natural disasters and other climate-related hazards. The City of Salem received a grant from this program to develop a Vulnerability Assessment and Resilience Action Plan.

There have been several laws passed and executive orders issued in New Jersey since 2010 aimed at addressing climate change.

Some of the key measures include:

1. **The Global Warming Response Act (GWRA):** The GWRA, passed in 2007 but amended in 2019, sets a statewide goal of reducing greenhouse gas emissions to 80% below 2006 levels by 2050. It also requires the New Jersey Department of Environmental Protection (NJDEP) to develop a plan for achieving this goal.

2. Executive Order 54: Issued by Governor Chris Christie in 2011, this order established the New Jersey Climate Adaptation Alliance to address the impacts of climate change in the state and promote resilience and adaptation.
3. Executive Order 28: Issued by Governor Phil Murphy in 2018, this order directed the NJDEP to take several actions to address climate change, including rejoining the Regional Greenhouse Gas Initiative (RGGI), developing a plan to achieve 100% clean energy by 2050, and promoting electric vehicles and energy efficiency.
4. The New Jersey Clean Energy Act: Passed in 2018, this law requires the state to achieve 50% of its electricity from renewable sources by 2030 and to reduce greenhouse gas emissions by 80% below 2006 levels by 2050. It also directs the NJDEP to establish a program to promote energy efficiency and renewable energy in low- and moderate-income communities.
5. New Jersey Executive Order 89 was issued by Governor Phil Murphy in November 2020. The order establishes a statewide goal of achieving 100% clean energy by 2050 and directs state agencies to take a coordinated and comprehensive approach to achieving this goal. The order requires the state to develop a Statewide Climate Change Resilience Strategy and created an Interagency Council on Climate Resilience.
6. New Jersey Executive Order 100 was issued by Governor Phil Murphy in 2019 and launched the New Jersey Protecting Against Climate Threats (NJPACT) initiative. The order directs state agencies to act to reduce greenhouse gas emissions, promote clean energy, and build resilience to the impacts of climate change.

   The key components of Executive Order 100 include:

   1. Setting a goal of achieving 100% clean energy by 2050, through a combination of renewable energy and energy efficiency measures;
   2. Establishing the New Jersey Climate Change Alliance, a partnership between government, academia, business, and other stakeholders to develop a comprehensive strategy for addressing climate change in the state;
   3. Rejoining the Regional Greenhouse Gas Initiative (RGGI), a cap-and-trade program that reduces greenhouse gas emissions from power plants in the Northeast;
   4. Requiring state agencies to consider the impacts of climate change in their planning and decision-making processes;
   5. Creating the Climate and Flood Resilience Program, which provides funding and technical assistance to local communities for climate adaptation and resilience projects;
   6. Creating the Zero Emission Vehicle (ZEV) Task Force, which is charged with developing strategies to increase the adoption of electric vehicles in New Jersey.

   Executive Order 100 represents a comprehensive and ambitious approach to addressing the challenges of climate change in New Jersey. By promoting clean energy, resilience to the impacts of climate change, and collaboration among stakeholders, the order seeks to ensure a sustainable and prosperous future for all residents of the state.

7. The New Jersey Protecting Against Climate Threats (NJPACT) is a suite of policies and initiatives launched by the New Jersey Department of Environmental Protection (NJDEP) in 2020. NJPACT aims to reduce greenhouse gas emissions, build resilience to the impacts of climate change, and promote clean energy and environmental justice in New Jersey.

   The key components of NJPACT include:

   1. The Energy Master Plan, which outlines a roadmap for achieving 100% clean energy by 2050, including a transition away from fossil fuels and a focus on energy efficiency and renewable energy sources;
   2. The New Jersey Climate Report, which provides a comprehensive assessment of the state's vulnerability to climate change and outlines strategies for adapting to these impacts;

3. The Healthy Community Initiative, which aims to promote environmental justice and address environmental disparities by engaging with overburdened communities and promoting clean air, clean water, and healthy environments for all New Jersey residents;
4. The New Jersey Clean Energy Equity Initiative, which seeks to promote access to clean energy and energy efficiency programs for low- and moderate-income households and communities;
5. The Sustainable Jersey Program, which provides support and resources for local communities to promote sustainability, including energy efficiency, green infrastructure, and climate adaptation and resilience planning.

8. The New Jersey Climate Adaptation and Resilience Act (CARA) is a law enacted in 2019 that aims to enhance the state's ability to prepare for and respond to the impacts of climate change. The law requires the New Jersey Department of Environmental Protection (NJDEP) to take a comprehensive and coordinated approach to climate change adaptation and resilience planning and implementation.
   The key provisions of the CARA include:
   1. Establishing the New Jersey Climate Change Resource Center to serve as a clearinghouse of information and resources on climate change adaptation and resilience;
   2. Requiring the NJDEP to develop and implement a statewide climate change adaptation and resilience plan that addresses the impacts of climate change on New Jersey's communities, infrastructure, and natural resources;
   3. Requiring the NJDEP to develop and update vulnerability assessments and risk analyses to identify areas of the state that are most vulnerable to climate change impacts and to prioritize adaptation and resilience efforts accordingly;
   4. Requiring the NJDEP to establish a grant program to support local climate change adaptation and resilience planning and implementation;
   5. Requiring state agencies to consider the impacts of climate change in their decision-making processes and to incorporate climate change adaptation and resilience considerations into their planning and operations;
   6. Requiring the NJDEP to establish guidelines and standards for green infrastructure and natural resource-based solutions to climate change adaptation and resilience.

9. New Jersey Assembly Bill A2785 Aca (1R), Governor Murphy signed into law P.L. 2021, c6, amending the MLUL on February 4, 2021. Municipalities are required to incorporate a climate change-related hazard vulnerability assessment into any Master Plan Land Use Element adopted. The specific amendment added a new section to the MLUL, Section 3B:5-3, which requires municipalities to consider the vulnerability of their communities to natural hazards and climate change impacts when adopting and amending land use plans, master plans, and zoning ordinances. The amendment requires municipalities to assess the vulnerability of their communities to hazards such as flooding, sea-level rise, and extreme weather events, and to consider strategies for mitigating these risks in their land use planning efforts.

   According to the law, the vulnerability assessments must rely on the most recent natural hazard projections and best available science provided by the NJ Department of Environmental Protection (DEP) (https://www.nj.gov/dep/climatechange/). Municipalities must also consider environmental effects associated with climate change, including, but not limited to, extreme weather, temperature, drought, fire, flooding and sea-level rise; and contain measures to mitigate reasonably anticipated natural hazards, such as coastal storms, shoreline erosion, flooding, storm surge, and wind.

10. The NJDEP **Long-Term Control Plans (LTCPs)** were first established as a regulatory requirement under the New Jersey Pollutant Discharge Elimination System (NJPDES) Municipal Separate Storm Sewer System (MS4) Permit in 2004.The permit established the LTCP requirement for municipalities with combined sewer systems or certain types of sanitary sewer systems, requiring them to develop and implement a long-term strategy for controlling overflows of untreated sewage and reducing pollution in local waterways. The LTCP requirement has since been revised and updated several times through subsequent permit renewals and regulatory updates. The most recent update to the LTCP requirement was issued in 2016, when the NJDEP revised the MS4 permit to include more specific requirements for LTCP development and implementation.

11. The **New Jersey Clean Stormwater and Flood Reduction Act (CSFRA)** is a law enacted by the New Jersey Legislature in 2019. The law requires that certain types of development projects include green infrastructure practices to manage stormwater runoff, reduce flooding, and improve water quality.

    The CSFRA applies to development projects that require a stormwater permit under the New Jersey Pollutant Discharge Elimination System (NJPDES) regulations. Specifically, the law requires that these projects incorporate green infrastructure practices such as rain gardens, green roofs, permeable pavement, or other practices that mimic natural processes to manage stormwater runoff.
    The CSFRA also requires that the New Jersey Department of Environmental Protection (NJDEP) establish a funding program to assist municipalities in implementing green infrastructure projects. The program is funded by a new surcharge on water consumption that is applied to both residential and non-residential water users.

    The goal of the CSFRA is to reduce the volume and velocity of stormwater runoff, reduce flooding and erosion, improve water quality, and promote the use of green infrastructure practices to achieve these goals. The law is part of a broader effort by the state of New Jersey to address the impacts of stormwater runoff and to promote sustainable development practices.

12. **The New Jersey Environmental Justice Bill (S232**) is a law that was enacted in September 2020. The law aims to address environmental justice issues in low-income and minority communities in New Jersey by requiring greater transparency, public participation, and accountability in environmental decision-making. The law establishes a framework for identifying and addressing environmental justice issues in the state, requiring the New Jersey Department of Environmental Protection (NJDEP) to take certain actions to ensure that environmental justice communities are protected from disproportionate environmental impacts.

    Specifically, the law requires the NJDEP to:
    1. Identify environmental justice communities in the state based on a set of criteria such as income, race, and language proficiency;
    2. Consider the cumulative impacts of pollution on these communities when making permitting and enforcement decisions;
    3. Establish a public participation process that ensures meaningful engagement of environmental justice communities in the decision-making process;
    4. Provide greater transparency in the decision-making process by requiring the NJDEP to make certain documents, data, and analyses available to the public in a timely and accessible manner;
    5. Consider the social and economic impacts of environmental rules and regulations on environmental justice communities, and take steps to mitigate any negative impacts.

Under the law, an overburdened community is defined as a community that meets one or more of the following criteria:

1. A median household income that is less than or equal to 250% of the federal poverty level;
2. At least 40% of households in the community have limited English proficiency;
3. At least 40% of households in the community are minority, as defined by the U.S. Census Bureau;
4. At least 30% of households in the community have a housing cost burden greater than 30% of their income;
5. The presence of environmental contamination that poses a significant threat to public health, as determined by the New Jersey Department of Environmental Protection.

13. On July 17, 2023, NJDEP implemented the Inland Flood Protection Rule as part of NJ PACT to address climate threats by updating the Stormwater Management (SWM) and Flood Hazard Area Control Act (FHACA) rules. These adjustments respond to extreme weather and project future rainfall increases through 2100.

    Key Changes Include:

    A two-foot increase in the Design Flood Elevation (DFE) for the first habitable floors in fluvial areas, according to NJDEP flood maps.

    Permit applicants must use anticipated rainfall data for 2100 for flood elevation calculations.

    Flood Hazard Area permits need to align with NJ Uniform Construction Code and FEMA requirements.

    Stormwater Best Management Practices (BMPs) must account for both current and future storm scenarios, moving away from Rational and Modified Rational methods for impact calculations.

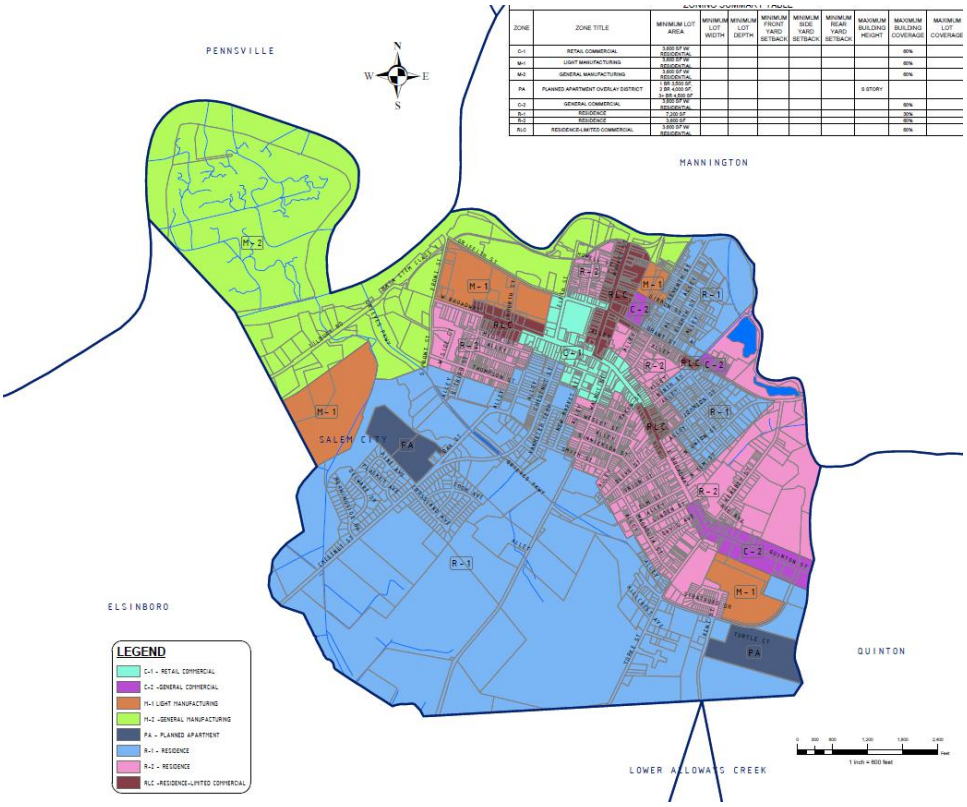
    The Inland Flood Protection Rule mandates new standards for flood elevation and stormwater management to mitigate future climate impact risks. These standards involve using long-term rainfall projections and enhancing building and development practices to withstand anticipated conditions. Exemptions apply to certain developments based on application submission or construction start dates relative to the rule change.

Review of Plans

The sections below examine Salem City's zoning map and city and county planning documents, with particular attention given to any mention of climate change.

Zoning Map

Salem City adopted a zoning map in 1976 that was revised in 2002 and again in 2004.[1] Of the total 6,798.19 acres within the city, 3,068.34 (45%) acres are zoned as Residential, 473.87 (7%) acres as Industrial, and 482.18 (7.1%) as Commercial. The remainder of the acreage is A 1/Agriculture (One-Family Dwellings on larger plots with parking, Parks, Playgrounds, Community Centers, Golf Courses, Agricultural Uses) of 2082.30 acres, Industrial/Manufacturing Planned Development of 395.31 acres, Mixed Use of 17.59 acres, and Public Facilities of 286.71 acres. The majority of the land designated as Residential (1,642.88 acres) is medium density, where single-family and multi-family dwellings are commingled.



Flood Damage Prevention Ordinance, 2016

Flood Damage Prevention ordinance in Salem City was amended in 2016 to ensure compliance with statutory authorization granted to the municipality to adopt regulations promoting the citizenry's public health, safety, and general welfare. These are some of the significant changes and new regulations that have been implemented in New Jersey since the 2016 amendment of the Salem Ordinance. The provisions of the ordinance would need to be updated to fully comply with new requirements.

[1] https://suvgis.spanishfork.org/Salem_maps/GIS_Data/Zoning%2024x36.pdf

Neighborhood Level Planning Documents

Draft Neighborhood Plan for Public Review – 2022 (prepared by Stand Up for Salem)

Currently available for public review, this neighborhood plan updates and refreshes a previous neighborhood plan completed in 2010. The goals of the Plan are the following:

- Improve access to quality affordable housing,
- Support business, economic and workforce development, and
- Support community building and youth development.

The report focuses only on the Center of Salem, a neighborhood that includes the city's central business district, historic county and city government center, business district, and surrounding residential areas, comprised mainly of single-family homes. The Center of Salem constitutes approximately 20% of the total geography of the City of Salem and is an area that is particularly rich in community assets (educational, medical, retail, historical, parks/recreation, religious, etc.).

Although the Plan covers current and future brownfield remediation projects as aligned with the city's interests to support environmental development and improved health outcomes, there is no mention of goals specifically related to climate change.

Salem City Port District Redevelopment Plan - 1982

This Plan focuses specifically on the proposed commercial barge port to be constructed along the Salem River "in order to capitalize on the area's potential for waterborne transportation." It lists several recommendations related to preservation of historical buildings/sites, recreational space, road improvements, and redevelopment of a landfill area, but because the area was previously developed, there is no mention of environmental protections other than that adjacent water-oriented recreational development should be "designed in an environmentally sensitive manner." The Plan mentions that the port development area is within the defined Coastal Zone and therefore subject to permit requirements under the Coastal Zone Management Plan. The recommendation is for the permitting process to be completed as quickly as possible in order to "substantially relieve future developers of the delays and submission requirements of the coastal permitting process."

City Planning Documents

Salem Comprehensive Plan – 1974

This Plan replaced the 1962 Comprehensive plan and sets forth goals and policies adopted by the City of Salem for managing growth. The first stated goal of this Plan is to "encourage types of development and uses which … will increase the financial capability of the City to provide required community

services and facilities. …It is imperative as a matter of survival that development proposals and land use decisions be considered with a view to encouraging those which will help restore the City to a more financially viable position." Key to the plan is preserving and strengthening Salem's industrial sector as a source of employment, and the authors acknowledge Salem as a city with a "wide range of economic means and tastes."

The main planning goals of the Salem Comprehensive Plan are:

- Provide for adequate and diversified housing supply in attractive, healthy, and safe environments
- Continue the City's program to eliminate substandard housing
- Maintain an active and viable central business district
- Provide adequate community facilities, including programs to meet social, cultural, and recreational needs

Municipal building

The Plan makes no specific mention of challenges related to current and future impacts of climate change, but even in 1974 there was concern about "substandard" housing and neglect of historical buildings in Salem. The Plan mentions the area of Mud Digger Ditch as a recreational asset but views "reclamation" of the surrounding marshlands and tidal marshlands through the Town Bank project as positive steps for construction of new roads and housing. There was at the time significant concern about the loss of housing units due to "urban renewal."

There is a section in the Plan on "Environmental Assessment of Plan Proposals," which includes:

- Elimination of substandard housing and reduced population density in order to lessen "detrimental environmental influences"
- Development of new and supplemental sources of water, establishment of a possible secondary sewage treatment facility, and development of new recreational facilities
- Transportation improvements to reduce through-traffic within the city "while minimizing the amount of area devoted to streets and other forms of paving" (though it is noted that there will be ecological impact to marshland from construction of a planned by-pass connecting Route 45)
- Additional industrial development on vacant land (including construction of "modern office buildings") and expansion of existing industries to increase employment opportunities
- Preservation of open spaces in the city, particularly marshland "to be retained in its natural state"
- Continued development of mass transit facilities to reduce the number of fossil fuel-burning vehicles in the city, reduce air pollution, and provide "transportation opportunity to those who do not have private vehicles."

Historic homes on Broadway

In all of the above cases, the economic benefits were considered to outweigh possible adverse environmental effects, though priority was clearly placed on creation of jobs and increasing sources of municipal revenue. The Plan noted that "If the City decides to participate in the National Flood Insurance Act, the required local floodplain requirements will represent

another environmental control to be administered by the Planning Board."

Salem City Master Plan – 1978

In 1978 the Salem City Planning Board reviewed the 1974 Salem Comprehensive Plan to determine whether it was in compliance with the Municipal Land Use Law (MLUL) and to make sure its recommendations were still appropriate. One of the new sections added to the 1978 Plan was a policy statement indicated the relationship of the city plan to those of neighboring municipalities and the county. The Plan also notes continued loss of housing and of industrial jobs in the years 1974 to 1978. The decrease in housing units (particularly apartments) was due to improved Housing Code enforcement that led to the demolition of substandard housing and rehabilitation of a small number of units.

A new section of the 1978 Plan that deals with the Coastal Zone Management Strategy "for preservation of existing environmental resources" requires issuance of a permit for development of a new or reconstructed facility in coastal, marsh, and riverside areas. However, while the Plan calls for conservation in the area between the Salem River and the coastal zone, it encouraged manufacturing development along the Salem River, acknowledging that "the permitted manufacturing uses may conflict with some of the environmental principles in the coastal management strategy." Essentially, the need for growth and development trumped other resource policies: "the Master Plan's use policies are generally in conformance with the management strategy if the permitting authority properly considers the trade-off between economic development and environmental principles."

Salem River

Salem City Master Plan Re-Examination Report – 1982

The Report begins by acknowledging continued population decline in Salem City but focuses largely on more optimistic topics such as commercial and industrial development (including the Barge Port project) and a new city park. The Report mentions two new municipal plan elements required by MLUL as of 1981 – Energy Conservation and Stormwater Management – but does not address them, partially because topographic mapping of the City had not yet been completed.

Salem City Master Plan Re-Examination Report – 1996

This brief report begins by acknowledging the continued decline of both population and industry in Salem City but states that the original goals of the 1974 Plan are still relevant and continue to guide development of the city.

Only 25% of the city's land area was residential in 1996, while 40% was classified as wetlands or vacant, and 10% was commercial or industrial. Regarding development in residential uses, the Plan

mentions the trend away from home ownership states that multifamily apartment overcrowding (i.e., more than one person per room) is a significant problem.

Master Plan of Salem City: Housing Element – 2001 (revised and amended)

This housing plan element focuses on residential standards and proposals for the construction and improvement of housing. Most of the Plan is related to affordable housing but does not specifically address considerations such as the flood plain.

Anderson Drive Complex (Salem Housing

Salem City Master Plan Re-Examination Report – 2002

This Report once again states that the main goals of the 1974 Plan are still relevant and should continue to guide development of the city, but it notes that particular attention should be given to conservation of natural resources and energy conservation (among other elements) in future re-examination reports. "Overall, however, there have not been any significant changes [since 1996] in land uses, circulation, conservation of natural resources, energy conservation, and collection and disposal of recyclable materials to report."

City of Salem Environmental Commission Open Space and Recreation Plan – 2009

83 Griffith St., Salem

Although the responsibility for drafting master plans lies with the Salem City Planning Board, the Environmental Commission was tasked with preparing this Plan. Land available for development into new recreational uses is very limited, as the Plan concedes.

The Plan focuses primarily on recreational uses of green/open spaces, but it does have elements that are related to environmental preservation, such as maintenance of water quality and groundwater recharge areas and protection of sensitive environmental features (e.g., wetlands and water bodies). The Plan prioritizes coordination with neighboring local governments, given that the natural resources the Plan attempts to preserve are not limited by political boundaries.

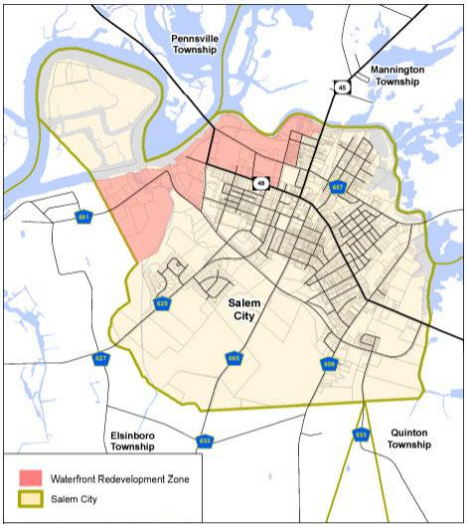
City of Salem Planning Board Master Plan Re-Examination Report – 2012

This Plan Reexamination Report focuses mainly updates to the redevelopment of Main Street, historic preservation, recreation and cultural activities, and the rehabilitation and development of housing. The Report notes that while the population had continued to decline and the number of vacant housing units had increased, household and poverty indicators improved. It notes that there had not been any significant changes in land uses, circulation, conservation of natural resources, or energy conservation.

The other mention of climate is a recommendation that the Planning Board should prepare and adopt a Conservation Plan Element to the Master Plan, but no date is given. The report does not refer to threats from climate change or to preparedness.

Salem City Waterfront Redevelopment Zone Plan - 2018

In 2018, the City was the recipient of New Jersey Department of Community Affairs (DCA) funding for the development of a Waterfront Redevelopment Zone Plan, an area that consists of almost 13% of the total land area of the City. About 80% of the Waterfront Redevelopment Area is in a 100-year flood zone, but the redevelopment plan lacks actions and guidance about how to address redevelopment in an area so vulnerable to sea level rise. Prioritizing strategies that incorporate resilience as a tool and driver for economic development can serve as a model for a municipality in need of both.



From Waterfront Redevelopment Zone Plan - 2018

The Plan's main focus is bringing jobs, business, and life back to the City's waterfront. Specifically, Goal 3 of the Redevelopment Plan states that one intent of the redevelopment plan is "to support the working waterfront by encouraging maritime and industrial businesses to locate on the waterfront, encouraging more port commerce and shipping, and ensuring that the waterfront infrastructure is well maintained."

The Port of Salem has experienced a decline in manufacturing and industry, leaving this once-thriving harbor area in a state of deterioration and under-utilization. The Redevelopment Area encompasses roughly 212 acres and 142 parcels within the City, portions of which were previously designated as Areas in Need of Redevelopment, and are currently in a New Jersey Department of Environmental Protection (DEP) Brownfield Development Area (BDA). The Redevelopment Area consists largely of active and vacant industrial sites, former gasoline service stations, a former heating oil storage facility, and the closed Salem Sanitary Landfill.[2]

The Plan proposes a Waterfront Industrial Business Park Zone, a Mixed-Use Transition Zone, and a Conservation/Preservation Zone. It contains no mention of sea level rise, riverine flooding, or other climate hazards to which Salem City is vulnerable.

Salem County Planning Documents

The remaining recent, publicly available Plans that pertain to Salem City are Salem County Plans.

Salem County Final Cross-Acceptance Report - 2004

This Report was published in 2004 by the Salem County Planning Board. It details the responses of the County's townships regarding Planning Area Changes discussed during the Cross-Acceptance process. Many relate to storm and wastewater management, redevelopment along local waters, etc. Climate change is not mentioned specifically.

[2] https://cityofsalemnj.gov/wp-content/uploads/2018/10/2018%20Salem%20Waterfront%20Redevelopment%20Plan.pdf

Salem County Economic Development Strategic Plan - 2014

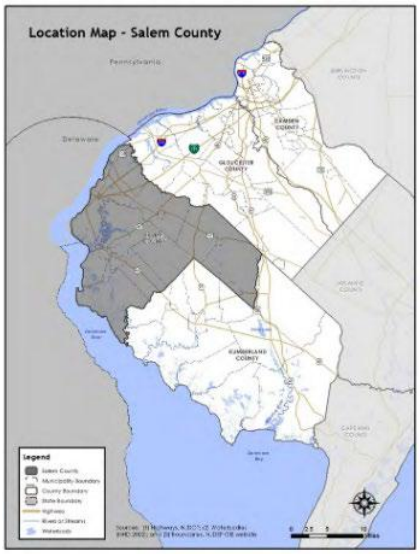
This plan does not mention climate change specifically, but it lists flooding and severe weather events as general “threats” to the county.

Salem County Comprehensive Master Plan - 2015

In FY 2015, the Salem County Planning Board approved the County’s Comprehensive Master Plan. The Growth Management Element mentions the County’s "evolving agricultural economy that is supported by a tough adaptable group of farmers" that are faced with increasing challenges… (including).... climate change." It is the only mention of climate change in the document.

Salem County Hazard Mitigation Plan – 2016

This Plan was published as a part of the Mitigation Plan for four New Jersey counties, including Camden, Gloucester, Salem, and Cumberland. The only mention of climate change is in Part 4: Mitigation Measures. It broadly lists "staying informed" about changing science and effects of climate change listed as part of the County’s general mitigation strategy.



Mitigation Plan for Four New Jersey Counties - Appendix SC.1 - Salem County

As part of the County Hazard Mitigation Plan update process, Salem has the following goals for pursuing mitigation measures:

1. Improve education and outreach efforts regarding potential risk of natural hazards and appropriate mitigation measures that can be used to reduce risk (including programs, activities, and projects),
2. Improve data collection, use, and sharing to reduce the risk of natural hazards,
3. Improve capabilities and coordination at municipal, county, and state levels to plan and implement hazard mitigation measures, and
4. Plan and implement projects to mitigate identified natural hazards, known problems, and areas of concern.

This Plan has expired but Salem County is in the process of developing a plan expected to be completed at the end of 2023, with a comment period on the draft plan expected to end September 15, 2023.

Regional Level Planning Documents

RTP 2050: Moving South Jersey Forward – 2021

This Regional Transportation Plan is the current long-range plan for South Jersey detailing how the region aims to invest in the transportation system.[3] Produced by the South Jersey Transportation Planning Organization (SJTPO), encompassing Salem, Cumberland, Atlantic, and Cape May counties), it identifies the region's long-term needs and the policies, strategies, and projects that will address those needs, and guides how over $5 billion in federal transportation funds will be spent in the region over the next 30 years.

Although primarily related to transportation, Goal 5 (Improve the resiliency and reliability of the transportation infrastructure, particularly along the Atlantic and Delaware Bay shorelines) touches on threats climate change poses to transportation in Salem County. The strategies listed are:

- Prioritize evacuation projects: Evaluate evacuation and other critical routes and prioritize roadway maintenance projects on these routes.
- Emergency preparedness plans: To the maximum extent possible, ensure coordination, as well as appropriate integration with transportation plans of emergency relief and disaster preparedness plans, strategies, and policies amongst SJTPO subregions and planning partners.
- Emergency preparedness education: Educate the public about emergency preparedness efforts.
- Improve transportation vulnerability: Analyze the vulnerability of the transportation system to determine where adaptation strategies are most appropriate.
- Resiliency partnerships: Participate in regional and statewide resiliency planning initiatives.
- Support resiliency funding: Serve as a technical resource to partner agencies in pursuing funding opportunities to improve resiliency and reliability of transportation infrastructure.
- Resiliency education: Educate the public on the worsening vulnerabilities of the regional transportation network with the resulting increases in flooding and storm severity.
- Stormwater management: Assess strategies appropriate to address stormwater management.

Goal 9 also touches on environmental issues (Protect and enhance the environment and complement land use planning) but not specifically on preparedness for threats from climate change. SJTPO region's numerous resources are carefully documented in the RTP in Chapter 2.

Conclusions

The goals of this research document were:

- To establish a baseline understanding of the threats posed by climate change in Salem City;
- To understand and prioritize populations most vulnerable to threats posed by climate change; and
- To review public plans and documents in order to identify the ways that municipal and county planning has addressed threats posed by climate change.

[3] Link to full plan: chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.sjtpo.org/wp-content/uploads/2021/01/Final-RTP-2050_1.25.2021.pdf

The analysis was intended to review public plans and documents to assess the actions that address for climate change and the gaps that need to be addressed as part of the Action Planning phase of the project. Each of the plans reviewed will benefit from the Vulnerability Assessment analysis to target strategies. The next step will be to build an understanding of how public planning, policy, and community engagement can be enhanced to meet Salem City's resilience goals.

While Salem City and Salem County have addressed measures to improve equitable economic development, homeownership, and transportation (among many other topics), a plan to prepare and protect the population and valuable city assets from climate change threats is largely absent. We hope this document will serve as a repository of the work done so far and an indication of critical issues that must be addressed soon as Salem City builds its local climate resilience strategy and municipal environmental justice plan.

Appendix B:

COMMUNITY VISION

KEY FINDINGS

2023

RESILIENT SALEM

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION

BRS inc

PRINCETON HYDRO

NEW JERSEY FUTURE

City of Salem NJ

Resilient Salem

Key Findings Memorandum

Contents

The environmental assessments, data, and actions in this plan do not represent guidance or policy of the New Jersey Department of Environmental Protection or the National Oceanic and Atmospheric Administration and does not replace the need for regulatory review by the appropriate local, state, and federal agencies.

This work was made possible with financial assistance from the Coastal Zone Management Act of 1972, as amended, administered by the Office for Coastal Management, National Oceanic and Atmospheric Administration (NOAA) through the New Jersey Department of Environmental Protection, Coastal Management Program.

About

The City of Salem received a grant from the Resilient NJ Municipal Assistance Program in 2021 to develop a Vulnerability Assessment and Resilience Action Plan, the Key Findings Memorandum is a product for this project to document the community visioning process that guides the Vulnerability Assessment and the development of the Resilience Action Plan.

The Resilient NJ Municipal Assistance Program is a state-sponsored program that provides technical assistance and support to municipalities in New Jersey to help them become more resilient to the impacts of climate change. The program is administered by the New Jersey Department of Environmental Protection (NJDEP) and provides funding to eligible municipalities to undertake planning and implementation projects that address climate change risks and vulnerabilities. The program is part of the larger Resilient NJ initiative, which is a statewide effort to build resilience to climate change impacts across all sectors of society.

Community Meetings

Meeting 1: July 19, 2022 at 6pm via Zoom

Meeting 2: February 16, 2023 at 6pm in person at the Salem County Superior Court Building, 92 Market St, Salem, NJ 08079

Recordings of both meetings are available at: brsinc.com/resilient-nj-salem

Meeting Flyers:

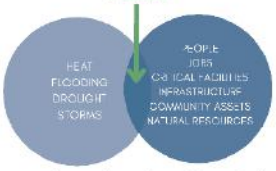
A VULNERABILITY ASSESSMENT AND ACTION PLAN FOR SALEM

PUBLIC INFORMATION MEETING
TUESDAY, JULY 19
6PM - ZOOM
BRSINC.COM/RESILIENT-NJ-SALEM

EVALUACIÓN DE VULNERABILIDAD Y PLAN DE ACCIÓN PARA SALEM

REUNIÓN DE INFORMACIÓN PÚBLICA
MARTES, 19 DE JULIO
6PM - ZOOM
BRSINC.COM/RESILIENT-NJ-SALEM

THE CITY OF SALEM IS DEVELOPING A CLIMATE CHANGE VULNERABILITY ASSESSMENT AND RESILIENCE ACTION PLAN



We invite you to learn about the Risks and Vulnerabilities we identified in Salem and share your experiences.

Thursday, February 16, 2023 at 6pm
Old Salem Courthouse
113 Market Street, Salem, NJ

Why?
Understanding Risks from Climate Change
Identifying Vulnerabilities
Setting community priorities
Developing actions and implementation plan

LA CIUDAD DE SALEM ESTÁ DESARROLLANDO UN PLAN DE ACCIÓN DE RESILIENCIA Y EVALUACIÓN DE VULNERABILIDAD AL CAMBIO CLIMÁTICO

Le invitamos a conocer los Riesgos y Vulnerabilidades que identificamos en Salem y compartir sus experiencias.

Jueves, 16 de Febrero de 2023 a las 18:00
Old Salem Courthouse
113 Market Street, Salem, NJ

¿Por qué?
Comprender los riesgos del cambio climático
Identificación de vulnerabilidades
Establecer las prioridades de la comunidad
Desarrollo de acciones y plan de implementación.

Learn more and get involved!/*¡Aprenda más y participe*!: **https://brsinc.com/resilient-nj-salem/**

1. Meetings Summary

The Project Team facilitated two meetings with Salem City residents. The first meeting was virtual, included Spanish interpretation, and was held on July 19, 2022. The meeting presentation was recorded and posted on the project webpage. Polling was conducted during the meeting and was also available on the webpage to collect additional information. The meeting participation and engagement were less active than the project team had hoped for, and at the February 16, 2023, Vulnerability Assessment In-Person public meeting, an additional conversation was facilitated about the Vision and Goals of the Vulnerability Assessment.

Meeting 1: Project Introduction and Vision, July 19, 2022

The meeting opened with an introduction to the Resilient Salem project, which aims to analyze the City's vulnerability to climate change impacts. The project is funded by the New Jersey Department of Environmental Protection (NJ DEP), which received funding from NOAA to work with communities in the state to create a vulnerability assessment and climate resilience action plan. The project team includes the BRS, New Jersey Future, and Princeton Hydro, who will be working together to conduct research, data collection, and assessments.

During the meeting, attendees participated in a series of anonymous polls that collected data about their experiences in Salem and opinions on the city. The polls asked about attendees' tenure living in Salem, housing situations, presence of children or elderly in their homes, experiences with climate events such as rain and flooding, and aspects of the city they were proud of and loved.

Image of Poll Slide from Presentation

The project team presented information on potential climate impacts on Salem and invited the community to collaborate on developing a vision for the city. The team emphasized collaboration with the community to develop a shared vision for the city's future development. The project involves five critical steps: research, data collection and assessments, collaborative work with the community, vulnerability assessment, and resilience adaptation actions and plans. The team also showcased an online tool in development that will be used to provide access to different aspects of the project, such as public engagement, research results, data collection, reports and analysis, and interactive vulnerability assessments. They explained their approach to vulnerability assessment, which involves understanding how a system (natural system, neighborhood, energy grid, etc.) can respond to climate change impacts and be prepared for stressors, and defining climate resilience as the ability of those systems to absorb and be prepared for stressors. The team also talked about the importance of geographically-based information such as land use and flood inundation maps and how these will inform the vulnerability assessment.

A desktop exercise helped the team understand the goals and steps taken in Salem's past. The presentation shared some planning goals previously identified by the Salem waterfront redevelopment zone plan and the Salem masterplan reexamination report. These included increasing economic development in the waterfront industrial areas, promoting historic preservation, and supporting recreation and cultural activities. Another important goal was the rehabilitation and development of affordable housing in the city.

The presentation provided background information about New Jersey climate change impacts and how the State is preparing. The team then explained the terms and concepts that will be used in the process and how those climate change impacts could be experienced in the City.

During the meeting, the project team discussed the importance of developing a shared vision for the city's future as a critical aspect of the Resilient Salem project. They emphasized the need to collaborate with community members, neighborhood groups, government agencies, and business associations to ensure that the potential impacts of climate change are understood, and the risks are adequately addressed.

The team highlighted the importance of identifying the values that community members hold dear to create a vision that aligns with their needs and aspirations. They noted that a shared vision would help guide the development of resilience actions that are more effective in protecting the community from the impacts of climate change.

Summary of the poll results:

The attendees participated in various anonymous polls to collect data about their experiences in Salem and opinions on the city.

The first poll asked attendees how long they had lived in Salem, and two anonymous responses were collected: one response stated that it was not applicable, and the other response indicated that the person had lived in Salem for 20 or more years. The second poll asked about housing, and both anonymous responses indicated that they owned their homes. The third poll asked who lived at home with the attendees, and one anonymous response indicated that they had no children, while the other response indicated that an elderly person (over the age of 60) lived with them.

Another poll asked attendees if they had experienced any disruptions to their lives due to flooding. One anonymous response stated that they had experienced disruptions due to the roads.

The next poll asked attendees if they had experienced any climate impacts in Salem. Some of the responses indicated that hot days, rain and flooding events, and extreme storms and impacts were more frequent than in the past, while others said that these events were the same as always in Salem.

Then, the attendees were asked about their vision for the future of Salem. Answering this question, one attendee suggested that a nice public park with trees and a grocery store should be added to the area, while another suggested the importance of clean and liter-free properties that show pride of ownership.

Lastly, attendees were asked to provide three words that describe their community, and the responses included words like water, people, home, historic, friendly, and diverse.

The poll results and discussions from the meeting provide valuable insights into the experiences and perspectives of Salem residents regarding climate impacts and their vision for the future. These responses will help inform the vulnerability assessment and resilience adaptation actions that will be developed as part of the project.

Meeting 2: February 23, 2023/Vulnerability Assessment

The Resilient Salem Project Team presented analysis of Climate Change impacts in Salem, focusing on extreme heat, sea-level rise, increased rain events, and increased extreme weather events. The meeting highlight the crucial proximity of water all around Salem and the importance of studying flooding and tree canopy. To frame the conversation about impacts, the meeting started with a discussion of the project goals and how they aligned with the City's goals. Referencing the most recent planning documents including Salem Waterfront Redevelopment Zone, DRAFT 2022 Stand Up for Salem Center of Salem Neighborhood Plan, and the 1974 Salem City Comprehensive Plan.

2. Vision Discussion:

To facilitate the development of a shared vision, the team plans to engage with the community through various means, such as online tools, community meetings, and focus groups. The team intends to provide a platform where the community members can share their thoughts and concerns about the future of the city and collaborate on resilience actions.

Vision statements that were shared from existing plans:

Salem Comprehensive Plan – 1974, Vision

"…making Salem a good place in which to live, to work, and to raise a family by providing the best possible physical, social, and economic environment…preserving the good qualities of Salem, correcting existing deficiencies and problems, and preparing for changes which will affect City development."

Salem Waterfront Redevelopment Zone Vision, 2018

The Redevelopment Plan envisions a Redevelopment Zone with a range of land uses that coexist in harmony: a waterfront that is a thriving home for maritime, industrial and manufacturing businesses; a mixed-use transition zone that contains a complementary mix of residential, public uses, retail, commercial, and other personal service establishments; a new county court facility/ justice complex with adequate facilities to serve the needs of Salem County residents; and nearby open space where residents of the City and neighboring towns are provided with public access to the waterfront.

DRAFT Stand Up for Salem Center of Salem Neighborhood Plan, 2022

- Vibrant downtown that focused on the distinctive historic streetscape and rich diverse history to attract a bustling shopping district
- Increasing activities and opportunities for Youth
- Safety: Physical conditions and Youth Engagement
- Housing: Homeownership, rental affordability, maintenance
- Public transportation to employment centers, work readiness training

SALEM WATERFRONT
REDEVELOPMENT ZONE PLAN

JANUARY, 2018

- INCREASE ECONOMIC ACTIVTIES
- IMPROVE WATERFRONT FACILITIES AND PUBLIC ACCESS
- ADDRESS CONTAMINTED SITES
- ENVIRONMENTAL CONSERVATION

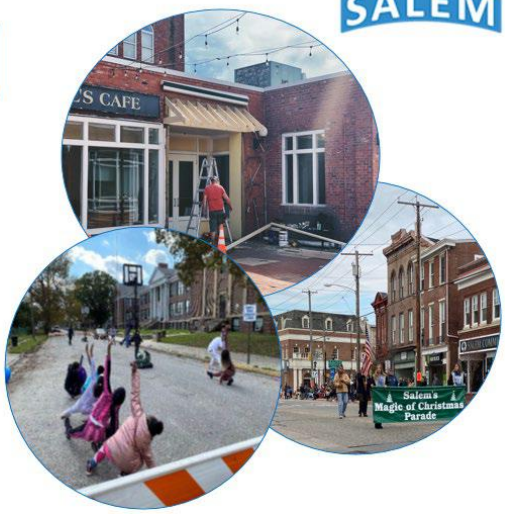
CITY OF SALEM
PLANNING BOARD
MASTER PLAN REEXAMINATIOM REPORT

November 15, 2012

- CENTRAL BUSINESS DISTRICT
- HISTORIC PRESERVATION
- RECREATION AND CULTURAL ACTIVITIES
- REHABILITATION AND DEVELOPMENT OF ADEQUATE HOUSING, FOCUS ON OPPORTUNITIES FOR HOME OWNERSHIP

CENTER OF SALEM NEIGHBORHOOD PLAN

- Vibrant downtown that focused on the distinctive historic streetscape and rich diverse history to attract a bustling shopping district
- Increasing activities and opportunities for Youth
- Safety: Physical conditions and Youth Engagement
- Housing: Homeownership, rental affordability, maintenance
- Public transportation to employment centers, work readiness training



The vision statements and existing goals in Salem have been consistent since the 1974 Comprehensive Plan, that "providing the best possible physical, social, and economic environment…preserving the good qualities of Salem, correcting existing deficiencies and problems, and preparing for changes which will affect City development" are still the goals. Supporting the existing thriving elements and supporting new development to complement the community and needs. Engaging youth and safety, addressing housing challenges, waterfront access and contaminated sites are all elements that the project team is including in the assessment and actions as part of the subsequent project steps. The project team aims to use the community-developed and supported vision for Salem as a guide for developing a Resilience Action Plan and conducting a Vulnerability Assessment. The existing goals of providing the best possible physical, social, and economic environment, preserving the good qualities of Salem, and preparing for

changes that may affect the city's development will be preserved and supported by a Resilient Salem.

To achieve this, the team will incorporate strategies that enhance the physical infrastructure, foster social resilience, promote economic resilience, and address environmental challenges. The goal is to ensure that Salem can withstand and recover from shocks and stresses caused by natural disasters, climate change, and other threats while preserving the thriving elements of the community.

The team discussed the importance of prioritizing goals for implementation based on the shared vision developed. They noted that by working together, they could set achievable goals that align with the community's values, needs, and aspirations. The team also highlighted that by prioritizing these goals, they could focus their resources and efforts on implementing the resilience actions that have the most significant impact on the community.

3. Requirements for Plan Endorsement

Plan Endorsement is a state-level planning process that encourages municipalities in New Jersey to create and implement local comprehensive plans that promote sustainable development and address regional issues. The process is overseen by the New Jersey State Planning Commission, which provides technical assistance, guidance, and oversight to municipalities as they develop their plans .The Plan Endorsement process is voluntary, but it provides several benefits to municipalities that participate. These benefits include eligibility for state funding and grants, priority consideration for certain state programs.

A Regional Center designation is a special designation given to areas that are identified as important centers of regional activity and growth. These areas are typically located near major transportation hubs, employment centers, and other key community assets. The designation is intended to encourage targeted growth and development in these areas while preserving the character and vitality of surrounding communities. Regional Centers are expected to provide a mix of land uses, including housing, commercial development, and public spaces, that support the needs of residents and businesses while also promoting sustainable development.

The Resilient Salem project is supporting Salem’s process to recertify its Regional Center designation, and meet the requirements set forth by the State of New Jersey's Center designation program. The public meetings that were conducted in July 2022 and February 2023 served as part of the requirements to conduct outreach for a shared vision for the City.

The Plan Endorsement process can have a significant impact on how municipalities consider potential climate change impacts and climate-related hazards in their land use planning. The

revised requirements for the Municipal Land Use Law in P.L. 2021, c. 6 require municipalities to consider potential climate change impacts via a climate change-related hazard vulnerability assessment. This assessment must be incorporated into the updated land use element, which is one of the key components of a municipality's master plan.

The Resilient Salem project will provide information and data that can be used to inform the land use element of the comprehensive plan, particularly with regards to addressing the impacts of climate change. The project will identify the potential impacts of climate change on the city, such as sea-level rise, flooding, and extreme weather events, and develop strategies for addressing these impacts. The project will demonstrate a commitment to smart growth and sustainable development practices, such as promoting a mix of uses, providing a range of housing options, supporting compact, walkable, and transit-oriented development, encouraging redevelopment and revitalization, and conserving natural resources and promoting environmental sustainability.

Salem's vision is to be a place where residents can live, work, and raise a family in the best possible physical, social, and economic environment. The community is committed to preserving the good qualities of Salem, correcting existing deficiencies and problems, and preparing for changes that will affect the city's development. To achieve this vision, resilience planning is necessary to ensure that Salem is prepared to withstand and recover from any shocks or stresses that may threaten the community's physical, social, and economic well-being. Resilience planning can help enhance the physical infrastructure, foster social resilience, promote economic resilience, and address environmental challenges.

Through resilience planning, Salem can build physical infrastructure that can withstand natural disasters and other potential hazards. The community can also promote community engagement and support vulnerable populations, including low-income households, seniors, and youth.

Resilience planning can support local businesses and promote economic diversification in Salem. Sustainable tourism, green energy, and local food systems can be promoted through initiatives that provide resources and support for new and small businesses.

Addressing environmental challenges is also an essential component of resilience planning. Brownfield remediation, green infrastructure, and sustainable development practices can be implemented to promote a sustainable and healthy environment in Salem.

Once the Resilient Salem project is complete, the city can incorporate its findings and recommendations into the comprehensive plan, which will undergo a public review and comment process before final approval. The city's comprehensive plan, including the land use element, must be endorsed by the New Jersey State Planning Commission before it can be adopted. By incorporating resilience and addressing climate change impacts in the comprehensive plan, the city can ensure that it is well-positioned to adapt to the impacts of climate change and create a more sustainable and resilient future for its residents.

4. Approach to Project

The Resilient Salem project aims to develop a Resilient Salem Vulnerability and Resilience Action Plan using the existing shared visions for the city's future that aligns with the community's values, needs, and aspirations. By working together, the team hopes to create resilience actions that are more effective in protecting the community from the impacts of climate change.

The Actions developed will consider the goals and vision of the City that value the importance of a vibrant downtown, prioritize housing and safety, and economic opportunities. The Actions will also identify resilience solutions aimed at enhancing the waterfront's resilience to climate change and other potential hazards. These solutions can be designed to coexist in harmony with a range of land uses, including maritime, industrial, and manufacturing businesses, residential and commercial developments, and open space for public access to the waterfront.

Appendix C:

Resilient NJ Community Engagement Plan

City of Salem, NJ

May 2022 Updated September 2023
Finalized December 2023

RESILIENT SALEM

Prepared by BRS, Inc.

The environmental assessments, data, and actions in this plan do not represent guidance or policy of the New Jersey Department of Environmental Protection or the National Oceanic and Atmospheric Administration and does not replace the need for regulatory review by the appropriate local, state, and federal agencies.

This work was made possible with financial assistance from the Coastal Zone Management Act of 1972, as amended, administered by the Office for Coastal Management, National Oceanic and Atmospheric Administration (NOAA) through the New Jersey Department of Environmental Protection, Coastal Management Program.

Resilient NJ Community Engagement Plan

City of Salem, NJ

Contents

1. Overview

The Resilient NJ: Municipal Assistance Program (program) is intended to promote and support resilience planning at the local level by providing technical assistance and/or funding for the development of a local climate resilience strategy and/or climate change-related hazard vulnerability assessment. A local climate resilience strategy involves a) assessments to understand the local impacts of climate change, b) community engagement and visioning efforts, and c) identification and prioritization of resilience actions to minimize or address the impacts of climate change. The City of Salem has been awarded technical assistance to develop a Resilience Action Plan. A critical component of this planning effort will be to meaningfully engage the residents of Salem.

Salem is a small city located near the Delaware River shoreline. It has experienced years of disinvestment and population loss, leading to unfavorable social indicators for this socioeconomically disadvantaged community. Additionally, according to Headwaters Economics Neighborhoods at Risk Tool, 100% of Salem is in a hurricane flood zone. Salem is in the top quarter of cities in the State of New Jersey if ranked by its percentage of homes exposed, and remains in the top quarter if all cities are ranked by exposure after excluding areas that appear isolated or protected.[1] Salem is also expected to experience a 112% increase in extremely hot days and a 7% increase in days with heavy precipitation within 25 years (Headwaters Economics). The multidimensional and existential crises in Salem require a thorough Vulnerability Assessment that takes into consideration the impacts of climate change. The information gained will be part of the process of the engagement with the community of Salem. Each step will involve community input that will shape the living document that adjusts to the city's feedback.

The purpose of this Community Engagement Plan is to present a variety of available tools and strategies for the City of Salem to utilize while soliciting community feedback during the resilience planning process. This planning process intends to truly engage and empower the people in Salem. As such, the approaches will be tailored to fit the needs of the project and the feedback generated throughout the process. Engaging people in meaningful conversations is more likely to foster ongoing, long-term relationships for the benefit of the greater community.

2. Target Stakeholder Groups

Harnessing existing relationships with agencies and organizations is necessary to promote the project and to identify key stakeholder groups. Groups will include community-based organizations, non-profit organizations, city departments and more that may be identified through the planning process.

a. **City Departments:** Interviews with various City employees will be conducted and the information will be implemented into the analysis and Resilience Action Plan development. The project team met with new staff and consultant teams and shared materials and resources with city departments.

   Departments to be consulted with will be:

[1] Climate Central (2016). Sea level rise and coastal flood exposure: Summary for Salem, NJ. Surging Seas Risk Finder file created July 21, 2016. Retrieved from http://ssrf.climatecentral.org.s3- website-us-east-1.amazonaws.com/Buffer2/states/NJ/downloads/pdf_reports/Town/NJ_Salemreport.pdf

City Engineer	Remington & Vernick
City Clerk	Ben Angeli, RMC cityadmin@cityofsalemnj.gov
Construction Office	Patrick Zingaro, Construction Code Official 609-567-3653
Inspection and Permits	Carol E. Wright, Housing Inspector 856-935-5510
Streets Department	856-935-1265
Water & Sewer	Cindy Edwards 856-935-0469 and 856-935-0350
Police/FIRE/OEM	Police: Chief John A. Pelura III 856-935-0059 Fire: Chief John "Fred" Ayars 856-935-0354 EMS: Nick Valentine, Operations Manager/Captain 856-769-1779
Economic Development/Community Development Committee	Jim Smith, Chair
Public Works Committee	Vaughn Groce, Chair
School Board Department	Dr. Amiot Patrick Michel, Superintendent

During focused interviews with the key informants listed above, information will be gathered relating to the following topics:

- Geographic areas where climate change impacts have been experienced, for example, flooding
- Populations at greatest risk from climate change impacts
- Mitigation measures taken or planned, such as design standards, stormwater managements, or preservation of green space.
- Adaptation measures taken or planned, such as constructing new infrastructure or modifying land use
- Planned improvements and capital investments in facilities
- Program development, such as a tree replenishment program
- Supplies on hand or needed to address climate emergencies
- Critical and Emergency facilities for responding to climate emergencies and for protecting and maintaining quality of life
- Distribution of materials and educational sessions by schools and the use of materials for tabling and information sharing at events, meetings, and festivals
- Public education about risks
- Communication measures and identified gaps in communication

b. **Community Groups**: To date, the following community groups have been identified:

Stand Up for Salem	Amy Petrie Development and Communications amysufs@gmail.com Phone: 856-935-1248
Salem Family Success Center	856-935-8769 rbrown@gatewaycap.org
Salem City Community United	Contact done via Facebook

Stand Up For Salem: A main street organization that focuses on community development, economic development and historic preservation and building arts. This is a 501(c)3 organization that works to transform neighborhoods by fostering resident-based planning.

Salem Family Success Center: A Community Action Agency that works in impoverished areas and coordinates initiatives such as promoting citizen participation, job training, operating food pantries, and coordinating community initiatives.

Salem City Community United: A resident-driven Facebook group that is used as a virtual bulletin board to advertise events, promotions and general information. Public meeting notices and meeting materials will be posted to this page.

Places of Worship: The City of Salem has over a dozen different places of worship that the project team will reach out to in order to determine the capacity in which they are willing to participate in community engagement.

An online search provided the following results for Places of Worship located in Salem:

Broadway United Methodist Church	1323, 115 1/2 W Broadway, Salem, NJ 08079
First Baptist Church of Salem	130 W Broadway, Salem, NJ 08079
Mt Calvary S D A Church	5 Union St, Salem, NJ 08079
Mt Pisgah Ame Church	15 Yorke St, Salem, NJ 08079
Mt Zion Baptist Church	437 Grieves Pkwy, Salem, NJ 08079
New Life Destiny Fellowship	103 Union St, Salem, NJ 08079
Salem Wesleyan Church	91 Walnut St, Salem, NJ 08079
Spirit Life Fellowship	424 E Broadway, Salem, NJ 08079
St Mark's Church of the Living God	12 Hancock St, Salem, NJ 08079
St Mary's Roman Catholic Church	25 Oak St, Salem, NJ 08079
St. John's Episcopal Church	76 Market St, Salem, NJ 08079
The River Church Salem	91 Walnut St, Salem, NJ 08079
House That God Built Cell	228 E Broadway, Salem, NJ 08079
Salem Friends Meeting House	200 E Broadway, Salem NJ 08079
Harvest Time Worship Center	200 Temple Ave, Salem, NJ 08079

c. **Additional Community Resources to be included in outreach efforts, where available:**

- Volunteer organizations: United Way of Salem County, Salem Meals on Wheels, Salem Family Success Center (e.g., local Voluntary Organizations Active in Disaster, Community Emergency Response Team programs, volunteer centers, State and County Animal Response Teams, etc.)
- Community leaders (e.g., representatives from specific segments of the community, including seniors, minority populations, and non-English speakers)
- Disability services (Salem County Office on Aging and Disability Services, Department of Veterans Services)
- School board
- Higher education institutions (Mid-Atlantic States Career and Education Center, Rutgers Cooperative Extension)
- Animal control agencies and animal welfare organizations (Salem County Humane Society)
- Hardware stores, grocery stores, and pharmacies
- Home care services (Home care and Hospice care – South, Salem Home Health and Hospice Care, Community Home Care, Hospice of Salem County, Senior Care of Salem)
- Medical facilities (Salem Medical Center, South Jersey Healthcare, Southern Jersey Family Medical Centers)
- Media outlets (The News of Salem County, Today's Sunbeam, Salem County Radio Control Center)
- Public transportation systems (Salem County Community Bus Services, NJ Transit)
- Utility providers (Salem Water Department, Public Service Electric and Gas)

Interviews will take place with relevant community groups and return to select departments to continue conversations with the additional information of materials developed in the original scope as part of the Action Items deliverable. This will allow for follow up conversations about the selected action items, provide an opportunity to learn about specific concerns on how such actions may be implemented, address additional issues uncovered during the vulnerability assessment process, develop a Department-specific recommendation list and vet and provide additional resources to the department tasked with implementation.

3. Existing Resources

City Website: The home page of the City of Salem's website includes a "Latest News and Announcements" section that is used to post upcoming meetings, public notices, and links to City documents. Notice of public meetings related to the Resilience Strategy will be posted here along with digital versions of meeting materials and draft plans.

The project team will prepare an internet-based StoryMap, discussed in more detail below, that will be linked on the City's website either on the home page or relevant department's page, such as for the planning board. As part of the additional scope expansion, the webpage added additional mapping resources, educational resources, materials from meetings and surveys for review.

Social Media Accounts: Community-led Facebook groups, as mentioned above, will be engaged to disperse meeting information and solicit comments from residents.

4. Public Meeting Notices

Notice of public meetings will be advertised in several places and in several different ways in order to reach as many residents as possible.

Newspapers/publications advertisement: Meeting notices will be published in local newspapers, including Today's Sunbeam, and nj.com.

City Website: As previously mentioned, all meeting notices will be included on the City's homepage under the "Latest News and Announcements" section.

Email Blasts: The project team will identify if any of the community organizations listed above send out periodic emails regarding local news and announcements. Meeting notices and links to meeting materials will be included in email blasts.

Social Media: The project team will work with the community organizations mentioned above to craft meaningful social media posts that will inform followers of meeting times and locations, as well as include links to meeting materials.

5. Meeting Format Options

On site: A walking tour will be scheduled throughout the planning process. The tour will be more informal to facilitate conversations with the residents who have been most frequently affected by major weather events. Salem is working with the USEPA to address brownfield sites in the City and is planning on coordinating a walking tour with USEPA representatives to engage in a broad discussion of conditions. It is likely that these events will be combined to generate greater interest and highlight the interconnectivity of the planning processes.

In-person with virtual linkup or fully virtual: If health and safety protocols permit, the project team and municipal staff will conduct in-person public meetings at a community accessible venue. Meeting materials such as handouts and interactive displays will be provided in order to allow residents a chance to be hands-on in the planning process, and all materials will also be available for viewing and download on the expanded project website using the ArcGIS dashboard and mapping software. As appropriate, the project team and municipal staff will facilitate a hybrid meeting approach; live streaming video content from the in-person meeting with the opportunity for virtual participants to ask questions and provide feedback in real time. The suggested format for this session would be a Zoom meeting, a well-regarded and heavily used format for live meetings that the project team has utilized for live online presentations. Zoom provides the ability for presenters to conduct polling in real time that would obtain participant feedback in a controlled environment. Such polling can be done with the live audience and the online participants.

Story-mapping/online surveys: In order to facilitate broad and diverse participation, the expanded project website will have a section that is dedicated to public meeting and communication information, including: notices of meetings, agendas, materials, and notes; interactive data and maps; resources for more information about climate change; and strategies that have been implemented in other communities. This "home base" will serve as an exchange of information and education about the topic, with opportunities to provide input and feedback. It will serve as a topic-based virtual gathering space, and will live on as a

user-friendly way to digest complicated information contained in the final report. See attached outline of sections to closely follow the project tasks.

a. Public Meeting Materials

Dedicated Project Website: The StoryMap tool is a web-based format that will be linked to from the existing Salem webpage. It streamlines residents' access to engaging and dynamic information on the project, including outreach, printed materials, mapping, and data. It will house additional supplemental tools such as surveys and interactive mapping. The expanded scope enabled the team to expand the StoryMap site to a more robust and extensive resource that shared meeting materials, mapping tools, education resources.

Surveys: Informal questionnaire surveys will be implemented throughout the outreach process, in addition to targeted surveys for key informants, polling in public meetings, and polling within the project website will be utilized. These surveys will be distributed at public meetings and online.

Mapping Tools: The StoryMap tool will have interactive maps for stakeholders to access and have an opportunity to provide feedback and additional information to the project team. The project team will provide guidance about how to engage with these virtual tools on the StoryMap base.

Flyers: One-page documents that give an overview of the goals and objectives of the Resilience Strategy. These documents will be used to distribute at in-person meetings as well as post at various places throughout the City, as determined appropriate by City employees and community organizations.

b. Accessibility

Early discussions with the City revealed that a large percentage of City residents do not have reliable access to broadband services, or do not have the data capacity to participate in virtual meetings. In order to ensure the largest audience possible, all or a mix of the following engagement options will be used.

Teleconference Calls: Teleconference calls have been established practices for years for businesses and organizations. 96% of Americans own a cellphone, which means that a significant portion of residents without videoconferencing capabilities can still participate in calls. A teleconference call-in option will be offered along with the virtual meeting link so that residents will have a choice in how to participate.

Partnering with community and/or neighborhood leaders: This method will rely on partnering with some of the above-mentioned organizations. These representatives often already have the confidence and support of residents and will be asked to help develop creative ways to keep their community members involved and informed. Many live or work within hard-to-reach or underrepresented communities and can provide opportunities for better two-way communication between the City and the residents.

Print flyers in community gathering places: Community gathering places often have bulletin boards and other spaces for people to post important news and notices. Libraries, community centers, food banks and other spaces are dispersed throughout the city, making it easy for

residents to access needed information and services. Posted print information will include a main point-of-contact to allow residents to respond to topics related to the Resilience Strategy. Versions of materials will be posted in Spanish.

Translation service and bilingual materials: Lives translation services will be provided at meetings. Translation of all materials posted to the project website and other content developed for the Resilience Action Plan will be provided throughout the community engagement process. A poll of languages spoken will be taken to determine what languages need to be translated.

6. Chronology of Community Involvement

Community outreach will be informed by and implemented in partnership with the municipal staff. An effort to implement engagement in a safe, accessible, and engaging manner is one of the top priorities. Meetings may be in person, online, or a hybrid depending on what is likely to attract the most participants and maintain safety protocols.

The engagement will be ongoing through the project and beyond but will have targeted activities at critical decision points in the project as follows:

Key Informant Interviews – The Project Team will coordinate with Key Informants to identify the most effective approach to soliciting input and accessing information. The "interviews" will be a combination of one-on-one meetings, staff surveys, and a combination of department leaders together. Questions will be provided in advance of the meetings.	June- July 2022	In person, phone calls, and meetings combining several departments.
Public Meeting #1 - Project Kick-off: This meeting is intended to introduce the project, the team, goals, and description of online engagement tools. The project team will present the importance of a vision for community on priority risks, solutions, goals, and values and how that process will inform the implementation and prioritization in later tasks.	July 21, 2022	In person hybrid
Public Meeting #2 - Vulnerability Assessment: The workshop will include an introduction on resilience and climate adaptation globally and locally. This will be followed by a presentation showing visuals and maps of public assets in high risk flood zones and general implications of climate change. A description of vulnerability findings will be overlaid with the vision discussion to show how it can be achieved. The goal is to present a values-based framework for understanding risk and adaptation.	February 16, 2023	In person hybrid
Walking tours: Walking tours of hard-hit areas will be conducted to identify potential projects and understand risk at the community level directly from residents' lived experiences.	June 21, 2023	In person
Public Meeting #3 - Resilience Action Plan: The project team and municipal officials will present the draft plan in a positive way that connects to the residents' values and concerns, resulting in	September 13, 2023	In person hybrid

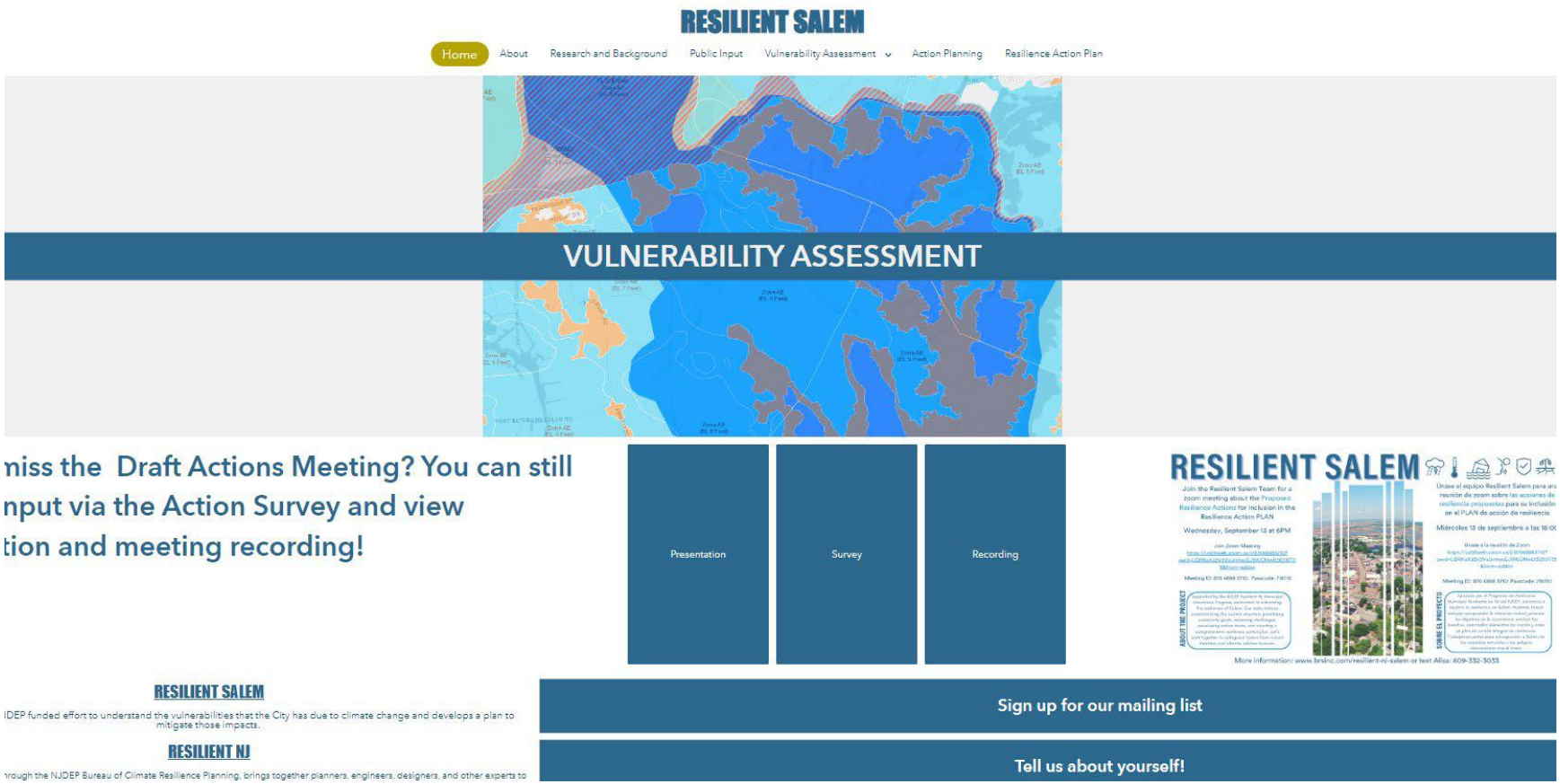
a meaningful conversation about actions and priorities. Included will be an exercise about implementation options that would facilitate impactful resilience outcomes. The participants will be guided through various ranking scenarios to help guide project prioritization.		
Presentation to Brownfield Steering Committee: As part of the BDA in Salem, a steering committee meets quarterly to discuss the plans for prioritization and redevelopment ok key sites. Many of these sites are in climate impacted areas and therefore, maps and summary of the CCHVA were discussed.	October 12, 2023	In person

7. Continued Community Involvement

The expectation is that, following the completion of the Resilience Action Plan the community will continue to be engaged in multiple ways. This would include implementation of recommended projects as well as opportunities to re-evaluate the effectiveness of the Resilience Action Plan through periodic Master Plan Re-examinations as required by the New Jersey Municipal Land Use Law. While the MLUL requires a re-examination every ten (10) years the Resilience Action Plan should additionally be re-evaluated after any major weather events.

The project website will remain live after the completion of the project to allow for ongoing access to information and provide a one site resource for planning efforts and could include tools to report and track future impacts.

8. ArcGIS based webpage:

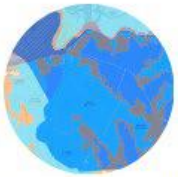


RESILIENT SALEM

Home | About | Research and Background | **Public Input** | Vulnerability Assessment | Action Planning | Resilience Action Plan

Meeting 1: Vision

This meeting introduced the project, the team, goals, and description of online engagement tools. The project team discussed the vision for this project and outlined the next steps for the project.



Meeting 2: Vulnerability Assessment

The workshop will included an introduction on resilience and climate adaptation locally. This was followed by a presentation showing visuals and maps of public assets in high risk flood zones and general implications of climate change.

Meeting 3: Action Planning

The project team and municipal officials will present the draft plan in a positive way that connects to the residents' values and concerns, resulting in a meaningful conversation about actions and priorities.

September 13, 2023 at 6pm via Zoom

Key Informant Interviews

The project team, conducted a series of interviews with City and County departmental leadership and staff.

Walking Tour

The project team will participate in a community walking tour of flooding areas, please join us!

Wednesday, June 21 at 10 am
Meet at Grieves Pkwy & Tilbury Rd, Salem, NJ 08079

Meeting 1: Vision and Introduction to Project

Tuesday, July 21, 2022 at 6 pm via Zoom

This meeting introduced the project, the team, goals, and description of online engagement tools. The project team discussed the vision for this project, based on the existing planning documents, and outlined the next steps for the project.

Meeting Presentation | **Meeting Recording** | **Survey**

Meeting 2: Vulnerability Assessment

Thursday, February 16, 2023 at 6pm
Old Salem Courthouse
113 Market Street, Salem, NJ

The workshop began with an introduction to resilience and climate adaptation at the local level. This was followed by a presentation that included visual aids and maps of public assets located in high-risk flood zones and the implications of climate change. The group then engaged in a facilitated discussion regarding the impact on residents and the tools necessary to understand and prepare for climate change.

RESILIENT SALEM

Home | About | Research and Background | Public Input | Vulnerability Assessment | Action Planning | Resilience Action Plan

- Climate Change Explained
- Flooding Explained
- Vulnerability Findings
- Explore All Mapping Data

What is a Vulnerability Assessment?

A process that helps communities **identify, understand, and prioritize their vulnerabilities** to the impacts of climate change. The goa… …sessment is to inform the development of adaptation strategies that can help a community become more resilient to the imp…

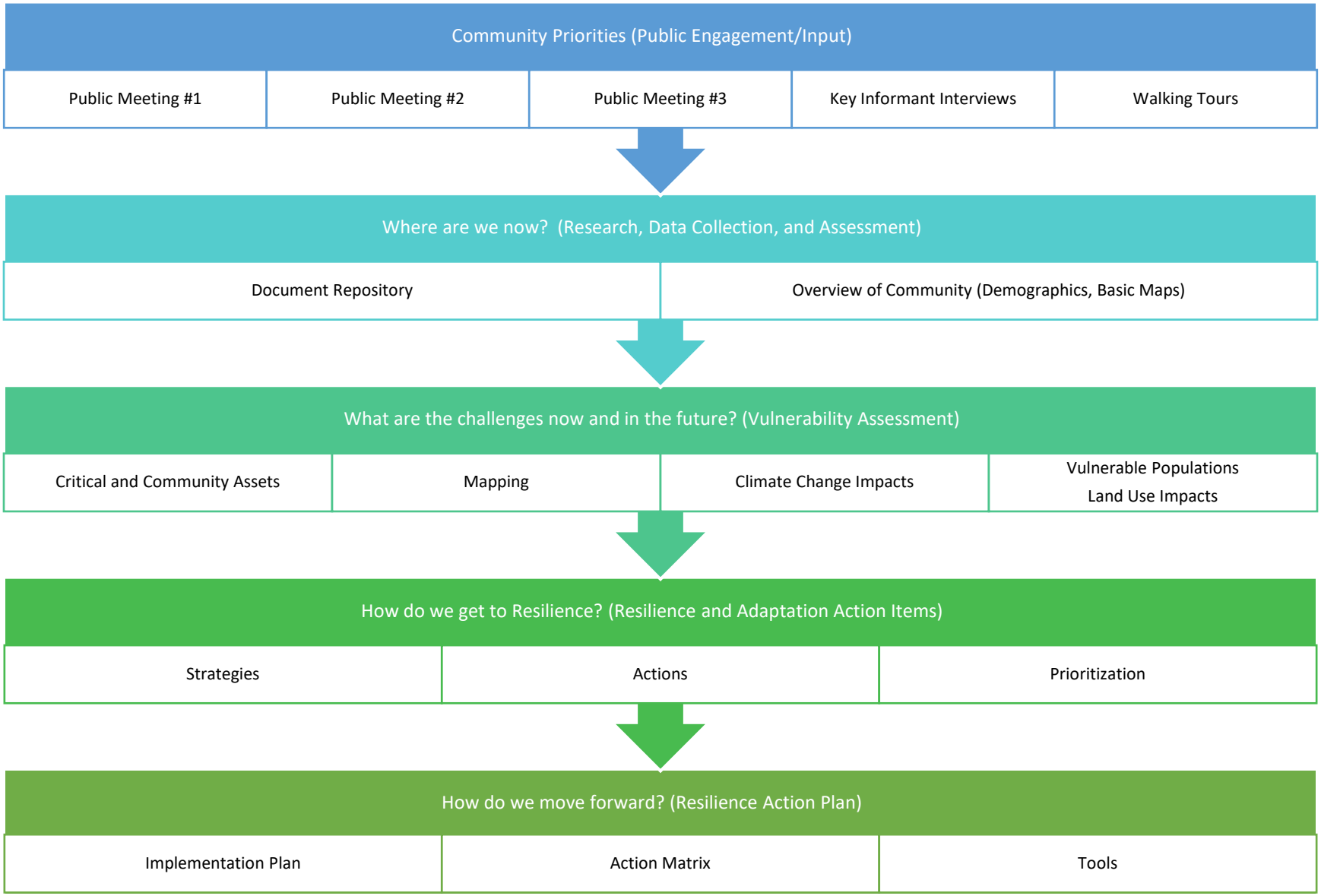
Why do we need a vulnerability assessment?

Community level climate change vulnerability assessments are important because they help to identify the specific risks and vulnerabilities that different communities face in relation to climate change. This is important because it allows policymakers and community leaders to better understand the needs and concerns of these communities, and to develop targeted strategies to mitigate and adapt to the impacts of climate change.

Some of the key reasons why community level climate change vulnerability assessments are important include:

- Identifying vulnerable populations: These assessments can help to identify populations that may be particularly vulnerable to the impacts of climate change, such as low-income communities, communities of color, and elderly individuals. This information can be used to prioritize efforts to protect and support these groups.
- Understanding local risks: Different communities in New Jersey may face different risks from climate change, such as sea level rise, extreme heat, or flooding. Community level assessments can help to identify these specific risks and provide a basis for developing targeted adaptation strategies.
- Developing targeted strategies: By understanding the specific risks and vulnerabilities faced by different communities, policymakers and community leaders can develop strategies that are tailored to the needs and concerns of these communities. This can help to ensure that efforts to address climate change are effective and address the specific challenges faced by different groups.

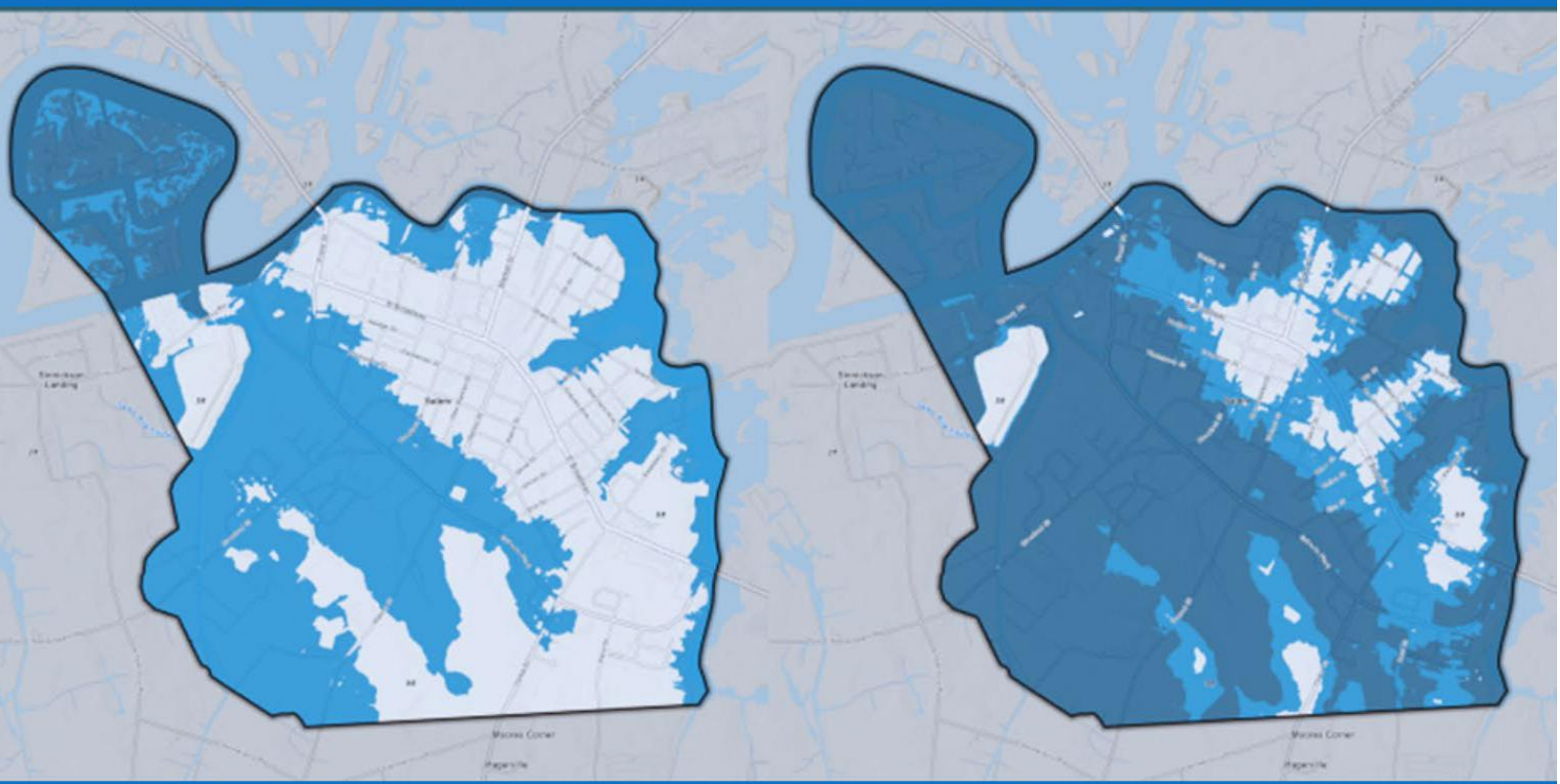
Overall, community level climate change vulnerability assessments are an important tool for helping to identify the specific risks and vulnerabilities faced by different communities, and for developing targeted strategies to address these challenges.


Community Priorities (Public Engagement/Input)
Public Meeting #1
Public Meeting #2
Public Meeting #3
Key Informant Interviews
Walking Tours
Where are we now? (Research, Data Collection, and Assessment)
Document Repository
Overview of Community (Demographics, Basic Maps)
What are the challenges now and in the future? (Vulnerability Assessment)
Critical and Community Assets
Mapping
Climate Change Impacts
Vulnerable Populations
Land Use Impacts
How do we get to Resilience? (Resilience and Adaptation Action Items)
Strategies
Actions
Prioritization
How do we move forward? (Resilience Action Plan)
Implementation Plan
Action Matrix
Tools

CLIMATE CHANGE-RELATED HAZARD VULNERABILITY ASSESSMENT

APRIL 2025

RESILIENT SALEM



NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION

BRS inc | PRINCETON HYDRO | NEW JERSEY FUTURE

About this Document

This document is the Climate Change-Related Hazard Vulnerability Assessment (CCRHVA) for Salem City. It presents a detailed analysis of the city's vulnerability to natural disasters and climate change-related hazards, focusing on climate change impacts, vulnerability findings, planning and land use, and build-out analysis. This document contains extensive research and data, including a demographic profile; information on sea level rise; a temperature profile; and current impacts of climate change, flooding, and drought.

The CCRHVA was developed using a robust methodology, including public engagement, to identify critical vulnerabilities and develop targeted strategies to address them. The document highlights various aspects of the city that are vulnerable to natural hazards, including open space, ecological resources, cultural resources, community assets, and critical facilities.

The CCRHVA also examines the impact of natural hazards on relevant elements of the master plan, including zoning, and provides recommendations for mitigating risks associated with climate-related hazards. Overall, this document serves as a useful resource for policymakers, urban planners, and other stakeholders involved in managing and developing urban environments. This document can be used as a guide to assess the city's vulnerability and to develop effective strategies to promote a safer, resilient Salem and inform the next step in this process- the Resilience Action Plan.

The City of Salem was a recipient of a technical assistance grant from the NJDEP Resilient NJ Municipal Assistance Program, administered by the New Jersey Department of Environmental Protection (NJDEP) and is part of a broader state-wide effort to build more resilient communities and reduce the risks of natural disasters and other climate-related hazards. This grant program aims to assist municipalities in New Jersey to become more resilient in the face of natural disasters and other climate-related challenges. The program offers technical assistance and funding to help local governments develop and implement plans to mitigate the risks associated with climate change.

This work was made possible with financial assistance from the Coastal Zone Management Act of 1972, as amended, administered by the Office for Coastal Management, National Oceanic and Atmospheric Administration (NOAA) through the New Jersey Department of Environmental Protection, Coastal Management Program.

Project Team:

The environmental assessments, data, and actions in this plan do not represent guidance or policy of the New Jersey Department of Environmental Protection or the National Oceanic and Atmospheric Administration and does not replace the need for regulatory review by the appropriate local, state, and federal agencies.

Contents

I. Introduction

The City of Salem, NJ has conducted a Climate Change-Related Hazard Vulnerability Assessment (CCRHVA) to gain insight into Salem's strengths, challenges, and opportunities as it prepares for changing climate conditions. By understanding which resources and assets within the city will be most affected, how daily operations and community quality of life may be impacted, and who is most vulnerable to these impacts, the city is better able to prioritize strategies that address its greatest vulnerabilities as it moves into the next phase of developing a Municipal Resilience Action Plan. In this context, vulnerability refers to the sensitivity of people, property, and resources to the negative impacts of hazards. A CCRHVA can guide the development of hazard mitigation strategies and the priority allocation of risk mitigation projects. This community assessment looks at the physical, social, environmental, and economic vulnerabilities of Salem.

Climate change is an existential threat that affects all of us, and the City of Salem is no exception. Situated in southern New Jersey, Salem is exposed to various climate-related risks. The city is located along the Salem River and is near the Delaware Bay, making it susceptible to coastal flooding and sea level rise. Additionally, Salem experiences fluvial flooding from the Salem River and other smaller waterways. Over the past several decades, the city has faced severe weather events, hurricanes, sea level rise, including historic flooding, extreme heatwaves, and droughts. The frequency and intensity of these events are expected to increase as the climate continues to change, necessitating a comprehensive assessment of Salem's vulnerability to such events.

A. Salem Background

Salem is a city with a rich cultural heritage and historic significance. Founded in 1675, it is one of the oldest cities in New Jersey with a plethora of historic landmarks and sites that date back several centuries.

The city is home to the Salem County Historical Society, which aims to preserve and promote the history of the area through various exhibits, artifacts, and educational programs. Among the landmarks located in Salem is the Old Salem Courthouse. This is the second oldest courthouse still in continuous use in the United States. Built in 1735, this building was occupied by British troops during the Revolutionary War and later was the site of treason trials for British sympathizers.

Image 1: Old Salem County Courthouse, photograph by Anna Price, Library of Congress Blogs

It's also the site where the endearing legend of the tomato was born. In 1820 to prove the edibility of the fruit, which many thought poisonous, soldier and statesman Robert Gibbon Johnson (1771–1850) apparently stood upon the courthouse steps and ate several tomatoes in front of a disbelieving crowd. [1] The Salem County Tomato Festival is an annual event held in Salem, NJ, hosted on the third Saturday in August. It celebrates the local tomato harvest and its importance to the region. While the festival has changed and evolved over time, the tomato has remained the central theme throughout the festival's history.

Image 2: This vintage photo of Salem County shows the H.J. Heinz Plant on Griffith Street in Salem. This postcard view, from across Fenwick Creek, shows the plant in the very early 1900s. The plant opened around 1905 and processed locally grown tomatoes into ketchup and chili sauce for decades. Source: Stand Up For Salem

Salem Fire Museum, built in 1869 as Union Fire Company No. 1, replacing their previous building named Union Hall, built in 1825. Salem fire companies included Union (est. 1749), Reliance (1825), Liberty (1866), Washington (1867) and North Bend (1904). This fire house was active until 1992, renovated and reopened as the Salem Fire Museum in 2013.

Today, Salem City, NJ, is a vital and diverse part of Salem County with a population of approximately 5,298 residents. The city covers an area of approximately 2.81 square miles, with a blend of urban and rural landscapes. Salem City is in southwestern Salem County, which is located approximately 40 miles south of Philadelphia, 44 miles west of Atlantic City, and 85 miles north of Baltimore.

Salem City is located on several major transportation routes facilitating its connectivity and economic activities, including:

- U.S. Route 49 is a major east-west highway that traverses through the southern part of New Jersey and passes through the center of Salem City. The highway provides an important transportation route for the movement of people and goods to several neighboring towns and cities.
- To the east, U.S. Route 49 connects Salem City to Bridgeton, Millville and eventually ends in Tuckahoe at Route 50 for connection to the Garden State Parkway. To the west, the highway passes through Pennsville before its terminus at the intersection of the New Jersey Turnpike and Interstate 295, providing access to other cities such as Philadelphia and New York City and the Delaware Memorial Bridge.
- New Jersey Route 45 is a major north-south highway that runs through Salem County and provides access to neighboring municipalities such as Woodstown, Pennsville, and Penns Grove.

[1] "Witness the most historic US courthouses," MSN, accessed May 2023, https://www.msn.com/en-gb/news/world/witness-the-most-historic-us-courthouses/ss-AAXe0vZ#image=9.

The highway also connects Salem City to these nearby areas and serves as an important transportation route for commuters and businesses alike. New Jersey Route 45 intersects with several other major highways, including U.S. Route 40 and 295, providing additional access to other cities in New Jersey and beyond. For example, the highway connects to Bridgeton in Cumberland County to the south and to Paulsboro and Camden County to the north.

These transportation routes play a crucial role in the city's connectivity, boosting its economic activities and commuter traffic. By facilitating easy access to neighboring municipalities and regions, they support the transportation of goods and people, making the city an essential part of the regional economy.

Several main streets and roads that run through the city, including:

Market Street: This is one of the major north-south roads in Salem, located in the heart of the city. It runs from the Salem River in the north to the center of the city where it intersects with Broadway.

Broadway: Broadway runs east-west through the center of Salem from the Salem River in the west to the eastern border of the city. Broadway intersects with several other streets in the city, including Market Street at the heart of the city, New Market Street and Yorke Street.

New Market Street: New Market Street is a north-south road that runs from West Broadway in the north to Smith Street in the south.

Yorke/Keasbey Street: Yorke and Keasbey Street run north-south through Salem's eastern neighborhoods. Keasbey Street runs north of the East Broadway intersection connecting with Grant Street. Yorke Street runs south of the East Broadway intersection connecting with Grieves Parkway.

Grieves Parkway: This is one of the major roads that runs along Salem's center, parallel with Broadway.

Salem City is also the county seat of Salem County, hosting various institutions that include the Courthouse, the Sheriff's Office, County Jail, and the Prosecutor's Office. It is also a hub for history and culture, featuring a vibrant downtown district and numerous historic sites. The city is bordered by the Salem River, connecting to the Delaware River which is a major contributor to its social, economic, and cultural activities. The river offers recreational opportunities, including fishing and boating, and creates a stunning waterfront for tourists and residents.

Demographic Profile of Salem

Salem City had an estimated population of 5,298 people as of July 1, 2020, according to the U.S. Census Bureau. The population density of Salem City is estimated at 1,343 people per square mile, which is higher than the population density of Salem County (446.1 people per square mile), and the state of New Jersey (1,210.1 people per square mile).

As of 2020, the age distribution of the population in Salem City is estimated to be relatively balanced, with 20.8% of the population being children under the age of 18, 58.2% being individuals between the ages of 18 and 64, and 21% being elderly individuals aged 65 and above. The age distribution of the population in Salem City suggests that there is a moderate exposure to the impacts of climate change from an age perspective because while climate change affects people of all ages, generally the very old and very young are more vulnerable.

For instance, higher temperatures and prolonged heatwaves can pose a health risk to elderly individuals, children, and those with chronic illnesses. Changes in precipitation patterns and increased frequency of

extreme weather events such as floods, droughts, and hurricanes can also impact people's health and livelihoods, particularly in low-lying areas with poor drainage systems.

The relatively balanced age distribution in Salem City suggests that the impacts of climate change may affect a broad range of people and communities in the area, highlighting the importance of implementing climate adaptation and mitigation measures to reduce these risks.

In terms of socio-economic indicators, Salem City faces significant challenges compared to both the county and state. The poverty rate in Salem City is 39.9%, which is much higher than the poverty rates of Salem County (9.8%) and New Jersey (9.5%). Moreover, the median household income is $35,319, which is lower than both the county and state medians ($72,059 and $85,751, respectively). The unemployment rate from 2015-2019 in Salem City is 8.7%, higher than both the county and state averages for that period, indicating economic vulnerability. Additionally, almost 20% of households in Salem City lack access to car ownership, which can limit mobility and access to opportunities, exacerbating other vulnerabilities.

A lower rate of educational attainment also increases vulnerabilities. In Salem City, 78.1% of residents have a high school diploma or equivalent, while only 10.1% have attained a bachelor's degree or higher. This suggests challenges in access to advanced educational and economic opportunities compared to both the county and state averages. For comparison, the percentage of Salem County residents with a high school diploma or equivalent is 87.3%, and the percentage with a bachelor's degree or higher is 22.4%. In New Jersey, the respective percentages are 90.2% and 45.5%. Language barriers also have a significant role, as 9.7% of Salem City residents speak a language other than English at home, indicating challenges in accessing and comprehending vital information. The percentage of residents with a disability in Salem City is 21.5%, which is higher than both the county (12.5%) and state (10.2%) averages, indicating challenges in accessing and receiving adequate healthcare and other necessary services.

Nearly half (49.7%) of Salem City residents are renters, which can contribute to housing instability and insecurity. For comparison, the percentage of renters in Salem County is 29.9%, and in New Jersey, it is 35.4%.

Overall, Salem City's demographic data highlights several socio-economic vulnerabilities that may put it at a higher risk of climate change impacts compared to both the county and state. These vulnerabilities include higher rates of poverty, limited access to advanced educational opportunities, limited access to transportation, higher rates of disability, and higher rates of renters. In addition, the City administration is overburdened with providing necessary services for their constituents. These factors can also challenge resilience as the city has limited capacity to adapt to and cope with the adverse impacts of climate change.

Table 1: Demographic Overview of Salem City, NJ[2]

Demographic Overview	Salem City	Salem County	New Jersey
Population Size (2020 estimate)	5,298	62,385	9,288,994
Population Density (2020 estimate)	1,343 people per square mile	446.1 people per square mile	1,210.1 people per square mile
Age Distribution			
0-17 years	20.8%	21.5%	22.7%
18-64 years	58.2%	60.9%	62.8%
65+ years	21.0%	17.6%	14.5%
Households below Poverty Line	40.6%	11.5%	9.1%
Median Household Income	$33,191	$70,374	$86,279
No Access to Car Ownership	18.2%	6.5%	4.6%
Educational Attainment			
High School Graduate	78.1%	87.3%	90.2%
Bachelor's degree or higher	10.1%	22.4%	45.5%

Sea Level Rise

The City of Salem is at risk of impacts from sea level rise due to its proximity to coastal areas and its connection to the Delaware Bay via major water courses including Fenwick Creek and Keasbey Creek. Rising sea levels pose a significant long-term threat to the city's infrastructure, economy, and natural environment.

Scientific studies indicate that sea levels have been rising globally, and this trend is expected to continue as a result of climate change. The melting of polar ice caps and thermal expansion of seawater contribute to the overall increase in sea levels. Salem, situated along a low-lying coastal area, is particularly vulnerable to the consequences of rising sea levels.

The impacts of sea level rise in Salem are manifold. Firstly, coastal flooding becomes more frequent and severe as the sea levels rise. The city's infrastructure, including roads, bridges, and buildings, is at risk of inundation and damage during storm surges and high tides. This poses a threat to public safety, disrupts daily activities, and may result in costly repairs and reconstruction efforts.

Moreover, the saltwater intrusion into coastal aquifers and freshwater sources is a concern. Rising sea levels can cause saltwater to infiltrate underground freshwater reserves, making them unsuitable for drinking and agricultural purposes. This jeopardizes the availability of clean water for Salem's residents and poses challenges for local farmers and industries that rely on freshwater resources.

Additionally, Salem's natural habitats and ecosystems, such as wetlands and marshes, are vital for biodiversity and provide essential ecosystem services, including flood protection and water filtration. However, as sea levels rise, these coastal habitats face the risk of submergence and degradation. The loss of these ecosystems can disrupt the balance of the local environment and negatively impact wildlife populations.

[2] Population size, density, and age distribution: U.S. Census Bureau (2020 estimate)
Educational attainment: U.S. Census Bureau, American Community Survey 5-Year Estimates (2015-2019)
Households below poverty line, median household income, and no access to car ownership: U.S. Census Bureau, American Community Survey 5-Year Estimates (2015-2019)

This assessment focuses on examining the effects of Sea Level Rise in one-foot increments up to five feet, although maps include levels of SLR up to 20 feet. This shows the relative vulnerability of areas that may face permanent inundation or increased tidal flooding frequency under projected sea level rise for 2100.

Temperature Profile

Salem experiences the effects of global climate change through noticeable changes in its temperature profile. The city's climate is characterized by hot, humid summers and cold winters, sometimes accompanied by snow. The average annual temperature in Salem is approximately 53.2°F (11.8°C). However, recent trends indicate a gradual increase in temperatures, aligning with global patterns of climate change.

The warmest month in Salem is typically July, with an average temperature hovering around 77°F (25°C), whereas January is usually the coldest month, averaging 30.2°F (-1°C) (Source: NOAA). These seasonal variations are expected but the intensity and duration of these seasonal extremes have been evolving.

Between 2015 and 2019, Salem experienced some of its warmest years on record, with an average temperature of 56.4°F (13.6°C). This period's temperature was notably higher than the 20th-century average, exceeding it by about 2.5°F (1.4°C) (Source: NOAA). This trend is consistent with the broader patterns of climate change and is a clear indicator of the ongoing changes in the city's climate.

Furthermore, Salem has observed an increase in the frequency and duration of heatwaves. These heatwaves are characterized by temperatures soaring above 90°F (32°C) for prolonged periods, which can have significant impacts on public health, local ecosystems, and the city's infrastructure. The increasing intensity of heatwaves presents challenges for Salem's residents, especially the elderly and those with health conditions that make them more vulnerable to extreme heat.

The city's infrastructure is also affected by these temperature changes. For example, roads and bridges may require more frequent maintenance and repair due to the expansion and contraction caused by extreme temperatures. Additionally, the demand for energy, particularly for cooling during hotter months, has likely increased, putting a strain on local energy resources and utilities.

The changing temperature profile also impacts Salem's natural environment. Flora and fauna may experience shifts in their habitats and behaviors in response to the changing climate. For example, certain plant species may become less viable in the area, while others, more suited to warmer conditions, may start to thrive. Similarly, wildlife may experience shifts in migration patterns and breeding cycles in response to the temperature changes.

Precipitation Profile

Salem experiences a varied precipitation pattern throughout the year, with an average annual rainfall of about 44.3 inches. This precipitation is crucial for the region's agriculture, ecosystems, and water resources but also presents challenges in the form of extreme weather events.

The wettest month in Salem is typically August, with an average rainfall of 4.06 inches. February is usually the driest month, with an average rainfall of just 2.96 inches, reflecting a typical winter pattern in the northeastern United States.

On average, Salem experiences precipitation about 117 days per year. This includes not only rainfall but also the occasional snowfall, especially during the winter months. The majority of the rainfall occurs from June to September, a pattern that is consistent with the general climate dynamics of the northeastern

United States, where summer months often bring more frequent and intense rainfall due to higher temperatures and increased atmospheric moisture.

In recent years, Salem has witnessed a rise in extreme precipitation events, such as severe thunderstorms and flash floods. These events are often localized but can cause significant damage to the city's infrastructure, including roads, bridges, and buildings, as well as to private property. The intensity of these events is a concern, as they can lead to rapid flooding, especially in areas with inadequate drainage or near water bodies.

The impact of these extreme precipitation events extends beyond immediate physical damage. Flooding can disrupt local transportation and business operations, leading to economic losses. It also poses health risks, as floodwaters can contaminate drinking water sources and create breeding grounds for disease-carrying insects.

Salem's precipitation profile, with its average annual rainfall and the pattern of wet and dry months, plays a crucial role in shaping the city's natural and human environments. Understanding these patterns and preparing for the challenges associated with extreme weather events are essential steps in ensuring the city's resilience in the face of changing climatic conditions. (Source: NOAA)

Drought

Drought is an increasing concern in Salem. From July 2021 to March 2022, Salem underwent an extended period of abnormally dry conditions, spanning nine months. The situation escalated to a moderate/severe drought in February 2022, notably impacting water resources, agricultural yields, and overall water availability for the community. Before this, the city hadn't faced such severe drought conditions since 2002. (Source: U.S. Drought Monitor)

Extreme Weather and Storms

Salem has been increasingly subjected to extreme weather events, posing significant challenges to its infrastructure, environment, and resilience. The frequency and intensity of these events have underscored the urgency for the city to implement adaptive strategies and bolster its defense mechanisms against these natural adversities. Such extreme events include intense storms, hurricanes, and tornados. Hurricanes are storms with winds from 75 to 200 mph, and can cause flooding, storm surge, high winds, and tornados. Tornados are more common in the southern and central parts of the county, with tornados in New Jersey typically short lived and relatively weak. However, damage can be caused from high winds and wind blown debris.

Salem County has experienced several significant weather events and emergencies in recent years, affecting the community's well-being and infrastructure:

January 22-24, 2016: Winter Storm Jonas

> Winter Storm Jonas brought a substantial snowfall to Salem County, with accumulations of a foot or more across the area. The storm led to power outages affecting over 100,000 homes throughout New Jersey and was directly linked to 8 fatalities. High winds, reaching 55 mph in adjacent Cumberland County, exacerbated coastal flooding, marking a challenging period for the state and Salem County residents.

August 4, 2020: Tropical Storm Isaias

Tropical Storm Isaias hit Salem County hard, with the county receiving up to 7.86 inches of rainfall. The storm's powerful winds caused extensive damage across New Jersey, reminiscent of Superstorm Sandy in 2012. Fallen trees and downed power lines disrupted power for 1.3 million customers and blocked roads, though significant coastal surges were avoided.

January 31 through February 2, 2021: Winter Storm

This winter storm delivered over a foot of snow to much of the state, including Salem County, with five counties experiencing more than two feet of snowfall. The storm prompted the suspension of NJ Transit services and USPS mail delivery, and temporary closures of coronavirus vaccination sites. It marked the beginning of a series of February storms that caused severe coastal erosion.

September 1 – September 3, 2021: Remnants of Hurricane Ida

The remnants of Hurricane Ida led to catastrophic flooding across New Jersey, severely affecting homes, businesses, and infrastructure. The storm's aftermath saw a concerted recovery effort that involved all levels of government, community organizations, and individuals, highlighting the community's collaborative response to disaster recovery.

Episodes of severe thunderstorms, flash floods, and hurricanes have become increasingly common. Salem has had to grapple with transportation disruptions, widespread power outages, and heightened public safety risks. The aftermath of these events has financially burdened both the local administration and its residents, demanding substantial investments in recovery and restoration efforts. (Source: The Philadelphia Inquirer).

The vulnerability assessment examines the vulnerability of Salem at the existing 100-year flood level, as well as New Jersey's Climate Adjusted Flood Elevation (CAFE) standard, which accounts for a future flood scenario of 100-year flood levels plus 5 feet, offering a conservative and comprehensive perspective for long-term resilience planning.

Levee Exposure

Salem City is home to two significant levee systems as documented in the South Jersey Levee Inventory:

1. Town Bank Levee (NCRS #11): Extends for 1,251 feet along Tilbury Road, from the Water and Sewer Department to Elsinboro. This levee protects a substantial area, encompassing two hundred and eleven (211) parcels within a 1,000-foot buffer zone.
2. Fenwick Creek Levee (NCRS #12): Measures 672 feet in length and is located at the Rail Road Bridge between Salem and Mannington. This system is vital for the areas adjacent to Fenwick Creek.

The Town Bank levee failed in 1933, marking a significant breach in Salem's flood defense infrastructure and highlighting the potential vulnerabilities of the levee systems. Recorded breaches occurred three more times when the Salem River overtopped the levee system at Town Bank in October 2012, August 2020, and most recently on October 29, 2021. These incidents have raised concerns over the levee's ability to withstand extreme weather events and flooding.

National Flood Insurance Program

The National Flood Insurance Program (NFIP) is a key component of the United States' approach to managing flood risk and assisting communities and individuals in recovering from flood events. Established

in 1968 by the National Flood Insurance Act, the NFIP is administered by the Federal Emergency Management Agency (FEMA). Its creation marked a pivotal shift in the way flood risk management and insurance were approached in the country, recognizing the limitations of solely relying on federal disaster assistance to address flood damage.

NFIP policies cover damage to buildings and contents from flooding, flood-related erosion, and the buildup of water from sources like storms, melting snow, or blocked storm drainage systems. Coverage is divided into two main types: building property and personal property (contents), with separate deductibles for each. Coverage limits vary, with residential buildings being able to secure up to $250,000 in building coverage and $100,000 for contents, while businesses can obtain up to $500,000 for both building and contents coverage.

Salem City's flood insurance landscape and repetitive loss properties in Salem City, NJ, as per the latest data from FEMA's Region II office, dated April 30, 2023 is outlined below:

NFIP Active Policies

Number of Active Policies: Salem City hosts 166 active NFIP flood insurance policies, which constitutes 11.45% of all active policies in Salem County.

Total and Average Premiums: The total annual premiums paid by policyholders in Salem City amount to $185,503. This breaks down to an average annual premium of $1,117 per policy, indicating a higher cost burden per policyholder in Salem City compared to the Salem County average of $992. This discrepancy suggests either a higher risk profile or higher value properties within the city, warranting further investigation.

Repetitive Loss Properties

Repetitive Loss Properties: Salem City has two properties classified as Repetitive Loss (RL) properties. These have accumulated four claims totaling $25,366, which represents a minor 0.47% of RL claims when compared to Salem County's total of $5,378,664.

Severe Repetitive Loss Properties: Notably, there are no properties in Salem City classified as Severe Repetitive Loss (SRL) properties. This distinction indicates a relatively lower severity of loss from flooding compared to areas with SRL properties, potentially signaling effective local flood management practices or lower severity of flood events.

Flood Exposure vs. Insurance Coverage

1% Annual Chance Flood Zone: Within Salem City, 311 buildings are located within the 1% Annual Chance Flood Zone, constituting 21.7% of all buildings. These buildings have an aggregated value of approximately $22.78 million, representing 20.1% of the city's total building value.

Proximity to 1% Annual Chance Flood Zone: A significantly larger number of buildings, 1,111 (or 77.6% of total buildings), are situated near (within 1,000 feet) the 1% Annual Chance Flood Zone. The total value of these buildings is estimated at $83.64 million, accounting for 73.8% of the city's total building value.

B. Why Climate Change-Related Hazard Vulnerability Assessment Is Relevant

CCRHVA Objectives

The CCRHVA aims to identify and address Salem's current and future vulnerability to climate change. This assessment is mandated by the Municipal Land Use Law (MLUL), which requires New Jersey municipalities to plan for the impacts of climate change and conduct vulnerability assessments to identify areas most vulnerable to climate-related risks.

The primary objectives of the CCRHVA for Salem are:

1. Identify areas at high risk: The CCRHVA helps identify specific areas in the city that are most exposed to the impacts of climate change, such as flooding from sea level rise, increased precipitation, and extreme storm events; increased temperatures; and drought. This information enables prioritization of investments in infrastructure, emergency management, and other measures to reduce vulnerability and enhance resilience.
2. Assess the impacts on resources and populations: The CCRHVA identifies resources and populations most likely to suffer negative impacts from climate-induced changes, allowing targeted resource allocation and strategic planning to protect vulnerable areas and populations.
3. Meet regulatory requirements: Conducting a CCRHVA aligns with the requirements of the Municipal Land Use Law (MLUL), ensuring that Salem is proactively planning for the impacts of climate change and fulfilling its obligations as a municipality.
4. Access funding opportunities: Conducting a CCRHVA provides valuable information that can support funding applications for climate resilience and adaptation projects, enhancing Salem's eligibility for various funding opportunities aimed at strengthening climate resilience measures.

The CCRHVA is crucial for Salem to understand the risks posed by climate change and to develop effective strategies to enhance resilience. By addressing vulnerabilities through strategic planning and adaptation measures, Salem can enhance its resilience and effectively respond to the challenges posed by climate change.

Current Impacts of Climate Change in New Jersey

As part of the scientific basis for the CCRHVA in Salem, the team relied on the 2020 New Jersey Scientific Report on Climate Change, which is recognized as the best available science by the New Jersey Department of Environmental Protection (NJDEP).

The report presents key findings and projections regarding climate change impacts in New Jersey, including temperature, precipitation, sea-level rise, storm surge, ecosystems, and infrastructure. These impacts serve as critical inputs for understanding Salem's vulnerability to climate change and developing appropriate adaptation strategies.

1. Temperature: New Jersey is projected to experience continued warming throughout the 21st century, with mid-century average temperature increases projected to be between 2.1-5.4°F, and late-century increases projected to be between 3.0-8.5°F. Already, New Jersey has witnessed a rise of 1.6°F in temperatures since 1895, with a notable increase in record high temperatures compared to record lows since 2000. Heatwaves are anticipated to become more frequent and intense, with a projected increase of 24-36 days per year above 90°F by

mid-century and 36-72 days per year by late century. Extreme heat events pose significant threats to public health, particularly for vulnerable populations such as the elderly and people with pre-existing health conditions, and can increase demand for energy for cooling.

2. Sea-level rise: Sea levels along the New Jersey coast will continue to rise throughout the 21st century, with projections indicating an increase of .9-2.1 feet by 2050 and 2.0-5.1 feet by 2100. These projections are based on the likely range of scenarios with an assumption of continued moderate levels of greenhouse gas emissions throughout the 21st century. The worst case scenario in the report is 8.8 feet of Sea Level Rise by 2100 under a high emissions model. Sea-level rise poses various challenges to New Jersey, including increased coastal flooding, erosion, and saltwater intrusion into coastal aquifers. These impacts can have significant implications for the state's infrastructure, economy, and natural environment. Currently, the rate of sea-level rise along the New Jersey coast is estimated to be twice the global average, with historic increases of 0.13 inches per year. According to a study from Rutgers University, which used satellite data from the period 2002-2019, the sea-level rise rate along the New Jersey coast was found to be 3.9 mm per year, or roughly 0.15 inches per year.
3. Precipitation: Based on the *Projected Changes in Extreme Rainfall in New Jersey based on an Ensemble of Downscaled Climate Model Projections*, 2021, New Jersey has witnessed a significant increase in extreme precipitation, with a rise of over 70% in the heaviest 1% of daily precipitation events from 1958 to 2010. Projections based on 46 downscaled climate model simulations indicate an increase in extreme precipitation amounts across the state. Under a high RCP8.5 emissions scenario, median change factors range from 1.10 to 1.30 by the end of the century, suggesting a 10-30% increase in extreme precipitation amounts.

   The LOCA[3]-downscaled models forecast a 10-20% increase in 2-year and 10-year ARI precipitation across New Jersey in the 2050-2099 period under RCP 8.5, with the majority of the model medians falling between 15 and 20%. Increases of 15 to 20% are common in southern New Jersey, while the largest increases, in the range of 20-25% for 2-year ARI and 25-30% for 10-year ARI, are projected for the extreme northern part of the state.

   These trends in extreme precipitation are influenced by increases in atmospheric water vapor and the frequency of local convective storm events, both enhanced by warming surface temperatures. Changes in the frequency, intensity, and tracks of tropical and extra-tropical cyclones also contribute to these trends. Climate model simulations suggest the continuation of these extreme precipitation trends throughout the 21st century. This change in precipitation patterns may lead to more frequent droughts and an increase in the size and frequency of floods, along with a heightened potential for more intense tropical storms due to a warmer atmosphere and oceans.
4. Storm surge: Storm surges, temporary increases in sea level caused by storms, will become more frequent and intense in New Jersey throughout the 21st century due to sea-level rise and changes in storm patterns. The state has already experienced major storm surge events

[3] LOCA, which stands for "Localized Constructed Analogs," is a technique used for downscaling climate model simulations and projections. It is a statistical downscaling method that improves the spatial resolution of climate model outputs, making them more useful for regional and local impact assessments.

in recent decades, including the significant damage caused by Hurricane Sandy in 2012, as reported by NOAA.

5. **Ecosystems**: Climate change is anticipated to have significant impacts on New Jersey's ecosystems, including vegetation, species distributions, and habitat suitability. Rising temperatures could alter the timing of plant flowering and leaf emergence, impacting pollinators and wildlife that rely on these plants. Changes in species distribution may occur as habitats become unsuitable, potentially affecting wildlife populations and commercial fisheries. For instance, data from the New Jersey Department of Environmental Protection (NJDEP) shows that in Salem County, there has been a decline in the winter sea duck population from 2,030 birds in 2008 to 717 birds in 2015.
6. **Infrastructure**: Climate change could pose significant challenges to New Jersey's infrastructure, such as roads, bridges, and buildings. Higher temperatures and more frequent extreme weather events may lead to increased damage and maintenance costs. Flooding and erosion, driven by sea-level rise and intense precipitation events, could further compromise transportation infrastructure, hindering the movement of people and goods.
7. **Drought:** Characterized by abnormally low precipitation that leads to water shortages, drought is becoming increasingly frequent and prolonged. This trend is exacerbated by increased evapotranspiration and reduced soil moisture, driven by warmer and drier conditions. In New Jersey, droughts lasting three to six months or more are expected to occur more frequently, especially under scenarios with high emissions. Short-term summer droughts are also anticipated to rise, presenting challenges to agriculture and water resource management. In Salem City, drought is a significant impact of climate change. Rising temperatures and shifting precipitation patterns are expected to lead to longer and more severe droughts. These conditions can damage crops, reduce water availability, and adversely affect natural ecosystems. Salem County, along with much of the Northeastern United States, has experienced drought conditions in recent years, with some areas facing moderate to extreme droughts. The National Integrated Drought Information System reported that Salem City experienced moderate drought for six months in 2020 and faced abnormally dry conditions for most of the year. These droughts, combined with high temperatures, placed stress on crops and vegetation, resulting in lower yields and increased prices for consumers.

Understanding the climate change impacts outlined above is crucial for assessing the vulnerability of Salem, NJ. These impacts, as identified in the New Jersey Scientific Report on Climate Change, provide the scientific basis for evaluating the potential risks and developing appropriate adaptation strategies. By considering the projected increases in temperature, sea-level rise, precipitation, storm surge, and their associated effects on ecosystems and infrastructure, the CCRHVA in Salem can help identify areas of concern and prioritize resilience-building measures.

As part of the CCRHVA process, it is essential to further investigate local and regional data and studies specific to Salem, NJ. Local observations, historical records, and models tailored to the region can provide more detailed insights into Salem's vulnerability to climate change impacts, including sea-level rise, and guide the development of localized adaptation strategies.

By incorporating the best available science and a localized approach, the CCRHVA for Salem enhances the understanding of climate risks and vulnerabilities specific to the city. This knowledge will serve as a foundation for decision-making, enabling Salem to implement targeted adaptation measures, safeguard critical infrastructure, protect vulnerable communities, and ensure the long-term resilience and well-being of the city and its residents.

C. Methodology

The CCRHVA for Salem was prepared through an assessment of various subjects, such as critical infrastructure, community assets, cultural resources, land use and zoning, vulnerable populations, and ecological resources to identify areas and assets that were potentially more vulnerable to climate change impacts. A full methodology can be found in Attachment 1.

Public Engagement

The public outreach for the Salem City resilience project included three key community meetings, a community walking tour, and individual meetings with key informants and city employees and representatives from Salem County, including discussions of the Resilient NJ project and findings during bi-weekly calls with the Salem representatives. In addition, a second walking tour was conducted with Salem and representatives from the Department of Housing and Urban Development specific to implications to affordable housing, and a meeting with the Brownfield Development Area (BDA) Steering Committee that included a discussion on the implications of the Resilient NJ findings to the BDA, followed by a tour, Relationships with school board members were leveraged to develop curriculum to be shared with the school, included as Appendix G to the Resilience Action Plan. Finally, opportunities for funding for stormwater management were reviewed with relevant Salem officials in a dedicated funding meeting. In addition, discussions with the County and the State were held to discuss how the Resilient NJ findings should be incorporated into the Hazard Mitigation Plan being undertaken by Salem County, and into the revised Salem Master Land Use Plan, being undertaken by the State.

In addition, a project webpage was launched to share information with the public, including posting recordings of the public meetings, copies of the presentations in English and Spanish, and a survey to collect additional information. The website is available at https://brsinc.com/resilient-nj-salem/

These Key Informant meetings took place during Spring 2023 and into the Fall. The meetings presented information about the project scope, CCRHVA findings, and gleaned information from participants about existing programs, procedures, areas of additional impact, and maintenance challenges. The participants also provided additional guidance about additional outreach opportunities.

These meetings were critical in engaging Salem City residents, gathering their inputs, and shaping the project's direction. The information from these meetings, along with additional feedback mechanisms, informed the development of the resilience action plan for Salem City.

Data Sources

Several comprehensive flood mapping and modeling resources were considered to assess flood risk. This analysis includes data from multiple sources that together provide a nuanced, layered view of flooding risk by examining historical patterns, tidal influences, climate projections, and extreme event risks. The following chart outlines each of these data sources, including their definitions, applications, and specific contributions to flood risk assessment:

Table 2: FEMA flood zone definitions

Term	Definition	Application	Purpose in Flood Risk Assessment	Type of Flooding Addressed	Source
FEMA Flood Zone AE / New Jersey Tidal Flood Hazard Area	A FEMA-designated high-risk flood zone with a 1% annual flood probability (100-year flood zone). Zone AE includes Base Flood Elevations (BFEs) to indicate expected floodwater height in major storm events.	Applied in the National Flood Insurance Program (NFIP) for insurance rating and floodplain management standards. Development in these areas often requires elevation and insurance mandates.	Provides a historical baseline of flood risk for regulatory requirements, insurance, and construction standards, helping mitigate consistent vulnerabilities in these high-risk areas.	Riverine Flooding, Tidal Flooding, Drainage Basin Flooding	FEMA Flood Insurance Rate Maps (FIRMs); NJ Flood Hazard Area Control Act; NJDEP
NJ Tidal Climate Adjusted Flood Elevation (CAFE) Area	Adjusted flood elevations in tidal regions accounting for projected sea-level rise and climate-driven changes, reflecting future risk increases for flood-prone areas.	Impacts building codes and land-use standards in areas where climate adaptation measures are required. Used for designing flood-resilient structures and infrastructure.	Anticipates future flood conditions and establishes minimum design elevations to build long-term climate resilience in at-risk areas. Helps plan for progressive SLR impacts and compound flood risks from storms.	Sea Level Rise (SLR), Tidal Flooding	NJDEP Tidal Flood Hazard Mapping; NJ Climate Change Resilience Strategy; NJDEP
Mean Higher High Water (MHHW)	Average of the higher of the two daily high tides over a 19-year period, forming a baseline for evaluating coastal flood risk and shoreline planning.	Sets baseline references for defining flood zones, coastal regulations, and shoreline development standards. Used to anticipate and assess impacts from sea-level rise on high tides, such as nuisance flooding.	Serves as a natural high tide marker, critical for understanding regular tidal influence. It helps design structures and infrastructure in areas exposed to recurring tidal flooding that may become permanent	Tidal Flooding, Nuisance/Sunny Day Flooding	Tidal data from NOAA's National Ocean Service (NOS); NOAA

			inundation zones in the future.		
Inundation Risk Zone (IRZ)	A designated area prone to continuous or permanent flooding as sea levels rise, extending beyond traditional 100-year flood zones. The IRZ factors in compounded climate risks and anticipates long-term changes in land use as some areas transition from temporary nuisance flooding to permanent inundation.	Informs emergency planning, infrastructure resilience, and long-term adaptation strategies by identifying zones at risk for lasting submersion. Used to support proactive measures, such as managed retreat, infrastructure relocation, and resilience building in permanently at-risk areas.	Helps assess long-term flood risk from SLR-driven permanent inundation, aiding in emergency preparedness, adaptive zoning, and infrastructure planning for areas that may lose viability over time.	Sea Level Rise (SLR), Permanent Inundation	FEMA Hazard Mitigation Planning; NOAA Sea-Level Rise Tool; NJ Climate Resilience Plan; NJFlood-mapper

These data sources provide a comprehensive, multi-dimensional assessment of flood risk by integrating historical flood data (FEMA AE zones), climate-adjusted future projections (CAFE), daily tidal influences (MHHW), and inundation considerations (IRZ). Within the Inundation Risk Zone (IRZ Zone), we have analyzed assets in one-foot increments up to five feet of sea level rise (SLR). This approach allowed us to assess the immediacy of the threat of SLR for each asset, with an asset threatened at one foot of SLR being affected sooner than an asset at two feet, and so on. With this analysis, we can provide a clear, phased understanding of SLR impacts, helping Salem prioritize resilience measures based on urgency and projected timelines.

This layered approach enhances the accuracy and reliability of flood risk assessments, supporting floodplain management, land-use planning, and resilience-building strategies. Each source contributes unique insights, essential for understanding both recurring and potential future flood risks in a changing climate.

At risk populations evaluated include the elderly, youth, disabled, low-income populations, and households without vehicles.

The following data sources were used for this CCRHVA:

- Center for Disease Control (CDC), Social Vulnerability Index (SVI) for 2018
- U.S. Census, American Community Survey (ACS), 2014-2018
- National Agriculture Imagery Program (NAIP)

- The Trust for Public Land, Urban Heat Island Severity for US Cities
- FEMA Flood Map Service Center
- NJFloodmapper
- NJGIN Open Data portal
- Landscape Project v3.3
- NOAA tide monitoring station at Reedy Point, DE
- 2020 New Jersey Scientific Report on Climate Change

A complete discussion of how these sources were used can be found at the end of the CCRHVA.

Additional Data

A CCRHVA requires the development and analysis of many maps to determine and illustrate at-risk areas, using the data sources described above. In addition to this analysis, an effort to determine the projected fluvial flooding risk was recognized as important to this analysis. To fill this gap, NJDEP retained Michael Baker Associates to model riverine flooding and sea level rise in the nine Sandy impacted counties. The New Jersey Department of Transportation (NJDOT) then took over and completed the modeling for the remainder of the state.

This modeling came with a disclaimers as listed below

1. The data is not a representation of actual flooding conditions and is only intended to be used as a high level planning tool.

2. The locations of the streams shown on the maps are not an indication that they encompass all regulated waters under the Flood Hazard Area Control Act rules.

3. NJDOT is not responsible for the quality, content, accuracy, or completeness of any of the data sets, applications, or application programing interfaces (API)s linked.

4. The creator of the data sets, applications, and APIs retain any copyright or intellectual property restrictions they have placed on the data sets, applications, or APIs in their original format.

5. When creating new applications, visualizations, or other projects based on the data from NJDOT, the user may not use any trademark, emblem, logo, or statement implying the endorsement of the original creator of the data set, application, or API unless the creator has agreed to that endorsement.

6. The user assumes sole responsibility for any applications, visualizations, or other projects created using data found on the NJDOT model and data set. The NJDOT team and the creator of the original data source have no legal responsibility or indemnity for projects created using this data.

7. The NJDOT does not recommend the use of the results on the Delaware River and recommends the use of alternate or more detailed methodology.

Because of this, while maps of the projected impacts are included in Attachment 3 to this CCRHVA, the analysis is based on the NJDEP and project team projections.

II. Vulnerability Findings

The Salem CCRHVA evaluates how different aspects of climate change can be expected to affect the city's resources, focusing on flooding hazards due to the impacts of sea-level rise and riverine flooding, impacts of severe storm events, drought, and extreme temperatures, predicted increase in precipitation intensity and frequency. These impacts do not affect the entire city evenly; some areas are at greater risk than others. Therefore, it is essential to develop mapping to illustrate and illuminate these uneven impacts as a key component of assessing vulnerabilities.

Attachments 2 and 3 include a comprehensive mapping package for this project with detailed maps and annotations. The maps include flood hazard areas, zoning districts, special status species habitats, vulnerable populations, overburdened communities, open spaces, land use, and economic development areas. These elements are essential for understanding and strategizing Salem's resilience against climate change impacts. Maps that contributed to the analysis are included in Attachment 2 and are:

1. Existing and Future 1% Storm Floodplains
2. Zoning in Existing and Future 1% Storm Floodplains
3. Special Status Species Habitat in Existing and Future 1% Storm Floodplains
4. Vulnerable Populations and Existing and Future 1% Storm Floodplains
5. Overburdened Communities in Existing and Future 1% Storm Floodplains
6. Open Space in Existing and Future 1% Storm Floodplains
7. Land Use/Land Cover in Existing and Future 1% Storm Floodplains
8. Economic Development Features in Existing and Future 1% Storm Floodplains
9. Ecological Resources in Existing and Future 1% Storm Floodplains
10. Cultural Resources in Existing and Future 1% Storm Floodplains
11. Critical Facilities in Existing and Future 1% Storm Floodplains
12. Community Assets in Existing and Future 1% Storm Floodplains
13. Community Assets in Existing and Future Tidal Inundation Areas
14. Critical Facilities in Existing and Future Tidal Inundation Areas
15. Cultural Resources in Existing and Future Tidal Inundation Areas
16. Ecological Resources in Existing and Future Tidal Inundation Areas
17. Economic Development Features in Existing and Future Tidal Inundation Areas
18. Land Use/Land Cover in Existing and Future Tidal Inundation Areas
19. Open Space in Existing and Future Tidal Inundation Areas
20. Overburdened Communities in Existing and Future Tidal Inundation Areas
21. Vulnerable Populations and Existing and Future Tidal Inundation Areas
22. Special Status Species Habitat in Existing and Future Tidal Inundation Areas
23. Zoning in Existing and Future Tidal Inundation Areas
24. Existing and Future Tidal Inundation Areas
25. Drought Vulnerable Landscapes
26. Land Use/Land Cover in Urban Heat Island Severity Areas
27. Urban Heat Island Severity and Population Vulnerable to Extreme Heat and/or Poor Air Quality
28. Urban Heat Island Severity and Tree Canopy
29. Urban Heat Island Severity

A. Flooding

Flooding is a recurrent issue in Salem City, exacerbated by the impacts of climate change. Increased precipitation and storm surges due to climate change worsen the severity and frequency of flooding events. The city has suffered several flood events in recent years, including the historic flood of June 28, 2006, which caused significant impacts including damaged homes, businesses, and infrastructure. According to the National Oceanic and Atmospheric Administration (NOAA), the frequency of heavy precipitation events has increased in New Jersey by 71% since 1958.

In addition to the physical and economic damage of floods, they also pose a risk to public health and safety. Floodwaters may contain contaminants, including sewage, chemicals, and debris, which can cause illness and injuries. In the aftermath of floods, mold growth due to increased humidity levels and water damage can also lead to respiratory problems and allergies.

Flooding is a recurrent and intensifying issue in Salem City, worsened by climate change. Increased precipitation, higher storm surges, and rising sea levels all contribute to more frequent and severe flood events. To assess the city's flood risks, an extensive vulnerability analysis was conducted, drawing on climate data, floodplain mapping, and projections of future sea level rise. Flooding can occur from sea-level rise, riverine sources, tidal sources, heavy precipitation, inadequate drainage, and groundwater, as described below.

To capture the full range of flood risk, the assessment integrated multiple data layers:

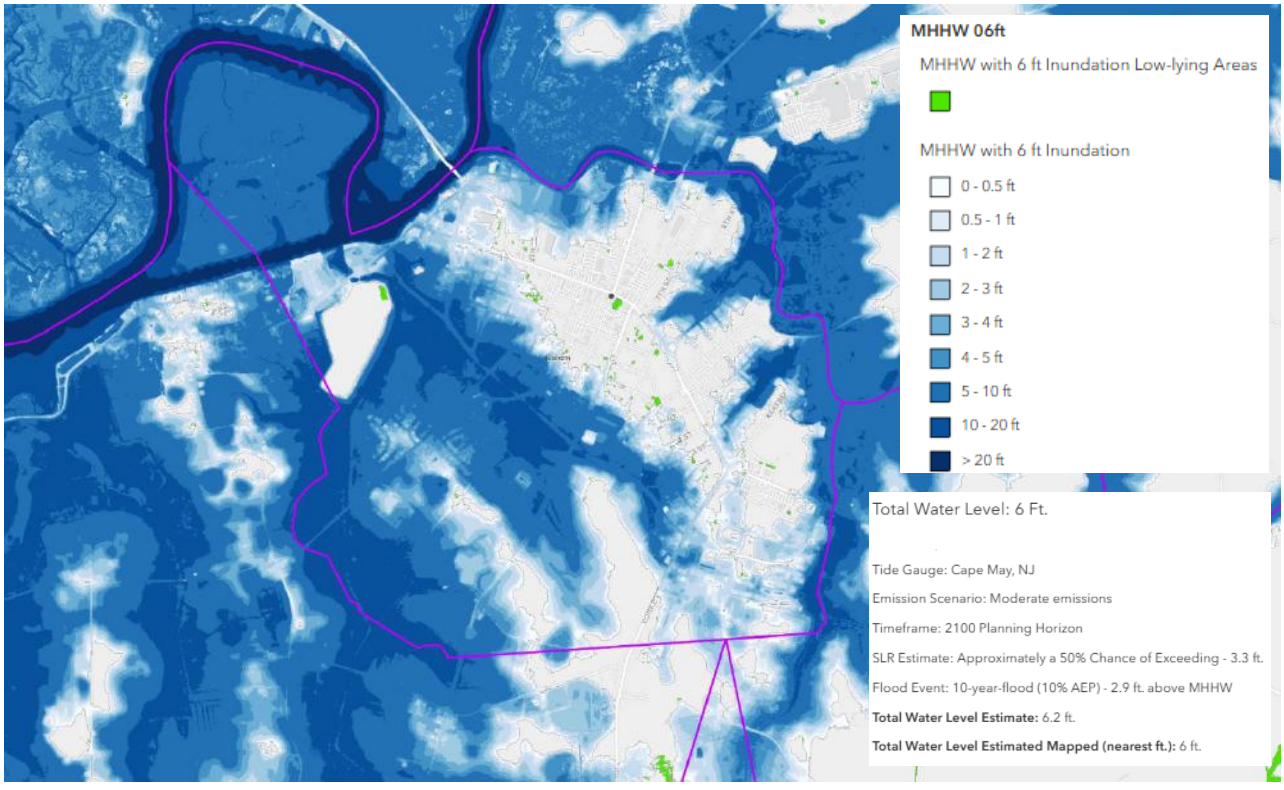
1. FEMA Flood Zone AE Mapping: Provided a baseline for the 100-year floodplain, identifying high-risk areas based on past flood frequencies.
2. Climate Adjusted Flood Elevation (CAFE): Adjusted flood elevations are based on FEMA 1% flood mapping with an additional 5 feet, establishing a more future-focused flood risk model for critical infrastructure and development areas.
3. Mean Higher High Water (MHHW): Set the baseline for tidal influence and nuisance flooding, capturing daily tidal fluctuations that increasingly impact Salem's low-lying areas.
4. Inundation Risk Zone (IRZ): Projected areas that will experience permanent inundation as sea levels continue to rise, identifying zones likely to transition from occasional to permanent flooding.

The analysis highlighted several contributing factors that collectively drive flooding in Salem and the surrounding areas, including:

- Sea Level Rise and Tidal Flooding: SLR has raised the Delaware Estuary by approximately 0.13 inches annually since 1900, leading to more frequent tidal flooding, especially during high tides and storm surges.
- Riverine Flooding: Increased precipitation and intense storms cause rivers like the Delaware and its tributaries to overflow, inundating surrounding areas.
- Flash Flooding: Extreme rainfall events overwhelm stormwater systems, particularly in narrow valleys or urban areas with limited drainage capacity.
- Pluvial (Surface) Flooding: Heavy rains in urban areas with impermeable surfaces contribute to surface flooding when storm drains are overloaded.
- Groundwater Flooding: Seasonal high water tables and prolonged rain events can push groundwater above the surface, leading to basement flooding and structural damage.

Sea level rise and tidal flooding: Tidal flooding occurs when water from the ocean surges inland, causing nearby rivers and waterways to flood. In Salem, the Delaware River is the primary source of tidal flooding, and it impacts areas situated near the river and its tributaries. Additionally, intense storms that occur in the area can cause tidal surges that compound the tidal flooding impacts. Salem, NJ, is located in the Delaware River Basin watershed, where sea level rise has been significant. The Delaware Estuary, which borders Salem County, has experienced SLR of approximately 0.13 inches per year since 1900, according to the Delaware Estuary Report Card. This rise has caused more frequent and higher water levels during flood events, particularly during high tide events, leading to more frequent and severe tidal flooding.

In Salem, permanent inundation in the Inundation Risk Zone (IRZ) represents a long-term change in land use and accessibility. As SLR progresses, some areas in Salem will transition from experiencing periodic nuisance flooding to becoming part of the IRZ, where they will be permanently underwater. This shift has significant implications for infrastructure, housing, and local ecosystems, as these permanently inundated zones will no longer be suitable for habitation or development (see Map 1).In Map 1, the mapped flood risk area under current conditions indicates that most nuisance flooding is currently limited to tidal channels and marshes. A large portion of this flood risk area consists of undeveloped or low-risk land, such as agricultural fields, industrial zones, and a baseball field, where people do not reside. However, some residential areas, particularly around Chestnut Street, are affected by this flooding. The map illustrates that most of the downtown area lies outside the flood hazard zone, showing that flood risks are primarily concentrated along the city's waterbody edges, with only a few areas encroaching into the commercial downtown. However, future projected flood risk shows a significantly larger area impacted with regular inundation; there is a projected 50% chance of exceeding 3.3 feet of SLR within the timeframe of 2100 and preparation is needed for even more extreme scenarios that are possible.



Map 1: Projected Sea Level Rise above the Mean Higher High Water (MHHW) for 2100 for City of Salem under a "Moderate" Emissions Scenario, combined with a 10-year flood event. Source: NJ Floodmapper.

Riverine Flooding: Riverine flooding in Salem, NJ, occurs when rivers and waterways, such as the Delaware River and its tributaries (Mannington Creek, Game Creek, and Fenwick Creek), overflow their banks. This typically happens due to heavy precipitation, snowmelt, or ice jams. Climate change is expected to increase the frequency and intensity of these heavy precipitation events, thus heightening the risk of riverine flooding in Salem and its surrounding areas. The overflowing of these water bodies can lead to significant water spilling onto adjoining land areas, impacting communities, agriculture, and infrastructure

Flash Flooding: Flash flooding is a rapid and intense flooding event typically caused by heavy rainfall within a short period. In Salem, flash flooding is a concern as climate change is expected to increase the frequency and intensity of extreme precipitation events. This type of flooding can quickly overwhelm stormwater infrastructure, leading to the inundation of streets, homes, and businesses, especially in areas near water bodies or in narrow valleys where water flow is naturally constricted. The most vulnerable areas in Salem to flash flooding are those close to rivers and streams or with a history of rapid water accumulation during heavy rain events.

Pluvial Flooding: Pluvial flooding, on the other hand, occurs in urban areas when excess rainfall cannot be absorbed or drained away efficiently. This type of flooding is typically associated with flat or low-lying areas and is exacerbated by impermeable surfaces like pavement and concrete. As climate change potentially leads to more frequent and intense precipitation events, Salem's drainage systems could become overloaded, increasing the risk of pluvial flooding. The areas of Salem particularly susceptible to pluvial flooding include neighborhoods with inadequate drainage systems and regions with extensive impermeable surfaces.

Groundwater Flooding: Groundwater flooding is another type of flooding in Salem. This occurs when the water table rises above the surface of the ground, causing water to seep into basements and other underground structures. Groundwater flooding is linked to seasonal changes and can occur after prolonged periods of heavy rainfall or extended dry spells. Salem has a high-water table level, which exacerbates the risk of groundwater flooding during heavy precipitation events. Low-lying areas near

Mud Diggers Ditch is known by several other names in the surrounding areas, including Grieves Ditch, Powder Mill Run, and Old Ditch. The waterway originates in Pittsgrove Township, flows through Elmer Borough and Upper Pittsgrove, and empties into the Delaware River at Salem City. The waterway takes on different names depending on its location within the county.

Image 3: Town Bank Pump Station and Mud Diggers Ditch

Mud Digger's Ditch is a significant contributor to various types of flooding in Salem City, NJ, and the surrounding communities, including both riverine and flash flooding.

The water from surrounding communities enters Salem County mainly due to developments which lead to increased impervious surfaces like parking lots and roads, leading to more stormwater runoff. During heavy rainfall, the runoff enters the drainages, including Mud Diggers Ditch in Salem County, raising water levels that eventually lead to flooding. This ultimately affects not just Salem City but also other surrounding communities connected to Mud Digger's Ditch.

groundwater reserves, such as the Pine Barrens aquifer, are particularly susceptible to groundwater flooding in the region.

Drainage basin flooding: Drainage basin flooding refers to the rise in water levels within a river or waterway caused by extensive water accumulation in the entire drainage basin or watershed. This phenomenon is evident in the Salem River and its tributaries, where widespread rainfall or other hydrological events lead to an increase in water levels across the basin. Notable instances include the floods affecting Mannington Creek, Game Creek, and Fenwick Creek. The Flood of June 2006, which caused notable damage in Salem, exemplifies drainage basin flooding's impact. This type of flooding encompasses a broader area than riverine flooding, affecting not just the rivers but the entire watershed, and is often the underlying cause of subsequent riverine flooding events.

Salem has historically experienced several severe flooding events. The most significant events[4] include:

- The Great Flood of 2004: This flood event was caused by Hurricane Ivan, a Category 3 hurricane that hit the Gulf Coast in September 2004. The hurricane caused significant rainfall in the northeast region, leading to flooding in several areas of New Jersey, including Salem County. According to NJ.com, the flood resulted in at least $40 million in damages to homes, businesses, and infrastructure in Salem and Cumberland counties. The Delaware River crested at a record level of 22.5 feet, causing significant damages to the communities along the river, including Salem City.
- The Flood of June 2006: This flood event occurred when Mannington Creek overflowed its banks, causing significant damages to the homes of Salem residents and the surrounding areas. According to the South Jersey Times, residents were displaced from their homes, and several roads and bridges were closed due to the flooding.
- August 2018 Flash Flood: In this event, a storm cell stalled over Salem County, causing heavy rainfall and flash flooding in several areas, including Salem City. According to NJ.com, several homes, businesses, and infrastructure were impacted by the flooding. Residents were evacuated from their homes, and several roads were closed due to the flooding. The damage was estimated to be in the hundreds of thousands of dollars.

These events demonstrate the significant economic and social impacts of flooding in Salem City and the surrounding areas. Infrastructure damage, property damage, business and job loss, and displacement of residents are some of the many consequences of flooding.

Precipitation

Extreme precipitation refers to events where the amount of rainfall or snow substantially exceeds what is considered a normal amount for a location. What is considered extreme varies by location and season, and climate change is expected to increase the frequency and intensity of extreme rainfall events. Heavy rainfall can cause riverine and pluvial flooding. In addition to the direct damages caused by flood condition, waterborne disease outbreaks are more likely, and water damage and mold in homes after an extreme

[4] The Great Flood of 2004: NJ.com: "N.J. remembers Hurricane Ivan's wrath 10 years later" (https://www.nj.com/cumberland/2014/09/nj_remembers_hurricane_ivans_wrath_10_years_later.html)
The Flood of June 2006: South Jersey Times: "Officials assess damage by floodwaters" (https://www.nj.com/south/2006/06/floodwaters_devastate_region.html)
August 2018 Flash Flood: NJ.com: "Flash flooding forces residents from homes, shuts down roads in Salem County" (https://www.nj.com/salem/2018/08/flash_flooding_forces_residents_from_homes_shuts_down_roads.html)

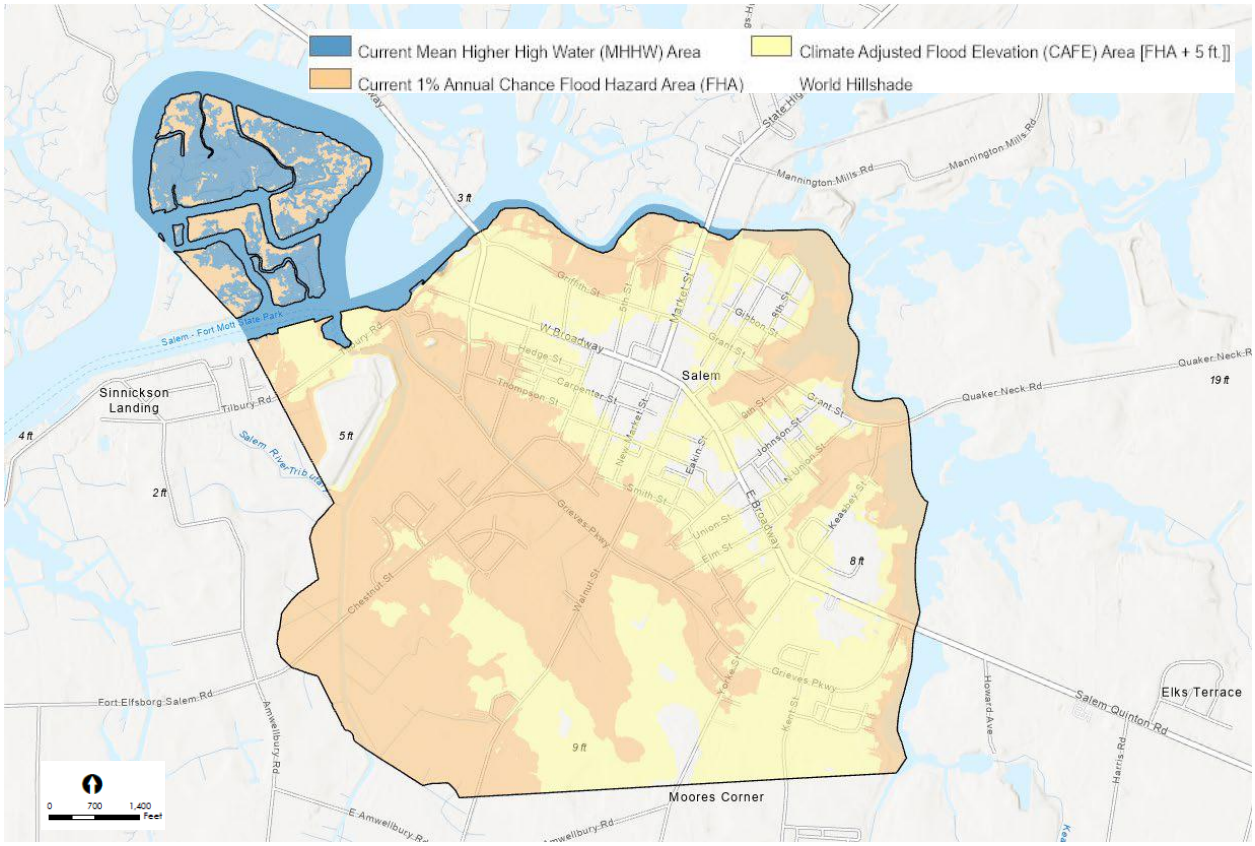
rainfall event can worsen indoor air quality, exacerbating asthma and other respiratory illnesses. Data in Table 3: Current and projected rainfall amounts in Salem, represents a 24-hour rain event.

Table 3: Current and projected rainfall amounts in Salem, Source: NJADAPT Climate Impacts Report

Storm Type	Baseline	Moderate Emissions, Mid-Century	Moderate Emissions, Late-Century	High Emissions, Mid-century	High Emissions, Late-Century
50% chance	3.24	3.46	3.59	3.59	3.79
20% chance	4.16	4.50	4.62	4.66	4.96
10% chance	4.95	5.40	5.55	5.55	5.94
4% chance	6.14	6.63	6.88	6.88	7.43
2% chance	7.17	7.81	8.03	8.03	8.60
1% chance	8.31	8.98	9.23	9.23	9.89

NJADAPT's Climate Impacts report includes a table showing current and projected rainfall amounts locally. This is the amount of rain in inches that is projected to fall over a 24-hour period during an extreme storm event. This data is sourced from the Northeast Regional Climate Center.

Map 2: Overview of Salem flood areas



Map 2 also illustrates the future flood risk area (year 2100), where Mean Higher High Water (MHHW) flooding greatly exceeds the current tidal channels, covering most of the city, and is highly dispersed across the region. The map shows that some major infrastructure, such as the city's industrial areas, agricultural areas, and schools, will likely be impacted by flooding under future conditions.

Additionally, the flood hazard areas are encroaching more into the downtown area, indicating a significant increase in flood risk in this area. This reinforces the urgency of developing adaptive strategies that minimize risks, increase resilience, and prioritize the protection of critical facilities and infrastructure to reduce the potential impacts of climate change on Salem's population and its infrastructure.

Sea level rise is expected to worsen flooding conditions during sunny day scenarios, particularly during high tides, whereas increased precipitation will create more frequent and impactful fluvial and pluvial flooding. Combined, these two forces act upon each other to collectively increase the flood risk.

Open Space

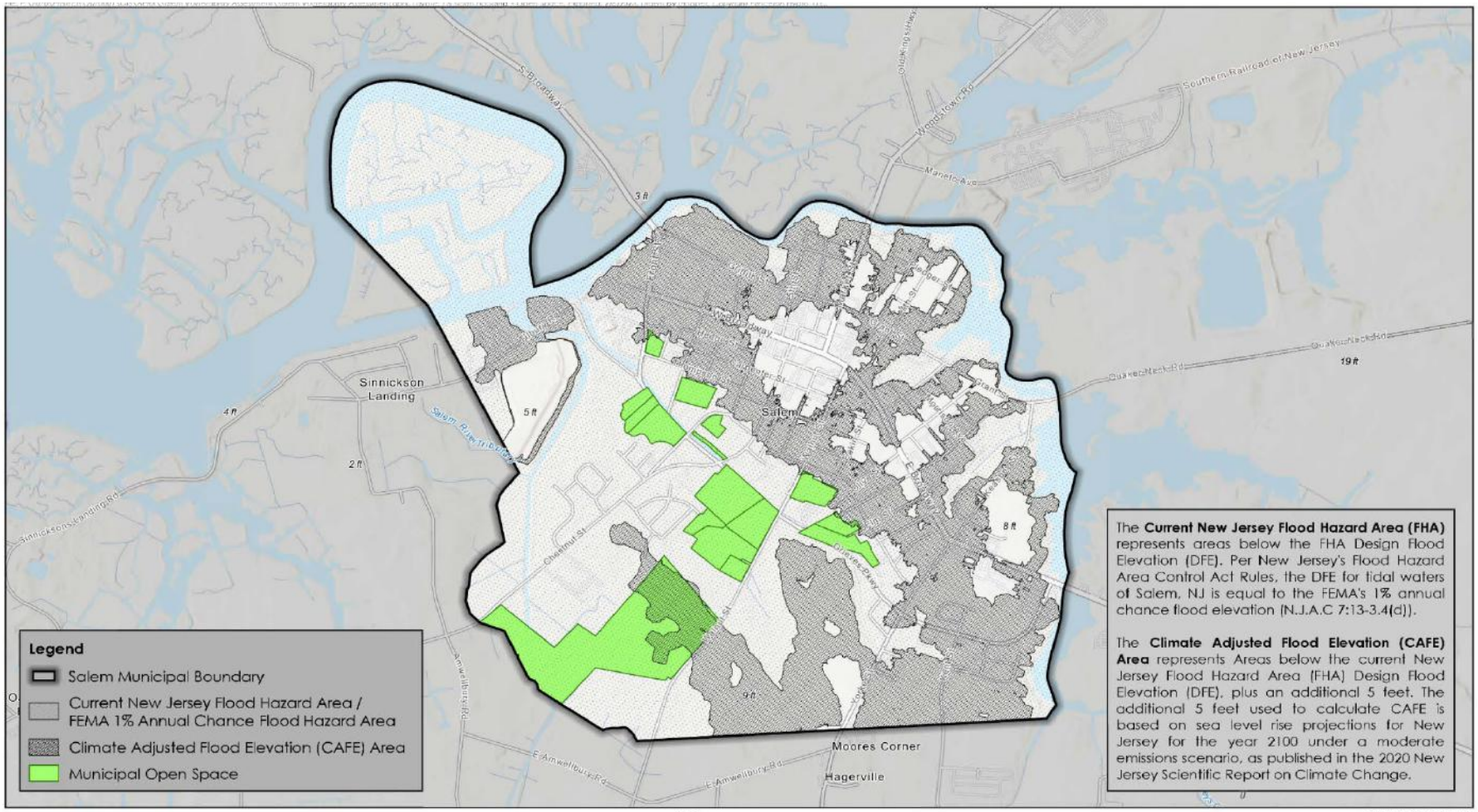
In terms of open spaces designated for public use, such as parks, wetlands, and tree canopy areas, the CCRHVA revealed that almost all of the city's open spaces are currently within a flood hazard area. The analysis indicates that under a climate adjusted flood elevation area scenario, 100% of Salem's open spaces will be in a flood risk area, as illustrated by Table 4: Open Space and Flood Risk, and depicted in Map 3: Open Space in Existing and Future Flood Hazard Areas and Map 4: Open Space in Existing and Future Tidal Inundation Areas.

Table 4: Open Space and Flood Risk

Open Space Flood Risk Area Expansion:		
Current Flood Hazard Area	83%	
Climate Adjusted Flood Elevation Area	100%	

None of Salem's open space exists outside of these flood risk areas. However, these spaces offer an opportunity, as they could be transformed into ecological services such as wetland restoration and flood mitigation. Careful consideration of future climate risks means that these spaces can be designed to adapt to changing conditions and continue to provide ecological benefits.

Map 3: Open Space in Existing and Future Flood Hazard Areas



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NOTES:
1. Open spaces obtained from the N.J. Geographic Information Network (NJGIN) Open Data portal: https://njgin.nj.gov/
2. FEMA 1% Annual Chance Flood Hazard Areas, effective 04/ 5/2016, obtained from FEMA Flood Map Service Center: https://msc.fema.gov/portal/
3. CAFE areas are derived using NJ Adopt Flood Mapper: https://www.njfloodmapper.org/
4. Salem municipal boundary obtained from New Jersey Geographic Information Network (NJGIN) Open Data portal: https://njgin.nj.gov/
5. Basemap obtained from ESRI basemaps services.

Spatial Reference: NAD 1983 2011 StatePlane New Jersey FIPS 2900 Ft US

OPEN SPACE IN EXISTING AND FUTURE FLOOD HAZARD AREAS

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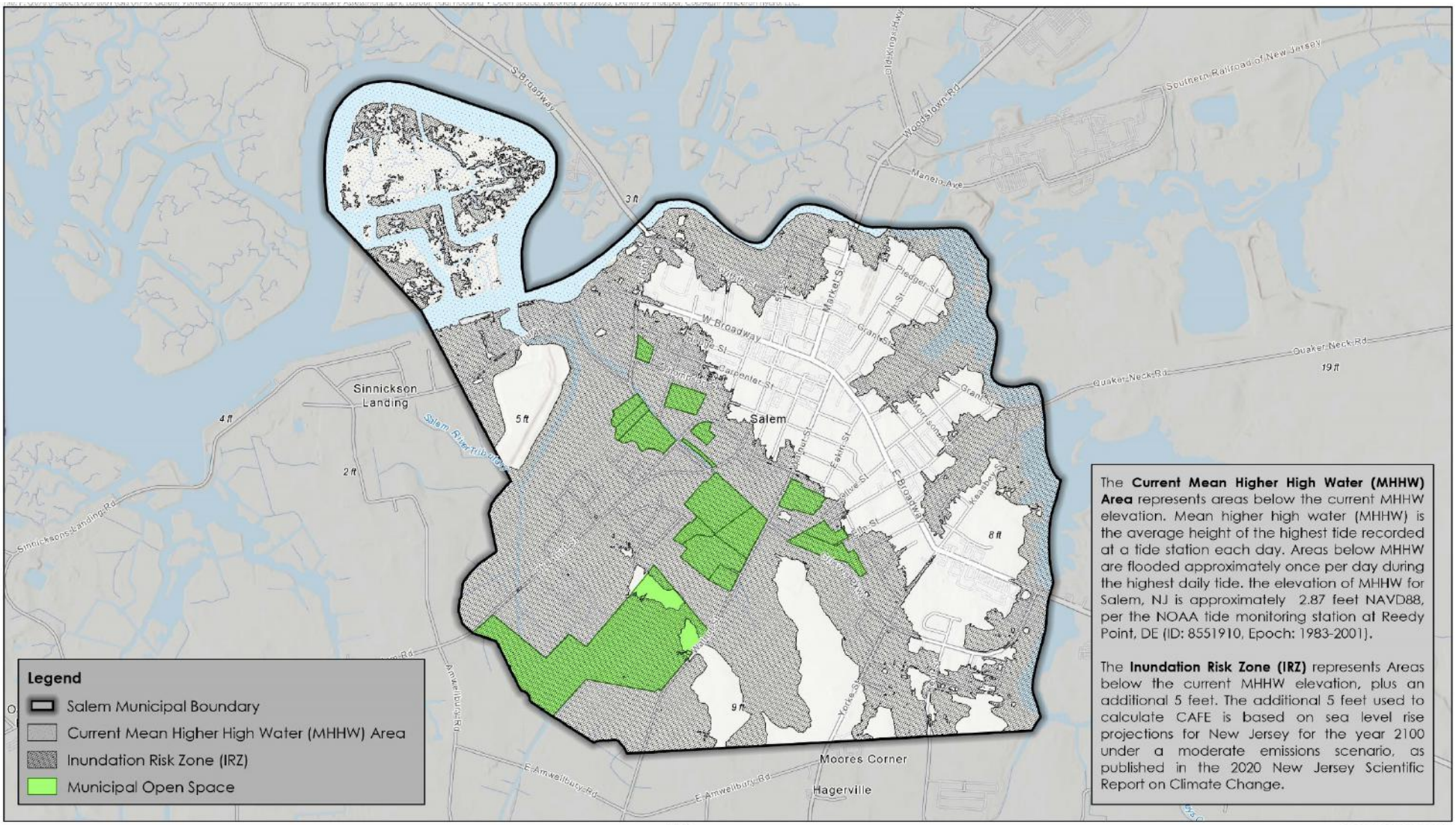
Table 5, Open Space and Sea Level Flood Risk, shows percentage of open space land that becomes inundated as sea level rises in one-foot increments. That open space is in land that is likely to become inundated is not necessarily a bad thing; it means that existing open space can help serve a protective function for the rest of the city as water levels rise. As was mentioned before, careful choices will need to be made in design and landscaping if open space is going to adapt to SLR.

Table 5: Open Space and Sea Level Flood Risk

Percent of Open Space Inundated by SLR Level	
1ft SLR	62%
2ft SLR	81%
3ft SLR	90%
4ft SLR	96%
5ft SLR	98%

The larger concern here is that inundation will prevent open spaces from providing the active recreation services that they provide today. The municipal open space with active recreational amenities impacted include: City Park, Stadium, Community Center, Martin Luther King Park, and Veterans Park, all of which are located within the Inundation Risk Zone. No one can play football or soccer on a flooded field, and some fields could become flooded every day. The siting of active versus passive recreation in the city may need to be rethought as part of its long-term planning, taking these changing conditions into account.

Map 4: Open Space in Existing and Future Tidal Inundation Areas



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NOTES:
1. Open spaces obtained from the NJ Geographic Information Network (NJGIN) Open Data portal: https://njgin.nj.gov/
2. Current MHHW area and IRZ produced using NJ Adapt Flood Mapper: https://www.njfloodmapper.org/
3. Salem municipal boundary obtained from New Jersey Geographic Information Network (NJGIN) Open Data portal: https://njgin.nj.gov/
4. Basemap obtained from ESRI basemap services.

Spatial Reference: NAD 1983 2011 StatePlane New Jersey FIPS 2900 Ft US

OPEN SPACE IN EXISTING AND FUTURE TIDAL INUNDATION AREAS

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Ecological Resources

Salem City, NJ has several ecological resources, including wetlands and tree canopy that support local wildlife and provide critical environmental services. These resources play an important role in reducing stormwater runoff, increasing flood storage capacity, and filtering pollutants.

However, the CCRHVA reveals that many of these ecological resources are particularly vulnerable to flooding. Table 6: Mapped Flood Areas and Ecological Resources outlines that in addition to the vulnerability of the open spaces as discussed above, almost all of the tree canopy and wetlands in Salem are currently within a flood hazard area, with 98% of the wetlands located in the FHA or Flood Hazard Area. Additionally, 56% of the tree canopy is within the Current FHA and 90% is in the Climate Adjusted Flood Elevation (CAFE).

Table 6: Mapped Flood Areas and Ecological Resources

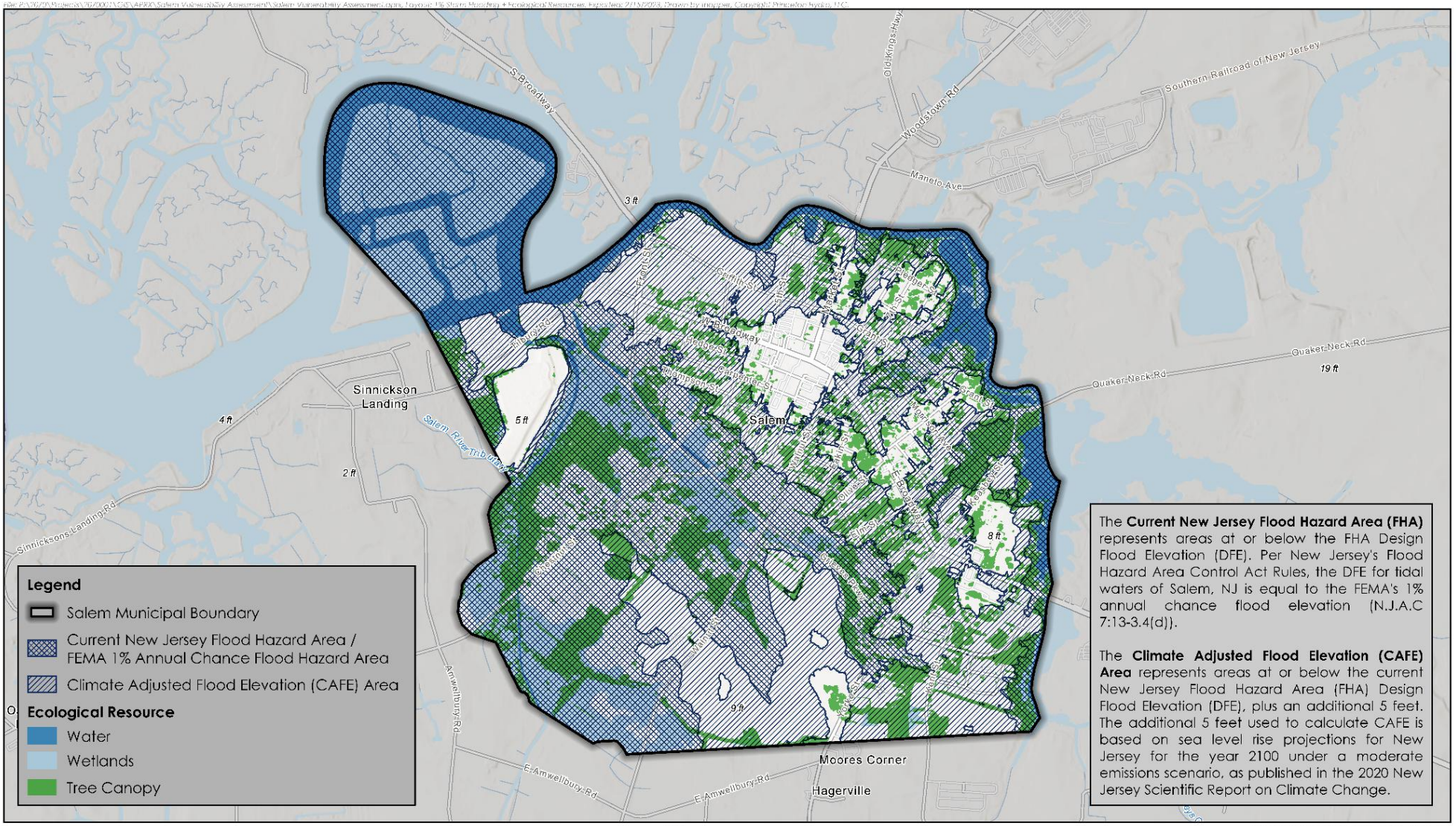
Ecological Resource	% in Current FHA	% in CAFE
Tree Canopy	56%	90%
Wetland	98%	100%

Flooding may cause direct damage to trees by changing soil conditions, interrupting normal oxygen and carbon dioxide exchange between trees and their environment, sedimentation and physical damage.[5] Flood damage to trees can have long term risks, making them more susceptible to damage from insects and diseases. The relationship between floods and wetlands is complex – floods can support wetlands by depositing nutrients, but can also damage vegetation and cause erosion.

What is clear is that both trees and wetlands provide essential protection to Salem from flooding. These resources will need to be closely monitored to ensure their health and ensure that they can continue to serve these functions.

[5] Baughman, Mel.. "How to Manage Flood Damage to Trees." University of Minnesota Extension, 2024. https://extension.umn.edu/planting-and-growing-guides/how-manage-flood-damage-trees

Map 5: 1% Storm Flood Areas and Ecological Resources



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Spatial Reference: NAD 1983 2011 StatePlane New Jersey FIPS 2900 ft US

ECOLOGICAL RESOURCES IN EXISTING AND FUTURE 1% STORM FLOODPLAINS

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Lower-elevation areas are more prone to flooding from both tides and storm events. These areas often lie close to water bodies, which naturally receive overflow during high tides or storm surges. Areas close to tidal water bodies are directly affected by regular tides, making them susceptible to tidal flooding that can intensify with sea-level rise. The MHHW and Inundation Risk Zone (IRZ) in Map 5: 1% Storm Flood Areas and Ecological Resources focus on these tidal areas, showing locations at risk of routine inundation under current and projected higher sea levels.

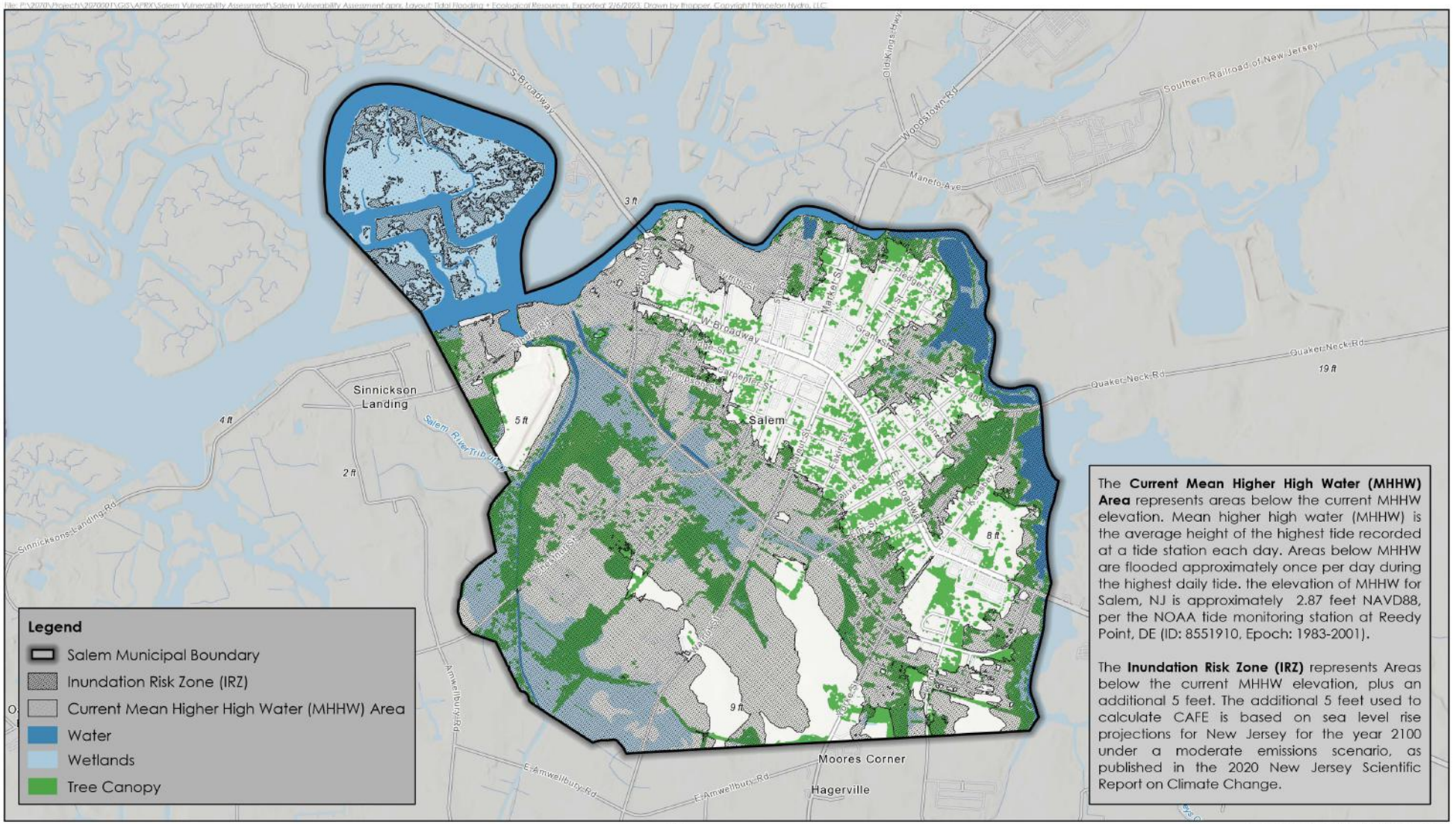
Table 7: Mapped Flood Areas and Ecological Resources

Ecological Resource	Acres	% in 1ft SLR Impact	% in 2ft SLR Impact	% in 3ft SLR Impact	% in 4ft SLR Impact	% in 5ft SLR Impact
Tree Canopy	64	26.6%	43.8%	59.4%	59.4%	75.0%
Wetland	166	27.1%	49.4%	72.3%	84.3%	95.2%

If these ecological resources, particularly wetlands, are damaged or inundated by flooding, it could significantly diminish their effectiveness in protecting the surrounding community and environment. While wetlands play a crucial role in storing floodwater and filtering pollutants, their capacity to mitigate flooding is compromised when they are overwhelmed with water. In Salem, where almost 100% of the wetlands are within the Inundation Risk Zone (IRZ), this is a critical concern. These wetlands provide an essential layer of flood defense, but their protective nature is reduced during extreme inundation. Therefore, while they offer some level of protection even when partially flooded, their ability to absorb and store additional floodwater is significantly limited under such conditions.

The ecological integrity of Salem City, NJ, is closely tied to its wetlands and tree canopies, especially considering that a significant portion of the protected open space is also within flood hazard areas. Flooding poses a dual threat to these crucial natural resources. First, inundation of wetlands compromises their ability to absorb and store floodwaters, filter pollutants, and provide wildlife habitat. Second, the loss of tree canopy due to floods leads to increased erosion, further loss of habitat, deterioration in air quality, and heightened greenhouse gas emissions. These intertwined impacts highlight the necessity of protecting and conservatively managing these ecological assets. Doing so is essential not only for mitigating the negative effects of future flooding events but also for maintaining a healthy and balanced ecosystem. Therefore, a holistic approach that encompasses both wetlands and tree canopies is imperative in the city's environmental planning and flood management strategies. These vulnerabilities are shown in Table 7: Mapped Flood Areas and Ecological Resources, above, and Map 6: Ecological Resources in Existing and Future Tidal Inundation Area, below.

Map 6: Ecological Resources in Existing and Future Tidal Inundation Area



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NOTES:
1. Water and wetlands (2013 Land Use/Land Cover) obtained from the NJDEP GIS website: www.state.nj.us/dep/gis/
2. Tree canopy is approximate. Canopy areas delineated through a Normalized Difference Vegetation Index (NDVI) using 2019 near-infrared imagery obtained from the National Agriculture Imagery Program (NAIP).
3. Current MHHW area and IRZ produced using NJ Adapt Flood Mapper: https://www.njfloodmapper.org/
4. Salem municipal boundary obtained from New Jersey Geographic Information Network (NJGIN) Open Data portal: https://njgin.nj.gov/
5. Basemap obtained from ESRI basemap services.

Spatial Reference: NAD 1983 2011 StatePlane New Jersey FIPS 2900 Ft US

0 700 1,400 Feet

ECOLOGICAL RESOURCES IN EXISTING AND FUTURE TIDAL INUNDATION AREAS

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Vulnerable Populations and Overburdened Communities

The CCRHVA analyzed the potential impact of flood risks on vulnerable populations and communities, especially those consisting of low-income households and people with disabilities. To estimate the demographic of different at-risk categories within these communities, the assessment relied on census data. This included people under the age of 17, elderly people, people with disabilities, households with no vehicle access, and people living below the poverty limit. Based on the findings that were revealed from the analysis of 2018 US Census data, it was determined that vulnerable populations in these areas include people who are older than 65, younger than 17, have a disability, live below the poverty limit, and households without vehicle access.

The largest flood-vulnerable population in Salem NJ are people living below the poverty limit (41% of the city's population), followed by people aged 17 or younger (32% of the city's population), people with a disability (22% of the city's population), households with no vehicle available (22% of the city's households), and people aged 65 or older (15% of the city's population). Map 7: 1% Storm Flood Areas and Vulnerable Populations depicts the areas of the city with Vulnerable Populations by census tract and the flood areas.

The vulnerability of residents in subsidized or supportive housing to flood risks is a matter of significant concern, outlined in Table 8: Subsidized Housing Assets in Flood Risk Areas. The Salem Group Home, located at 74 W. Broadway, exemplifies this issue. Although it's a private nursing home situated outside the current FEMA 1% Annual Chance Flood Hazard Area, it falls within the Climate Adjusted Flood (CAFE) Zone, suggesting a potential future risk of flooding due to climate change. This is particularly troubling as nursing homes cater to some of the most vulnerable members of society, including the elderly and those with special care needs, who may face significant challenges during evacuation or in accessing emergency services during a flood.

Similarly, Broadway Towers at 205 7th Street, which provides public age-restricted housing, and Salem Senior Village at 2 Hires Ave., a private age-restricted housing facility, represent segments of the population that are especially vulnerable due to age and possibly limited mobility, even though these facilities are currently not within identified flood zones. This does not negate the potential future risk as climate patterns shift, and the ability of residents to access critical services is compromised when other areas of the city are impacted by flooding.

Moreover, properties managed by the Salem Housing Authority, such as Westside Court and Anderson Drive, as well as Harvest Point and Carpenter Street HMFA Housing, show varying degrees of flood risk. Westside Court and Anderson Drive lie within both the Current FEMA Flood Hazard Area and the CAFE Zone. Harvest Point and Carpenter Street, while not in the risk zone based on current conditions, are within the CAFE Zone, indicating a future risk.

Residents of subsidized or supportive housing often have fewer resources to recover from the impacts of flooding. They may face financial constraints, limited access to alternative housing, and a lack of insurance coverage. Additionally, these communities often lack the infrastructure and support systems to effectively respond to and recover from such disasters. As a result, floods can exacerbate existing inequalities and lead to longer-term displacement and hardship for these vulnerable groups. This scenario necessitates targeted planning and intervention strategies to bolster the resilience of these communities against flood risks.

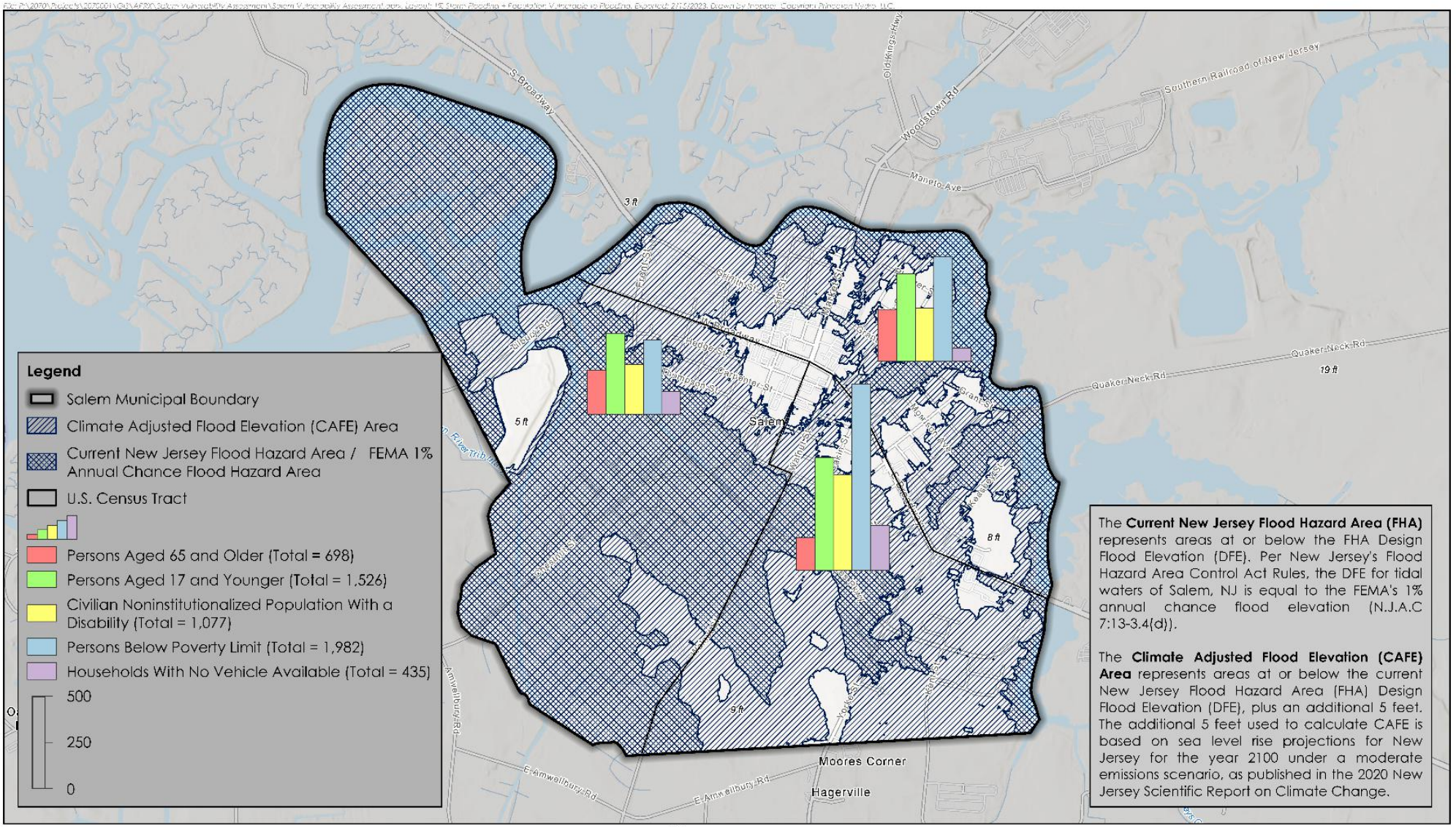
Given the vulnerability of identified populations to climate change in these areas, the findings highlight the need for tailored strategies, policies, and plans to reduce the risks faced by these vulnerable populations

from climate change-induced disasters. Prioritizing the needs of these vulnerable groups in disaster planning and response efforts can potentially mitigate the potential negative impacts of climate change.

Table 8: Subsidized Housing Assets in Flood Risk Areas

Facility	Type	FEMA 1% Annual Chance Flood Hazard Area (Current FHA)	Climate Adjusted Flood (CAFE) Zone
Salem Group Home (74 W. Broadway)	Private Nursing Home	No	Yes
Broadway Towers (205 7th Street)	Public Age-restricted Housing	No	Yes
Salem Senior Village (2 Hires Ave.)	Private Age restricted Housing	No	No
Westside Court	Salem Housing Authority	Yes	Yes
Anderson Drive	Housing	Yes	Yes
Harvest Point	Housing	No	Yes
Carpenter Street	HMFA Housing	No	Yes

Map 7: 1% Storm Flood Areas and Vulnerable Populations



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NOTES:
1. Vulnerable population data obtained from the Centers for Disease Control (2018), Social Vulnerability Index (SVI) for 2018. Population estimates are based on the U.S. Census, American Community Survey (ACS), 2014-2018.
2. FEMA 1% Annual Chance Flood Hazard Area, effective 6/7/2016, obtained from FEMA Flood Map Service Center: https://msc.fema.gov/portal/
3. CAFE was produced using NJ Adopt Flood Modeler: https://www.njfloodmapper.org/
4. Salem municipal boundary obtained from New Jersey Geographic Information Network (NJGIN) Open Data portal: https://njgin.nj.gov/
5. Basemap obtained from ESRI basemap services.

Spatial Reference: NAD 1983 2011 StatePlane New Jersey FIPS 2900 (US Feet)

0 700 1,400 Feet

VULNERABLE POPULATIONS AND EXISTING AND FUTURE 1% STORM FLOODPLAINS

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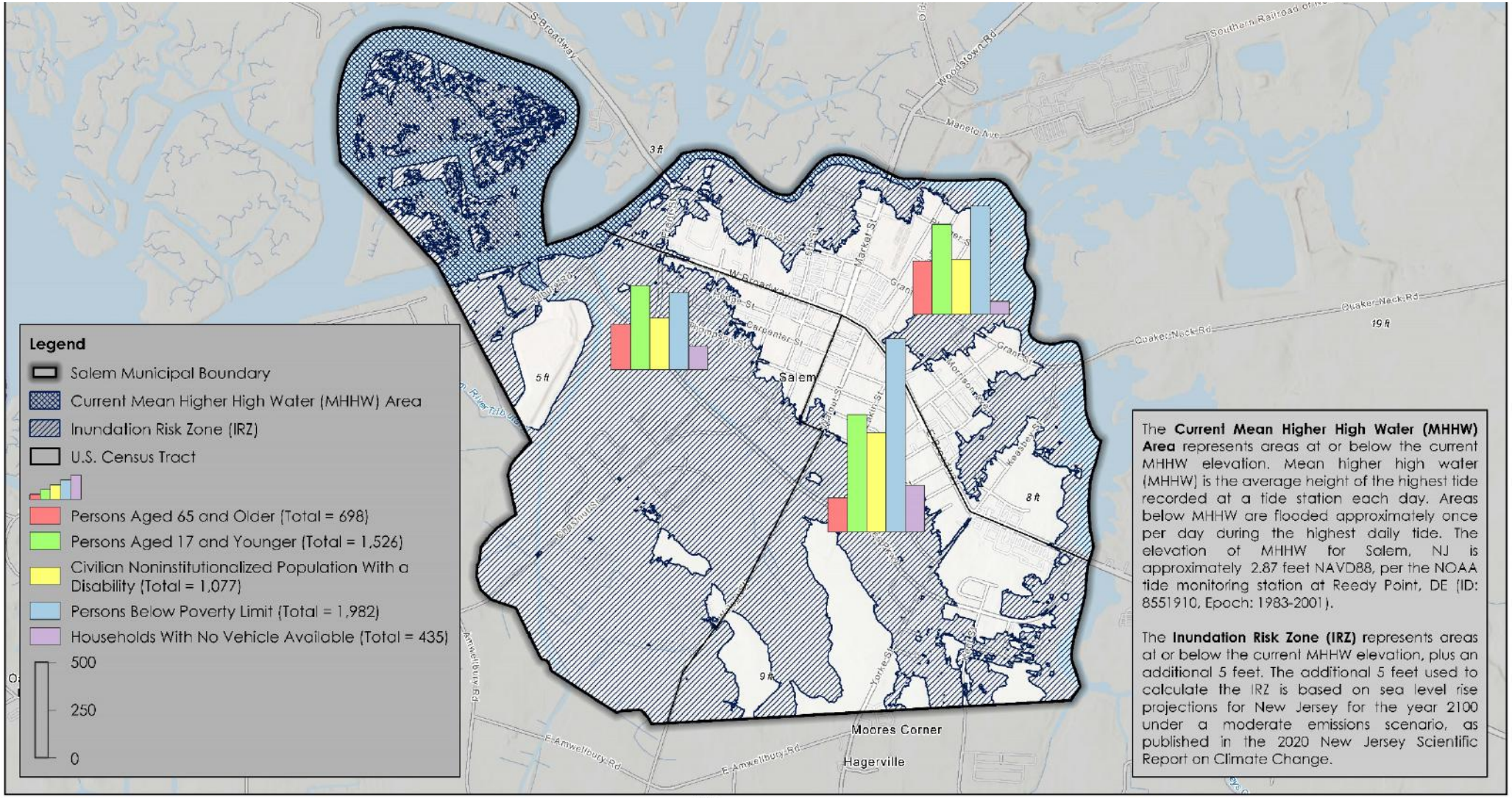
Subsidized housing sites vulnerable to inundation from SLR are depicted on Table 9 and Map 8. Two properties, Westside Court and Harvest Point, are especially concerning, with potential inundation occurring at only one foot of Sea Level Rise. The long-term viability of these sites will need to be carefully considered as the city plans for the housing needs of its residents.

Table 9: Subsidized Housing Assets in Flood Risk Areas

Facility	Type	1ft SLR Impact	2ft SLR Impact	3ft SLR Impact	4ft SLR Impact	5ft SLR Impact
Salem Group Home (74 W. Broadway)	Private Nursing Home	No	No	No	No	Yes
Broadway Towers (205 7th Street)	Public Age-restricted Housing	No	No	No	No	No
Salem Senior Village (2 Hires Ave.)	Private Age restricted Housing	No	No	No	No	No
Westside Court	Salem Housing Authority	Yes	Yes	Yes	Yes	Yes
Anderson Drive	Housing	No	No	No	Yes	Yes
Harvest Point	Housing	Yes	Yes	Yes	Yes	Yes
Carpenter Street	HMFA Housing	No	No	No	No	No

Map 8: Vulnerable Populations in Existing and Future Tidal Inundation Areas



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NOTES:
1. Overburdened communities under the NJ Environmental Justice Law obtained from the NJDEP GIS website: www.state.nj.us/dep/gis/
2. Current MHHW area and IRZ produced using NJ Adapt Flood Mapper: https://www.njfloodmapper.org/
3. Salem municipal boundary obtained from New Jersey Geographic Information Network (NJGIN) Open Data portal: https://njgin.nj.gov/
4. Basemap obtained from ESRI basemap services.

Spatial Reference: NAD 1983 2011 StatePlane New Jersey FIPS 2900 Ft US

VULNERABLE POPULATIONS AND EXISTING AND FUTURE TIDAL INUNDATION AREAS

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Cultural Resources

Historic resources are an important part of Salem's cultural identity, so considering how flood risk may impact the city's historic resources such as historic buildings and districts is a component of the CCRHVA. To do this, we evaluated the City's historic districts. Historic properties are often tied to a larger historic district, though some properties are stand-alone. Many of Salem's historic districts and buildings are located within flood hazard areas, with some already experiencing flooding during intense rainfall events, as shown in Maps 9, below.

Image 4: Home in Hedge--Carpenter--Thompson Historic District , via Wikimedia Commons

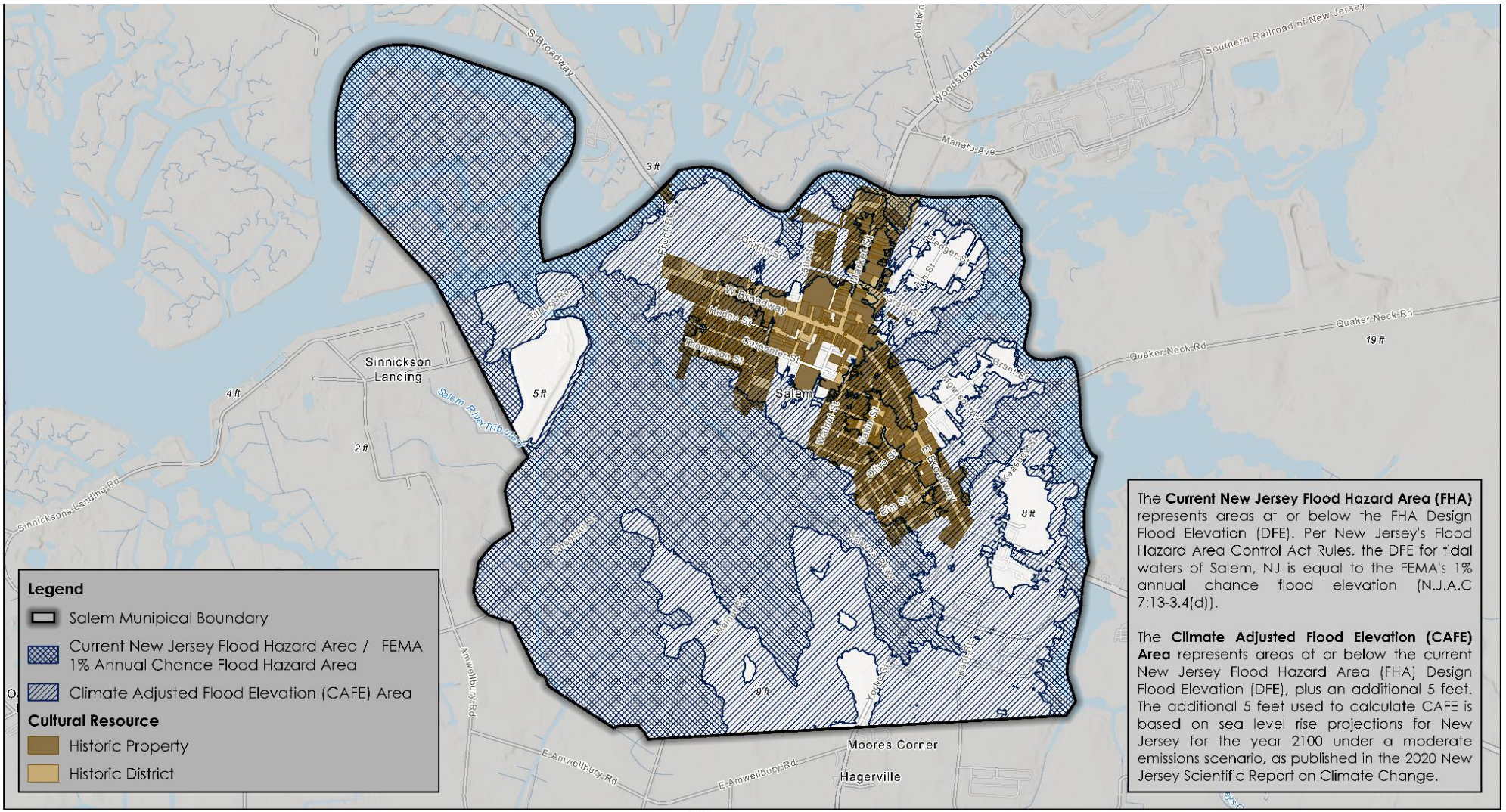
As depicted in Table 6: Summary of Historic Properties and Districts, the CCRHVA reveals that the Hedge-Carpenter-Thompson historic district is the most significantly impacted district by flooding, with 28% of the properties within the current FHA and 100% within CAFE. The Salem working-class and Broadway districts were also significantly impacted, with 90% and 68% of properties within the CAFE area, respectively. The data shows that nearly all the historic districts and stand-alone properties were within a potential flood hazard area. This stresses the significance of preserving these historic buildings, while still considering flood risk management strategies, such as finding ways to redirect stormwater.

Salem's historic districts are at risk from the effects of climate change due to their building materials, specialized maintenance needs, and location in flood-prone areas. Effective preservation of these historic sites while considering the impacts of climate change presents a challenge and an opportunity to promote long-term sustainability and resilience.

Table 10: Summary of Historic Properties and Districts, % of district in each area

Historic District	Total # of Historic Properties	% in Current FHA	% in CAFE
Salem Working Class	279	6%	90%
Broadway	228	6%	68%
Hedge-Carpenter-Thompson	201	28%	100%
Market Street	67	7%	73%
Walnut Street Streetscape	54	2%	98%
Oak Street Streetscape	45	9%	89%
5th and Ward Streetscape	26	0%	100%
Chestnut Street Streetscape	10	0%	0%
Alloway Creek Rural	3	33%	67%
Stand-Alone Historic Properties	11	36%	82%
Salem-Wide Total	924	11%	85%

Map 9: Cultural Resources in Existing and Future 1% Storm Floodplain



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NOTES:
1. Historic properties and districts obtained from NJDEP GIS website: www.state.nj.us/dep/gis/.
2. FEMA 1% Annual Chance Flood Hazard Area, effective 06/16/2016, obtained from FEMA Flood Map Service Center: https://msc.fema.gov/portal/
3. CAFE area produced using NJ Adapt Flood Mapper: https://www.njfloodmapper.org/
4. Salem municipal boundary obtained from New Jersey Geographic Information Network (NJGIN) Open Data portal: https://njgin.nj.gov/
5. Basemap obtained from ESRI base map services.

Spatial Reference: NAD 1983 2011 StatePlane New Jersey FIPS 2900 Ft US

CULTURAL RESOURCES IN EXISTING AND FUTURE 1% STORM FLOODPLAINS

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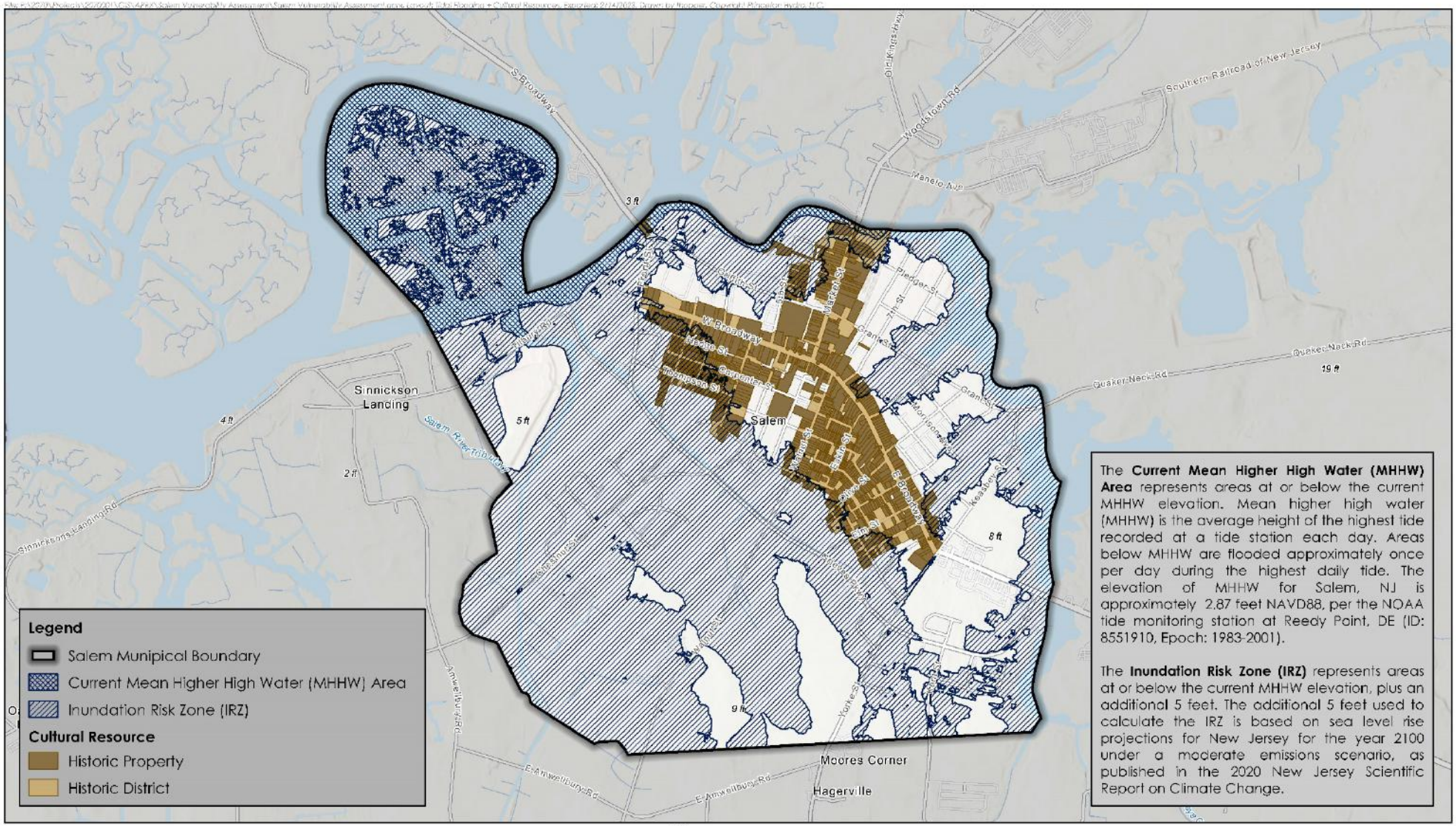
All of Salem's historic districts have at least some exposure to inundation from SLR, with most starting to have at least a few properties affected with just one foot of SLR. The percentage of historic properties that are vulnerable steadily rises as you approach five feet of sea level rise, with Walnut Street, Oak Street, and Alloway Creek districts having over 50% of properties vulnerable at that level of SLR. Inundation means that it will be very difficult to maintain the integrity of these neighborhoods as a whole - even in the lowest level scenarios, these neighborhoods will have properties that will become inundated and cannot be maintained as is in their current location.

Table 11: Summary of Historic Properties and Districts, % of district in each area

Historic District	Total # of Historic Properties	1ft SLR Impact	2ft SLR Impact	3ft SLR Impact	4ft SLR Impact	5ft SLR Impact
Salem Working Class	279	3%	6%	16%	26%	32%
Broadway	228	1%	4%	7%	12%	21%
Hedge-Carpenter-Thompson	201	5%	12%	16%	28%	41%
Market Street	67	3%	6%	9%	13%	28%
Walnut Street Streetscape	54	6%	9%	20%	44%	61%
Oak Street Streetscape	45	7%	13%	20%	38%	56%
5th and Ward Streetscape	26	0%	8%	19%	27%	35%
Chestnut Street Streetscape	10	0%	0%	10%	20%	30%
Alloway Creek Rural	3	67%	67%	100%	100%	100%
Stand-Alone Historic Properties	11	27%	36%	45%	64%	73%
Salem-Wide Total	924	4%	8%	15%	24%	34%

Map 10: Cultural Resources in Existing and Future Tidal Inundation Areas



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NOTES:
1. Historic properties and parcels obtained from NJDEP GIS website: www.state.nj.us/dep/gis/.
2. FEMA 1% Annual Chance Flood Hazard Area, effective 6/16/2016, obtained from FEMA Flood Map Service Center: https://msc.fema.gov/portal/
3. Current MHHW area and IRZ produced using NJ Adapt Floods Mapper: https://www.njfloodmapper.org/
4. Salem municipal boundary obtained from New Jersey Geographic Information Network (NJGIN) Open Data portal: https://njgin.nj.gov/
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Spatial References: NAD 1983 2011 StatePlane New Jersey FIPS 2900 Ft US

CULTURAL RESOURCES IN EXISTING AND FUTURE TIDAL INUNDATION AREAS

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Community Assets

Community assets such as schools, child care centers, places of worship, municipal offices, and public parks contribute to the day-to-day operation and social fabric of a city. These assets play a significant role in supporting the economic, social, and cultural well-being of Salem. For example, schools and childcare centers provide important educational and childcare services that enable parents to work and support the local economy. Places of worship can provide a sense of community and provide emotional and spiritual support to residents. Healthcare facilities help promote physical well-being and provide essential services to support healthy lifestyles. Municipal offices provide critical services such as waste management and infrastructure development that contribute to the efficient functioning of the city.

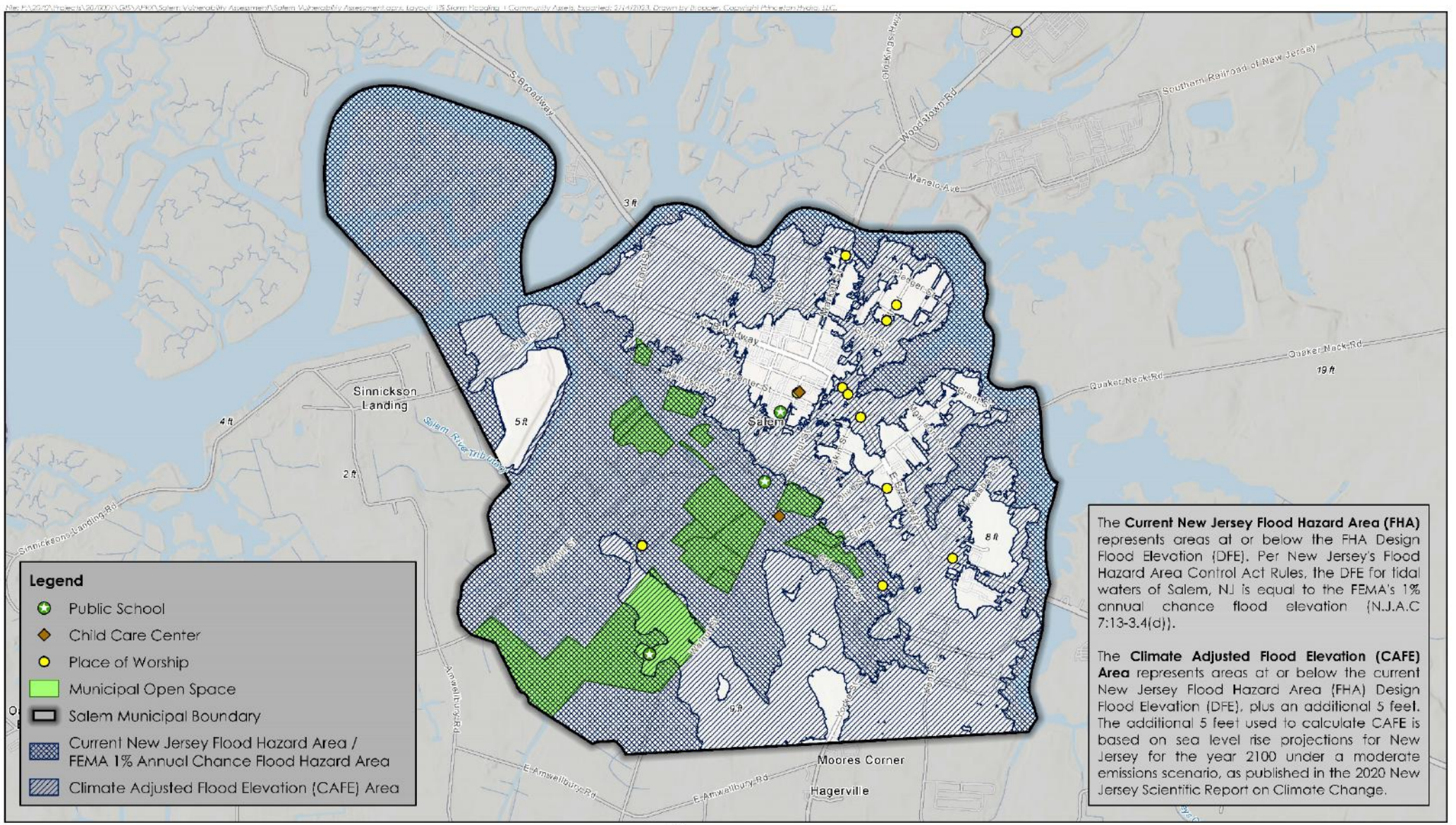
The CCRHVA identified several sites in Salem that are at risk of flooding, as shown in Table 12: Summary of Community Assets, and Map 11: 1% Storm Flood Areas and Community Assets for more detail. The United Way of Salem County Early Learning Academy is notable since the center provides childcare services. Climate-change induced flooding could potentially disrupt childcare services, and this can have severe impacts on working parents who depend on daycare for their children while they work.

Impacts of climate change on the broader vulnerable populations such as low-income residents and households living below the poverty limit could deprive individuals and communities of their social support, which can limit their ability to bounce back from the effects of flooding and other climate-induced events.

Table 12: Summary of Community Assets

Community Assets	Type	FEMA 1% Annual Chance Flood Hazard Area (Current FHA)	Climate Adjusted Flood (CAFE) Zone
Harvest-Time Worship Center	Place of Worship	Yes	Yes
Outreach Center of Faith Community Church	Place of Worship	Yes	Yes
First Baptist Church	Place of Worship	No	Yes
Memorial Baptist Church	Place of Worship	No	Yes
Philadelphia Yearly Meeting of Friends	Place of Worship	No	Yes
New Life Destiny Fellowship	Place of Worship	No	Yes
Mt Zion Baptist Church	Place of Worship	No	Yes
Spirit Life Fellowship	Place of Worship	No	Yes
Elyon Bible Church Inc	Place of Worship	No	Yes
Faith Life Church Inc	Place of Worship	No	Yes
Victory Fellowship Ministries Inc	Place of Worship	No	Yes
Full Gospel of Christ Fellowship Inc	Place of Worship	No	Yes
Living Grace Bible Church Inc	Place of Worship	No	Yes
United Way of Salem County Early Learning Academy	Child Care Center	Yes	Yes
Salem High School	Public School	Yes	Yes
John Fenwick Academy	Public School	Yes	Yes

Map 11: 1% Storm Flood Areas and Community Assets



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NOTES:
1. Community assets obtained from Home and Infrastructure Foundation-Level Data (HIFLD) Geoplatform: https://hifld-geoplatform.opendata.arcgis.com/
2. Open spaces obtained from the NJ Geographic Information Network (NJGIN) Open Data portal: https://njgin.nj.gov/.
3. FEMA 1% Annual Chance Flood Hazard Area, effective 06/15/2016, obtained from FEMA Flood Map Service Center: https://msc.fema.gov/portal
4. CAFE area produced using 4) Adapt Flood Mapper: https://www.floodmapper.org/
5. Salem municipal boundary obtained from New Jersey Geographic Information Network (NJGIN) Open Data portal: https://njgin.nj.gov/
6. Basemap obtained from ESRI basemap services.

Spatial Reference: NAD 1983 2011 StatePlane New Jersey FIPS 2900 FT US

COMMUNITY ASSETS IN EXISTING AND FUTURE 1% STORM FLOODPLAINS

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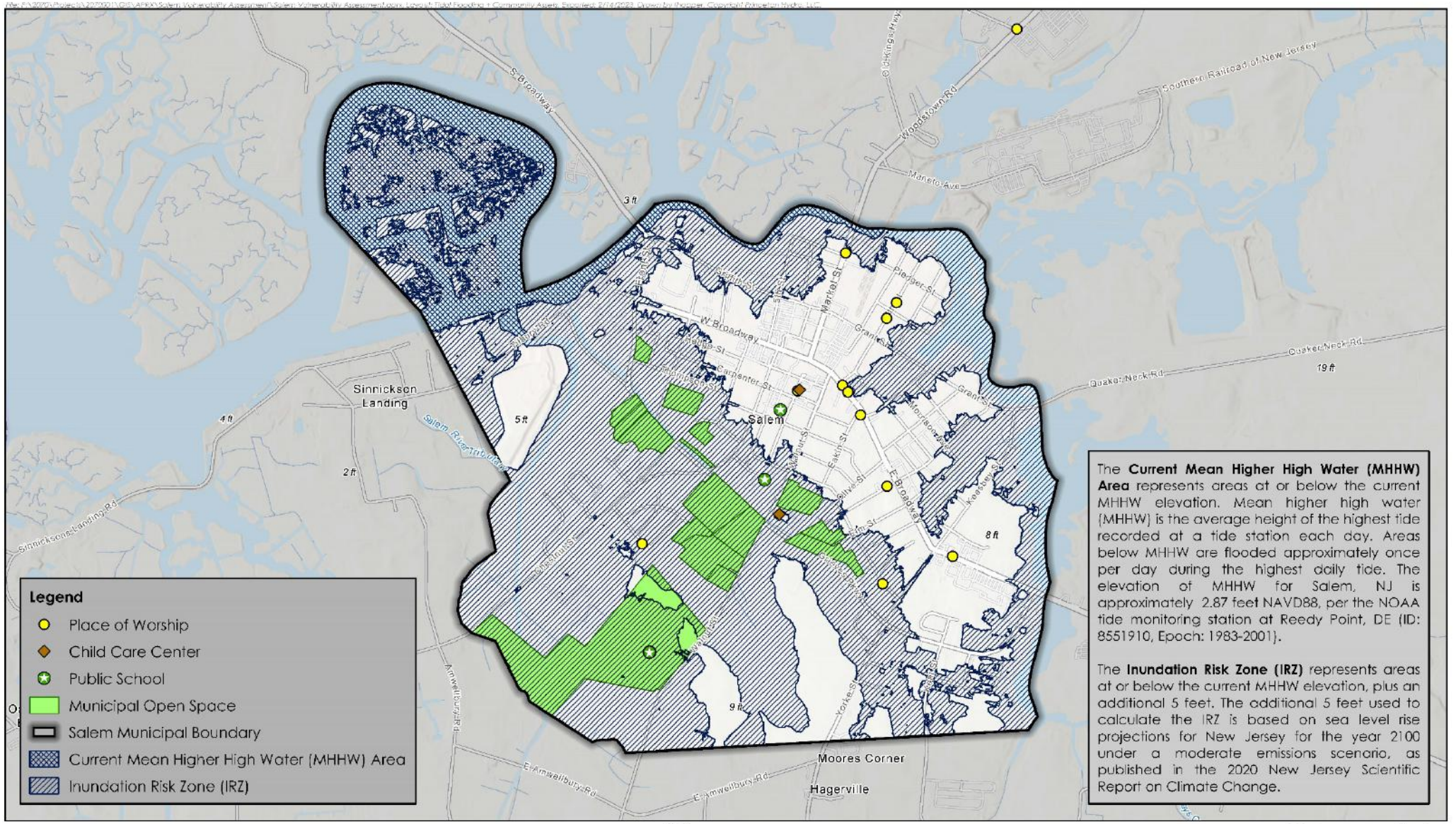
BROWNFIELD REDEVELOPMENT SOLUTIONS, INC.
CITY OF SALEM, SALEM COUNTY, NEW JERSEY

The potential susceptibility of community assets to inundation as a result of sea level rise can be seen in Table 13 and Map 12: Community Assets in existing and Future Tidal Inundation Areas. The vulnerability of the United Way Early Learning Academy and the John Fenwick Academy at only one foot of SLR, along with Salem High School at two feet of SLR, are particularly concerning. This is a case where different planning systems need to interact; the Salem City School District will need to understand these threats as part of its long-range facilities plan.

Table 13: Summary of Community Assets

Community Assets	Type	1ft SLR Impact	2ft SLR Impact	3ft SLR Impact	4ft SLR Impact	5ft SLR Impact
Harvest-Time Worship Center	Place of Worship	Yes	Yes	Yes	Yes	Yes
Outreach Center of Faith Community Church	Place of Worship	Yes	Yes	Yes	Yes	Yes
First Baptist Church	Place of Worship	No	No	No	Yes	Yes
Memorial Baptist Church	Place of Worship	No	No	No	No	Yes
Philadelphia Yearly Meeting of Friends	Place of Worship	No	No	No	No	No
New Life Destiny Fellowship	Place of Worship	No	No	No	No	No
Mt Zion Baptist Church	Place of Worship	No	No	No	No	No
Spirit Life Fellowship	Place of Worship	No	No	No	No	No
Elyon Bible Church Inc	Place of Worship	No	No	No	No	No
Faith Life Church Inc	Place of Worship	No	No	No	No	No
Victory Fellowship Ministries Inc	Place of Worship	No	No	No	No	No
Full Gospel of Christ Fellowship Inc	Place of Worship	No	No	No	No	No
Living Grace Bible Church Inc	Place of Worship	No	No	No	No	Yes
United Way of Salem County Early Learning Academy	Child Care Center	Yes	Yes	Yes	Yes	Yes
Salem High School	Public School	No	Yes	Yes	Yes	Yes
John Fenwick Academy	Public School	Yes	Yes	Yes	Yes	Yes
Salem Middle School	Public School	No	No	No	No	No

Map 12: Community Assets in existing and Future Tidal Inundation Areas



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NOTES:
1. Community assets obtained from Homeland Infrastructure Foundation-Level Data (HIFLD): GeoplatformsHifldopendata.esgis.com/
2. Open spaces obtained from the N. Geographic Information Network (NJGIN) Open Data portal: https://njgin.nj.gov/.
3. Current MHHW area and IRZ produced using NJ Adapt Flood Mapper: https://www.njfloodmapper.org/
4. Salem municipal boundary obtained from New Jersey Geographic Information Network (NJGIN) Open Data portal: https://njgin.nj.gov/
5. Basemap obtained from ESRI basemap services.

Spatial Reference: NAD 1983 2011 StatePlane New Jersey FIPS 2900 Ft US

0 700 1,400 Feet

COMMUNITY ASSETS IN EXISTING AND FUTURE TIDAL INUNDATION AREAS

RESILIENT NJ VULNERABILITY ASSESSMENT
BROWNFIELD REDEVELOPMENT SOLUTIONS, INC.
CITY OF SALEM, SALEM COUNTY, NEW JERSEY

Critical Facilities

The CCRHVA evaluated critical facilities and infrastructure that are crucial to the welfare and health of the population, such as hospitals, public safety facilities, transportation infrastructure, water supply and treatment, and emergency shelters, including cooling and evacuation centers. These critical facilities are needed to address the needs of the community daily but especially in a post disaster scenario to provide for basic needs such as buying food and repairing homes. In underserved communities, critical facility failure can increase the risk of illness, injury, and death due to fewer alternative resources to draw upon. General facilities or assets include grocery stores, hardware stores, and gas stations. While these were not included on the mapping of community facilities, etc. were not included in Tables 14 and 15 and maps 13 and 14, below, they are also important contributors to the ability of the community to prepare for, and rebound from, climate hazards.

Many of Salem's critical facilities located in areas vulnerable to flooding. Eleven identified facilities are located in the current flood hazard area, with an additional nine facilities located in the climate-adjusted flood elevation area. These are described in Table 14: Summary of Critical Facilities. Notably, all designated hurricane evacuation routes fall within the existing flood hazard area. Emergency operations plans need to be carefully examined to ensure that they will function as intended in the case of a flood given the threats to these facilities.

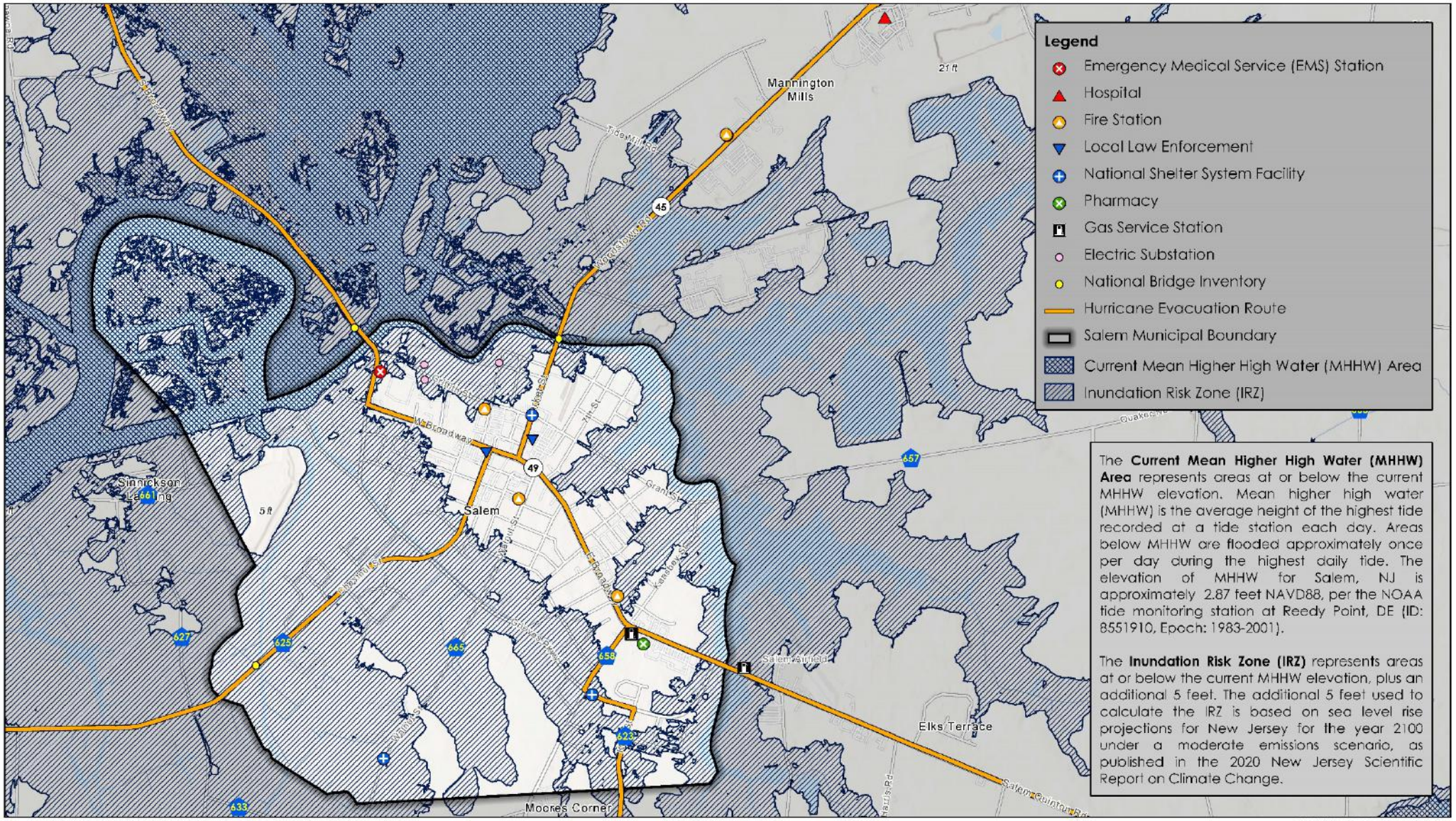
Table 14: Summary of Critical Facilities

Critical Facility	Type	FEMA 1% Annual Chance Flood Hazard Area (Current FHA)	Climate Adjusted Flood (CAFE) Zone
City Hall (17 New Market Street)	Municipal	No	No
Police Station (129 W. Broadway)	Law Enforcement Facilities	No	No
Emergency Operations Center (129 West Broadway)	EOC	No	No
South Jersey Medical Transportation (26 Front Street)	Emergency Medical Service (EMS) Station	No	Yes
Washington Fire Company 3 (374 E. Broadway)	Fire Station	No	Yes
Liberty Fire Company 2 (52 5th Street)	Fire Station	No	Yes
Union Fire Company (21 Walnut Street)	Fire Station	No	No
Fenwick City Ambulance (94 Market Street)	EMS	No	No
Water Treatment Plant (515 Grieves Parkway)	Utilities-water	Yes	Yes
Waste Water Treatment Plant (19 South Front Street)	Utilities-wastewater	Yes	Yes
Wastewater Pump Station #1(415A Magnolia Street)	Utilities-Wastewater	Yes	Yes
Wastewater Pump Station #2 (173 Oak Street)	Utilities-Wastewater	Yes	Yes

Critical Facility	Type	FEMA 1% Annual Chance Flood Hazard Area (Current FHA)	Climate Adjusted Flood (CAFE) Zone
Wastewater Pump #3 (219 Walnut Street)	Utilities-Wastewater	Yes	Yes
Town Bank Stormwater Pump Station (Grieves and Tilbury Road)	Utilities-Stormwater management	Yes	Yes
Chestnut Street bridge over Salem River tributary/ditch	National Bridge Inventory	Yes	Yes
NJ 45 bridge over Fenwick Creek	National Bridge Inventory	Yes	Yes
NJ 49 bridge over Salem River	National Bridge Inventory	Yes	Yes
Board of Education Offices (219 Walnut Street)	Schools	Yes	Yes
Salem High School (219 Walnut Street)	National Shelter System Facility	Yes	Yes
Mount Zion Baptist Church (437 Grieves Parkway)	National Shelter System Facility	No	Yes
Saint John Pentecostal Outreach Church (22 New Market Street)	Private Child care/Food Distribution Center	No	Yes
Family Success Center (14 New Market Street)	Social Service	No	No
Electric Substation	Electric Substation	No	Yes
Electric Substation	Electric Substation	No	Yes
Electric Substation	Electric Substation	No	Yes
Sunoco Gas Station (413 E. Broadway)	Gas Service Station	No	Yes

Map 13: 1% Storm Flood Areas and Critical Facilities

File: P:\2070\Projects\2070001\GIS\APRX\Salem Vulnerability Assessment\Salem Vulnerability Assessment.aprx, Layout: Tidal Flooding + Critical Facilities, Exported: 2/14/2023, Drawn by thopper, Copyright Princeton Hydro, LLC.



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NOTES:
1. Gas service stations obtained from the NJDEP GIS website: www.state.nj.us/dep/gis/
2. Other critical facilities obtained from Homeland Infrastructure Foundation-Level Data (HIFLD) Geoplatforms https://hifld-geoplatform.opendata.arcgis.com/
3. Current MHHW area and IRZ produced using NJ Adapt Flood Mapper https://www.njfloodmapper.org/
4. Salem municipal boundary obtained from New Jersey Geographic Information Network (NJGIN) Open Data portal https://njgin.nj.gov/
5. Basemap obtained from ESRI basemap services.

Spatial Reference: NAD 1983 2011 StatePlane New Jersey FIPS 2900 Ft US

0 800 1,600 Feet

CRITICAL FACILITIES IN EXISTING AND FUTURE TIDAL INUNDATION AREAS

RESILIENT NJ VULNERABILITY ASSESSMENT
BROWNFIELD REDEVELOPMENT SOLUTIONS, INC.
CITY OF SALEM, SALEM COUNTY, NEW JERSEY

It has been identified that Salem City's critical infrastructure and facilities are significantly susceptible to the impacts of Sea-Level rise and inundation. This vulnerability is not a hypothetical scenario but an impending reality, as essential elements of the city's infrastructure, including roadways, electrical substations, and public transportation routes, are at risk. The implications of this are far-reaching and multifaceted, extending beyond the immediate physical damage.

The inundation of roadways, which serve as critical arteries for the city's economic and social functionality, poses a severe threat to the continuity of daily life and commerce. Electrical substations, vital for the maintenance of fundamental urban operations, when compromised, can lead to systemic failures impacting healthcare, safety, and communication networks. Additionally, the disruption of public transportation routes can disproportionately affect the city's most vulnerable populations, limiting access to essential services and employment opportunities.

The repercussions of such flooding extend to the structural integrity of key buildings and facilities, leading to potential long-term detriments to the city's landscape. Furthermore, the financial implications, particularly in terms of insurance liabilities and the associated economic strain on both public and private sectors, cannot be overlooked.

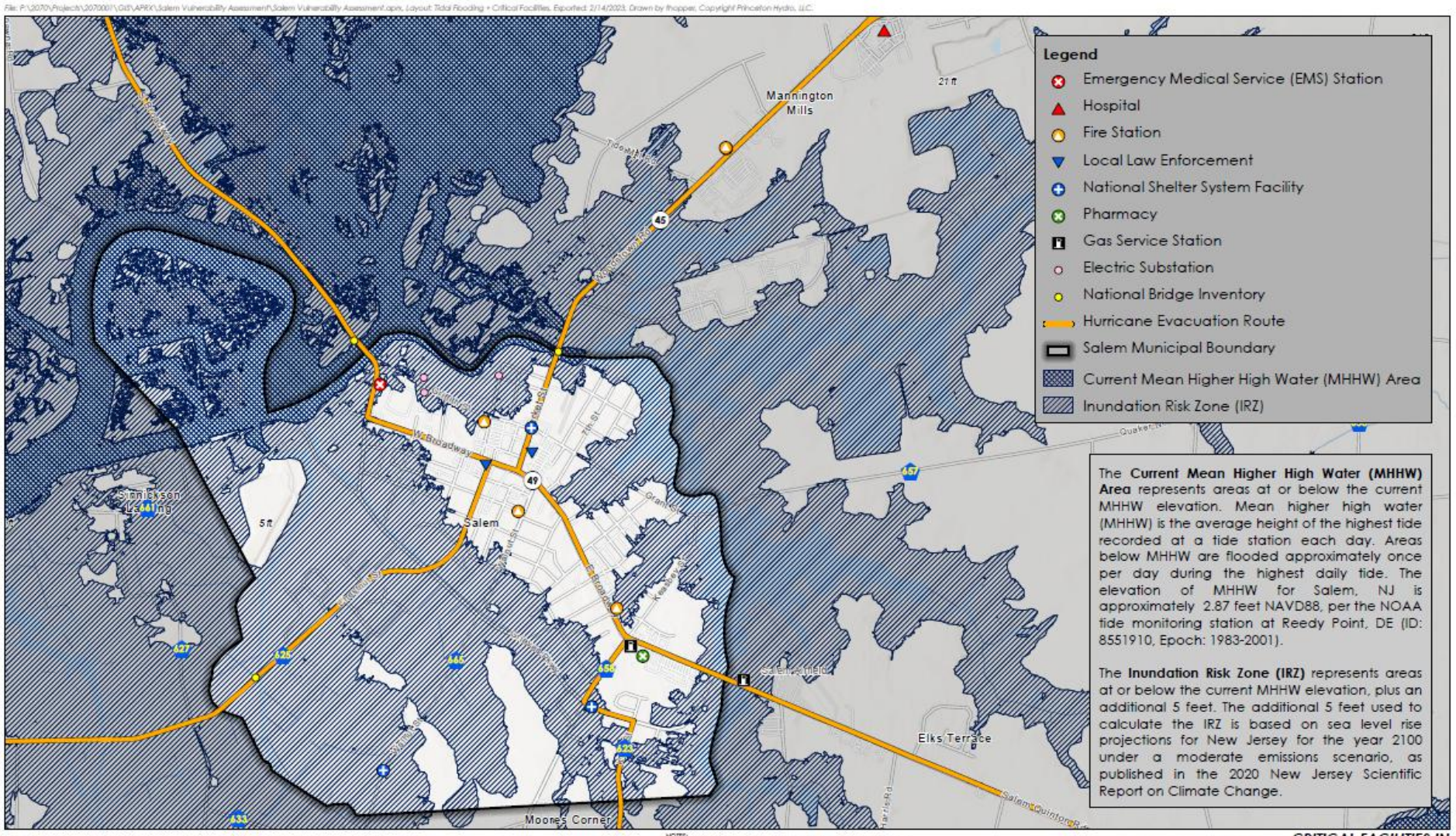
In light of these findings, it is imperative for Salem City to engage in a strategic prioritization of adaptation and resilience measures. The threat of permanent inundation may mean that some of these facilities cannot continue to operate even with hardening or elevation strategies; relocation may be the only solution. Consideration for how the city will function given the threat of inundation to transportation systems is an existential question for the city as it plans for its future.

Table 15: Summary of Critical Facilities

Critical Facility	Type	1ft SLR Impact	2ft SLR Impact	3ft SLR Impact	4ft SLR Impact	5ft SLR Impact
City Hall (17 New Market Street)	Municipal	No	No	No	No	No
Police Station (129 W. Broadway)	Law Enforcement Facilities	No	No	No	No	No
Emergency Operations Center (129 West Broadway)	EOC	No	No	No	No	No
South Jersey Medical Transportation (26 Front Street)	Emergency Medical Service (EMS) Station	No	No	No	Yes	Yes
Washington Fire Company 3 (374 E. Broadway)	Fire Station	No	No	No	No	No
Liberty Fire Company 2 (52 5th Street)	Fire Station	No	No	No	No	No
Union Fire Company (21 Walnut Street)	Fire Station	No	No	No	No	No
Fenwick City Ambulance (94 Market Street)	EMS	No	No	No	No	No
Water Treatment Plant (515 Grieves Parkway)	Utilities-water	No	No	Yes	Yes	Yes

Waste Water Treatment Plant (19 South Front Street)	Utilities- wastewater	Yes	Yes	Yes	Yes	Yes
Wastewater Pump Station #1(415A Magnolia Street)	Utilities- Wastewater	No	No	Yes	Yes	Yes
Wastewater Pump Station #2 (173 Oak Street)	Utilities-Wastewater	No	No	Yes	Yes	Yes
Wastewater Pump #3 (219 Walnut Street)	Utilities-Wastewater	No	No	Yes	Yes	Yes
Town Bank Stormwater Pump Station (Grieves and Tilbury Road)	Utilities-Stormwater management	Yes	Yes	Yes	Yes	Yes
Chestnut Street bridge over Salem River tributary/ditch	National Bridge Inventory	Yes	Yes	Yes	Yes	Yes
NJ 45 bridge over Fenwick Creek	National Bridge Inventory	Yes	Yes	Yes	Yes	Yes
NJ 49 bridge over Salem River	National Bridge Inventory	Yes	Yes	Yes	Yes	Yes
Board of Education Offices (219 Walnut Street)	Schools	No	Yes	Yes	Yes	Yes
Salem High School (219 Walnut Street)	National Shelter System Facility	Yes	Yes	Yes	Yes	Yes
Mount Zion Baptist Church (437 Grieves Parkway)	National Shelter System Facility	No	No	No	No	No
Saint John Pentecostal Outreach Church (22 New Market Street)	Private Child care/Food Distribution Center	No	No	No	No	No
Family Success Center (14 New Market Street)	Social Service	No	No	No	No	No
Electric Substation	Electric Substation	No	No	Yes	Yes	Yes
Electric Substation	Electric Substation	No	No	Yes	Yes	Yes
Electric Substation	Electric Substation	No	No	Yes	Yes	Yes
Sunoco Gas Station (413 E. Broadway)	Gas Service Station	No	No	No	No	No

Map 14: Critical Facilities in Existing and Future Tidal Inundation Areas



B. Temperature

According to the New Jersey Department of Environmental Protection, temperatures in New Jersey have been increasing by an average of 0.4°F per decade since the early 20th century, which has led to more frequent heat waves and increased energy demand for air conditioning. This trend is expected to continue, with temperatures projected to rise by an additional 3.5-5.5°F by mid-century and up to 9°F by the end of the century, depending on future greenhouse gas emissions.

In Salem County, New Jersey, the manifestation of climate change is particularly evident in the increasing frequency and intensity of heat waves, alongside rising temperatures that exceed historical averages. NJ Public Health Adapt tool provides information for County-Wide Heat Wave Duration, heat wave duration is the average length of a heat wave in days. Longer heat waves are projected to occur more frequently in the New Jersey region. The length of a heat wave can affect the severity of health outcomes including dehydration, heat stroke, cardiovascular and respiratory conditions, and kidney disorders. Data from the Northeast Regional Climate Center at Cornell University and projections based on Representative Concentration Pathways (RCPs) illustrate the future climate realities Salem County faces.

Historically, Salem County has experienced an average of 1.2 heat waves per year, with a mean duration of 3.3 days and a maximum heat wave duration of 8.6 days. The threshold temperature for classifying a heat wave in Salem County is identified as 82.3°F. Under moderate (RCP 4.5) and high (RCP 8.5) emissions scenarios, projections indicate a stark increase in both the frequency and duration of heat waves in Salem County as illustrated in Table 16: NJ Public Health Adapt Mean Historical and Projected Heatwaves.

Table 16: NJ Public Health Adapt Mean Historical and Projected Heatwaves
Mean historical and projected heatwave characteristics for Salem County. The threshold temperature for a heatwave in Salem County is 82.3˚F. Projected values are presented with 10th-90th percentile interval in parentheses.

	Baseline	Moderate Emissions (RCP 4.5)		High Emissions (RCP 8.5)	
Years	(1981-2010)	Mid-Century (2036-2065)	Late-Century (2070-2099)	Mid-Century (2036-2065)	Late-Century (2070-2099)
Mean Number of Annual Heat Waves	1.2	6.1 (4.4 - 9.6)	4.8 (3.6 - 7.4)	6 (3.8 - 10.3)	8.4 (5.6 - 13)
Mean Days of Heat Wave Duration	3.3	11.6 (8.3 - 18.4)	8.9 (6.5 - 12.2)	11.7 (7.7 - 17.7)	27.7 (15 - 52.5)
Maximum Days of Heat Wave Duration	8.6	24.5 (16.6 - 39.7)	19.9 (14.1 - 31)	24.5 (16.5 - 37)	51.8 (29.8 - 80.4)

- Mid-Century (2036-2065) Projections:
    - Moderate emissions scenario forecasts an average of 6.1 annual heat waves, with mean durations extending to 11.6 days.
    - High emissions scenario predicts similar trends, with slight variations in frequency and duration.

- Late-Century (2070-2099) Projections:
    - Under a high emissions scenario, the county could experience an average of 8.4 heat waves annually, with durations potentially reaching up to 27.7 days.

The number of days annually with maximum temperatures exceeding 95°F is expected to rise dramatically from a baseline of 2 days to as many as 50 days by 2090 under a high emissions scenario, as depicted in Table 17: NJ Public Health Adapt Projected Heatwaves
This increase signifies a substantial growth in the occurrence of extreme heat conditions.

Table 17: NJ Public Health Adapt Projected Heatwaves

	Baseline	**Moderate Emissions (RCP 4.5) Change from Baseline**			**High Emissions (RCP 8.5) Change from Baseline**		
Years	1981-2010	2030	2060	2090	2030	2060	2090
Days greater than 95˚F	2	+ 6	+ 14	+ 18	+ 6	+ 24	+ 48 - 50
Max Temp July	85	+ 2	+ 4	+ 4	+ 2	+ 6	+ 9
Cooling Degree Days	800	+ 200	+ 400	+ 600	+ 200	+ 800	+ 1,400

The New Jersey Heat Vulnerability index (HVI) was designed by NJ Public Health Adapt to identify and quantify the vulnerability of individuals and communities to extreme heat events. Its primary purpose is to highlight the susceptibility to heat-related health risks, such as dehydration, heatstroke, and exacerbated chronic conditions, which can lead to increased hospitalizations and even fatalities. It was generated using census data, natural and built environment data, summer temperature records, and community health data. The HVI helps identify the regions within New Jersey that may be most at risk from extreme heat today and bear special consideration in planning for future climate change. The HVI shows neighborhoods whose residents are more at risk for dying during and immediately following extreme heat as shown in Table 18: Exposure, Sensitivity, and Adaptive Capacity Scores for HVI in Salem Census Tracts. The scale that measures how different neighborhoods have different risks of heat-related illness or death. Neighborhoods are scored from 1 (lowest risk) to 5 (highest risk). A score of 5 means the neighborhood has the highest heat vulnerability.

The data outlines the vulnerability of three separate census tracts that make up Salem City to the effects of extreme heat by evaluating their exposure, sensitivity, and adaptive capacity. The indicators suggest high vulnerability across all tracts with subtle differences in their capacities to cope with and recover from heat events.

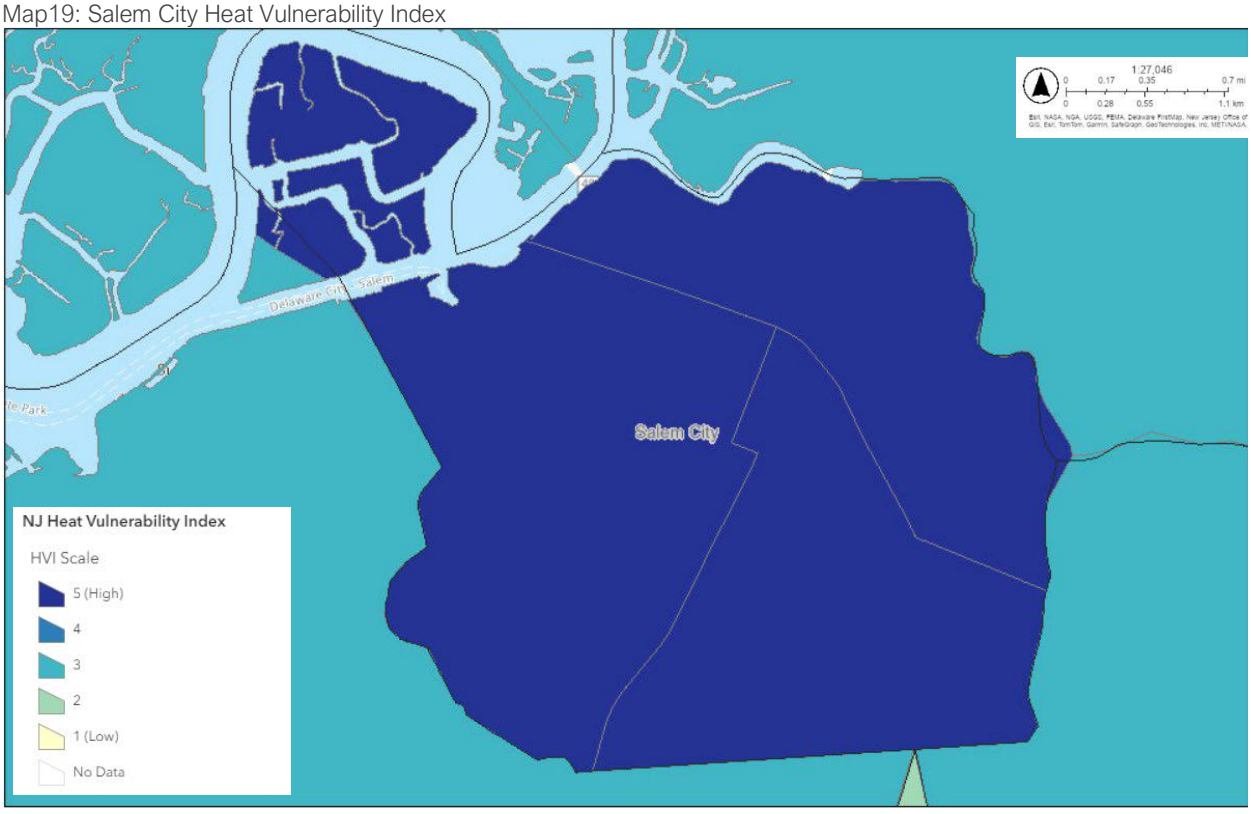
Table 18: Exposure, Sensitivity, and Adaptive Capacity Scores for HVI in Salem Census Tracts

Census Tract	Exposure Score	Sensitivity Score	Adaptive Capacity Score	HVI Scale	HVI Category	Key Variables Impacting Scores
220	High (4/5)	Very High (5/5)	Moderate (3/5)	5	High	- Impervious surface to canopy ratio - PM2.5 concentration - Prevalence of asthma, diabetes, CHD - Percent living alone
219	High (4/5)	Very High (5/5)	Low (3/5)	5	High	- Ozone exceedance days - Summer temperature normal - Percent with disability - Percent aged above 65
221	High (4/5)	Very High (5/5)	Moderate (4/5)	5	High	- Percent below poverty line - Percent unemployed - Asthma prevalence - Homes built before 1960

Note: The "Key Variables Impacting Scores" column lists a selection of variables that contribute to the overall scores for each category, not an exhaustive list. Each variable has its own individual score which contributes to the overall score for Exposure, Sensitivity, and Adaptive Capacity. The HVI Scale is consistent across all tracts, indicating a high vulnerability (5 out of 5), with "High" as the HVI Category.

Salem's extreme vulnerability to heat is also depicted in Map 15: Salem City Heat Vulnerability Index.

Map19: Salem City Heat Vulnerability Index



The Urban Heat Island (UHI) effect is a phenomenon where the temperature in urban areas is noticeably warmer than in surrounding rural areas due to the built environment's characteristics. Salem is prone to the urban heat island effect, where the temperature of the city is a few degrees more than the surrounding countryside.

The built environment and human activities contribute to the urban heat island effect. For instance, urban areas usually have abundant buildings, roads, and pavements that absorb and radiate heat, increasing the overall temperature of the area. The city's height compared to the countryside also influences the amount of heat absorbed and retained by buildings. Taller buildings in cities have more surface area exposed to sunlight compared to lower structures in rural areas, additionally, materials like concrete and asphalt used in taller buildings are efficient at absorbing and retaining heat. The height and density of buildings in urban areas can significantly reduce airflow. The activities within the urban area, such as industrial activities, transportation, and energy consumption, also contribute to the heat produced.

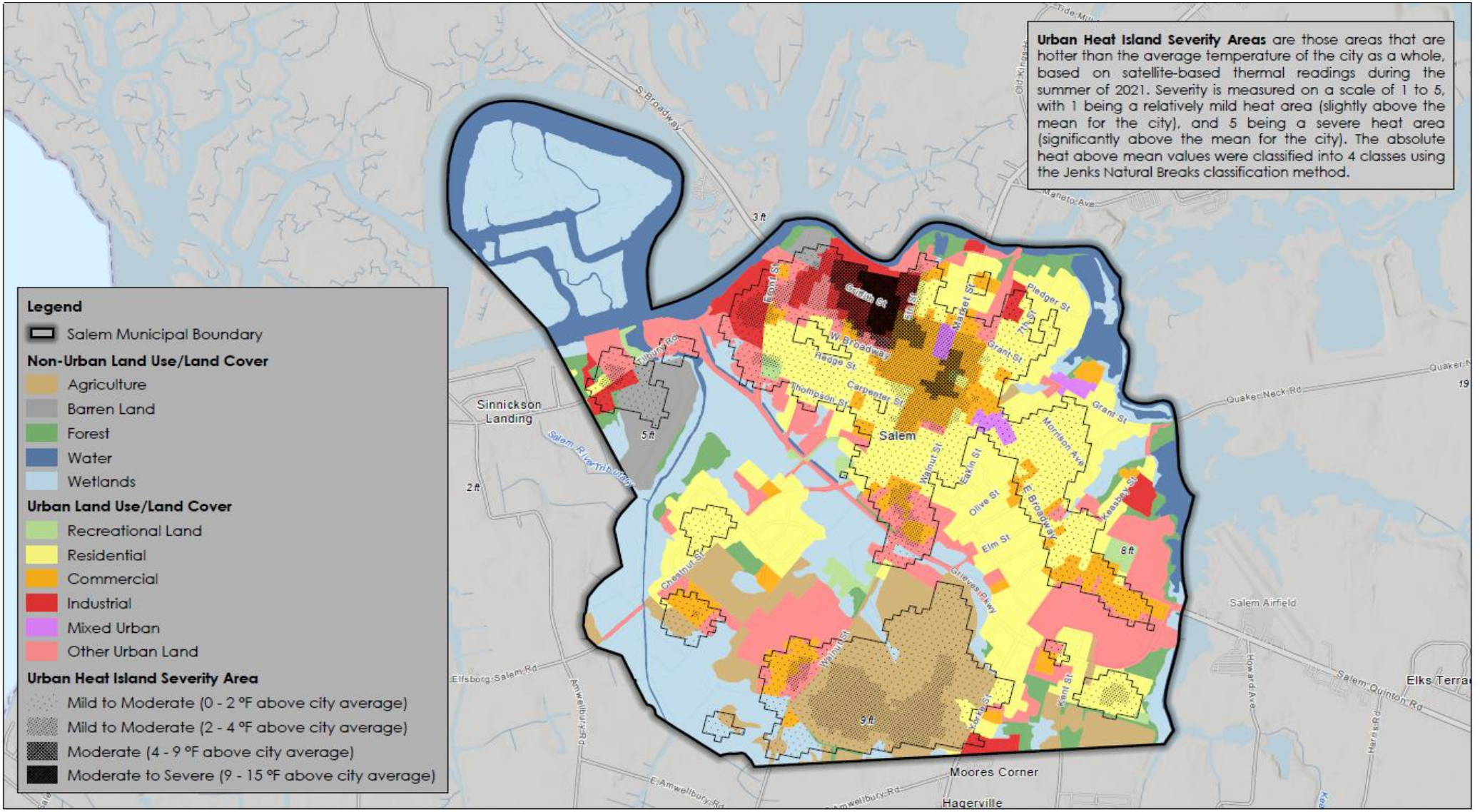
The urban heat island effect can have adverse effects on human health, causing heat stress-related illnesses such as heat exhaustion and heatstroke. Variable microclimates within the city can cause different temperature clusters and cause communities within the same area to heat up differently. Elderly or poor residents who rely on minimal air conditioning or seasonal cooling are at higher risk of exposure to high temperatures.

Heat anomalies were most concentrated around the northern industrial and commercial area of the city, where temperatures can reach upwards of 9-15 degrees Fahrenheit above the city average based on satellite temperature readings. Certain types of land cover were more or less likely to be in an urban heat area. Wetlands, forests, water, or recreational areas are rare within urban heat areas, while residential and agricultural areas were about equally likely to be within or outside of an urban heat area. Specifically, 43% of residential areas and 59% of agricultural areas were within an urban heat area, whereas 68% of industrial lands and 82% of commercial lands were within an urban heat area.

It is interesting to note that agriculture, which is not typically associated with urban heat due to its "Green" nature and lack of significant impervious surfaces, is still affected by the urban heat island effect, as it mitigates heat much less than wetlands and tree-covered areas.

Industrial and commercial areas are much more likely to be within urban heat areas, most likely due to their high impervious surface cover and lack of tree cover, as shown in Map 16: Land Use and Land Cover in Urban Heat Areas.

Map 16: Land Use and Land Cover in Urban Heat Areas



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NOTES:
1. 2015 Land Use/Land Cover obtained from the NJDEP GIS website: www.state.nj.us/dep/gis/
2. Urban heat island severity areas obtained from The Trust for Public Land.
3. Salem municipal boundary obtained from New Jersey Geographic Information Network (NJGIN) Open Data portal: https://njgin.nj.gov/
4. Basemap obtained from ESRI basemap services.

Spatial Reference: NAD 1983 2011 StatePlane New Jersey FIPS 2900 Ft US

0 700 1,400 Feet

LAND USE/LAND COVER IN URBAN HEAT ISLAND SEVERITY AREAS

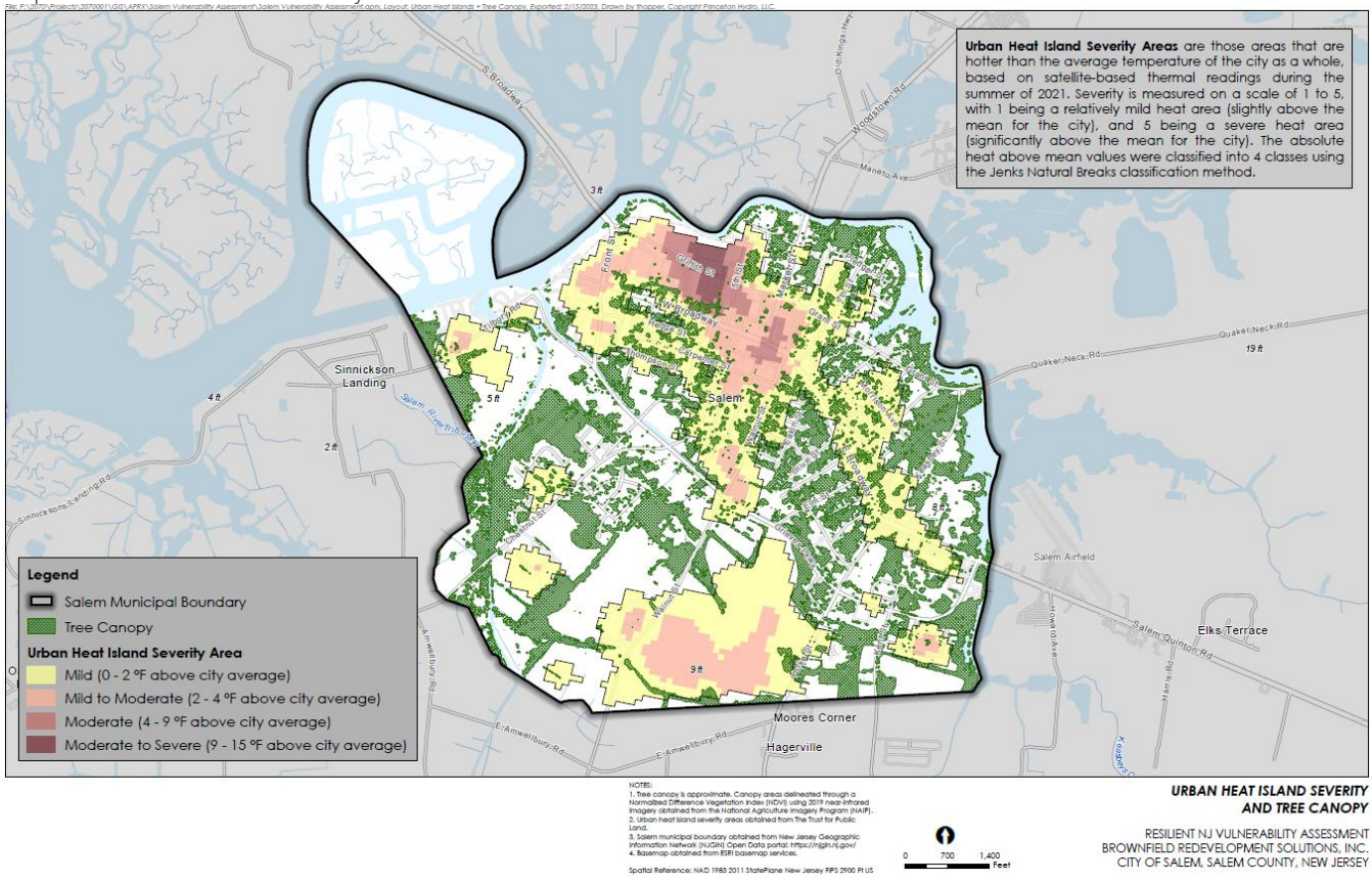
RESILIENT NJ VULNERABILITY ASSESSMENT
BROWNFIELD REDEVELOPMENT SOLUTIONS, INC.
CITY OF SALEM, SALEM COUNTY, NEW JERSEY

Ecological Resources

An important consideration in mitigating the urban heat island effect in Salem, NJ is increasing tree canopy cover. Areas with tree canopy cover are less likely to be within urban heat areas, and vice versa. About 21% of Salem City is covered by tree canopy. Interestingly, about 83% of canopy-covered areas are outside of urban heat areas, while about 89% of urban heat areas are not covered by tree canopy. This is depicted in Map 17: Urban Heat Island Severity and Tree Cover. This highlights the potential benefits of strategically planting trees in areas that are most vulnerable to the urban heat island effect, such as industrial and commercial areas, to help mitigate the adverse impacts of high temperatures. Another strategy to mitigating the effects of urban heat areas is an urban forestry plan.

However, it is also important to note that there are areas in Salem City that have no canopy but are not classified as urban heat areas. This could be due to other land uses that can mitigate urban heat, such as wetlands, proximity to water, and exposure to breezes coming off the water. Therefore, a combination of strategies such as tree planting, green infrastructure, and water-sensitive design should be considered when developing plans to reduce the effects of the urban heat island in Salem City.

Map 17: Urban Heat Island Severity and Tree Cover



Vulnerable Populations

According to 2018 US Census data, vulnerable populations include people who are older than 65, younger than 17, or those with a disability. The largest group of people in the heat-vulnerable population are individuals aged 17 or younger, estimated to be about 1,526 people, which represents around 32% of the

city's population. This group is followed by people with disabilities, estimated to be around 1,077 people or 22% of the city's population, and seniors aged 65 or older, estimated to be around 698 people or 15% of the city's population.

The data also shows that out of the total city population of 4,811, approximately 28.5% are in mild urban heat areas, 9.4% are in mild to moderate areas, 2.1% are in moderate areas, and only 0.8% are in moderate to high or severe areas. According to the breakdown of the urban heat island severity areas, an estimated 1,593 people, or 40.8% of the population, live in areas that are in mild to severe heat areas.

The largest group at risk is individuals aged 17 and younger, comprising about 32% of the city's population. This group, along with seniors over 65 and individuals with disabilities, is particularly susceptible to heat-related illnesses. The urban heat island effect exacerbates these risks, as higher temperatures can lead to heat exhaustion, heatstroke, and aggravated chronic health conditions. Map 18: Urban Heat Island Severity and Vulnerable Population illustrates this.

The breakdown of Salem's population in relation to urban heat areas indicates that a significant portion (approximately 33%) lives in areas ranging from mild to severe heat impact. Those in moderate to severe areas, although a smaller percentage, face heightened risks.

The urban heat island effect can lead to increased energy consumption due to higher air conditioning needs, potentially resulting in higher utility bills. This can disproportionately affect low-income families, further exacerbating social inequalities.

However, it is important to acknowledge that not all urban heat island effects are created equal. To understand the areas of the city that have higher impacts and temperatures from heat island, please reference Map 18.

Cultural Resources

High temperatures can significantly impact cultural resources, including historic sites and cultural landscapes. Prolonged heat can accelerate the deterioration of materials like stone, wood, and paint, leading to cracks, warping, and fading the city's historic buildings. Increased temperatures can also intensify thermal stress on ancient structures, compromising their structural integrity over time.

Moreover, the risk of wildfires, often heightened by high temperatures, poses a direct threat to cultural sites and archives. Protecting these resources requires adaptive strategies, such as climate-controlled environments, restoration techniques, and ongoing monitoring to mitigate the impacts of rising temperatures. The city's downtown district is designated as the Market Street Historic District with some buildings having been constructed in the 18th century. There are 924 historic structures listed in the Historic Registry that are susceptible to effects of rising temperatures.

Community Assets

High temperatures can significantly affect community assets, including infrastructure, public spaces, and essential services. Prolonged heat can damage roads and railways, causing buckling and safety hazards, while increasing the risk of power outages as electrical grids struggle to meet high demand for cooling. Community facilities like schools and recreation centers may face operational challenges due to inadequate cooling systems. Public spaces, such as parks and playgrounds, may become unusable during extreme heat, limiting opportunities for outdoor activities and social interactions. Vulnerable populations, such as the elderly and low-income families, are disproportionately affected as they may lack access to air conditioning or other cooling resources. Addressing these challenges requires investments

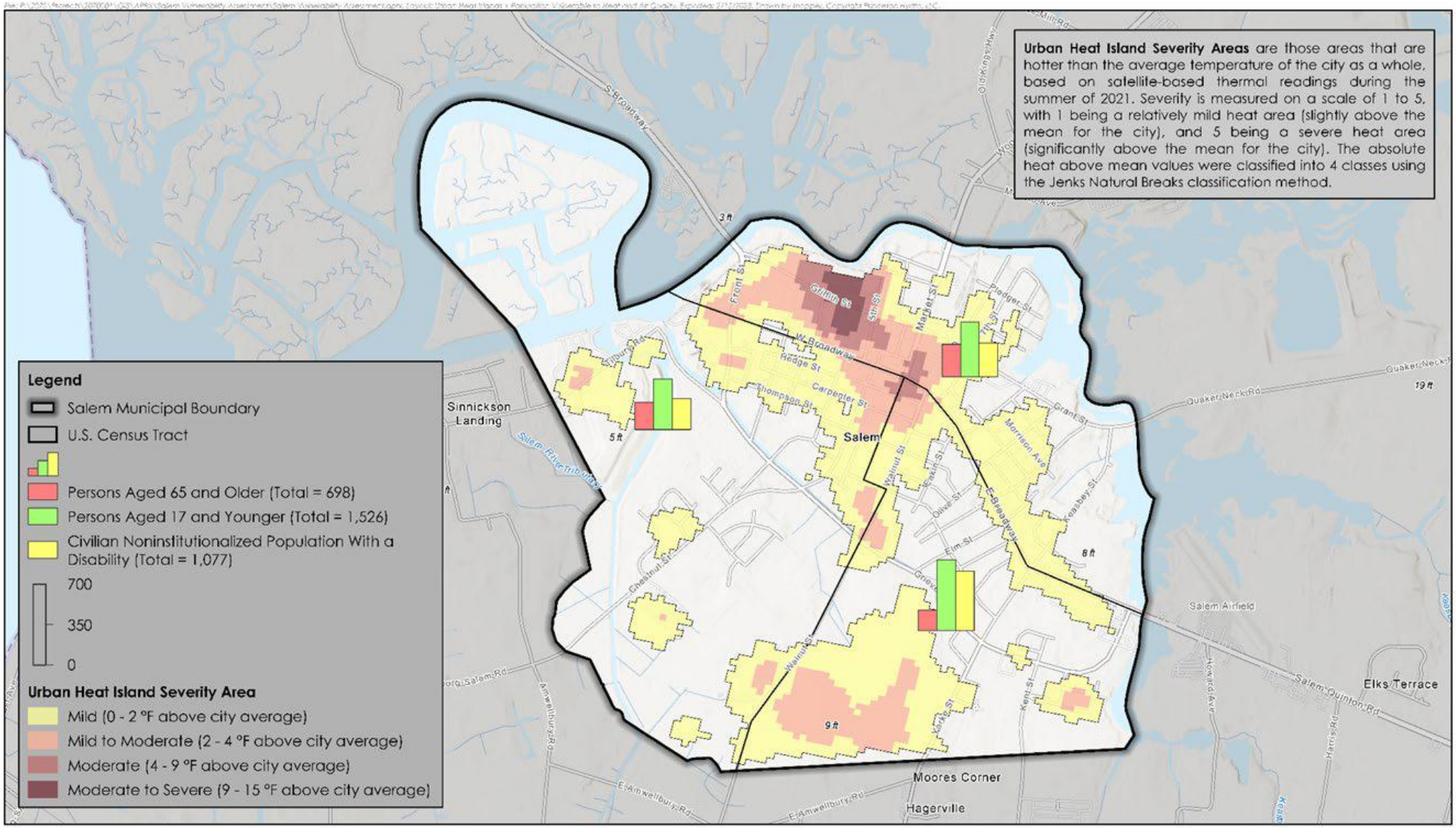
in heat-resilient infrastructure, cooling centers, and community education to mitigate the impacts of rising temperatures on shared assets.

Critical Facilities

High temperatures can severely impact critical facilities, including hospitals, emergency services, power plants, and water treatment systems. Overheated conditions strain electrical grids, increasing the likelihood of blackouts that can disrupt essential services and operations. High heat can also impair the city's emergency response times, as vehicles and equipment may overheat, and personnel may struggle to work efficiently under extreme conditions.

Salem's water treatment plants can experience reduced efficiency or mechanical issues due to heat stress, compromising water quality and availability. To ensure resilience, critical facilities require robust cooling systems, energy-efficient designs, and contingency plans to maintain functionality during prolonged heatwaves.

Map 18: Urban Heat Island Severity and Vulnerable Population



C. Hurricanes and Wind

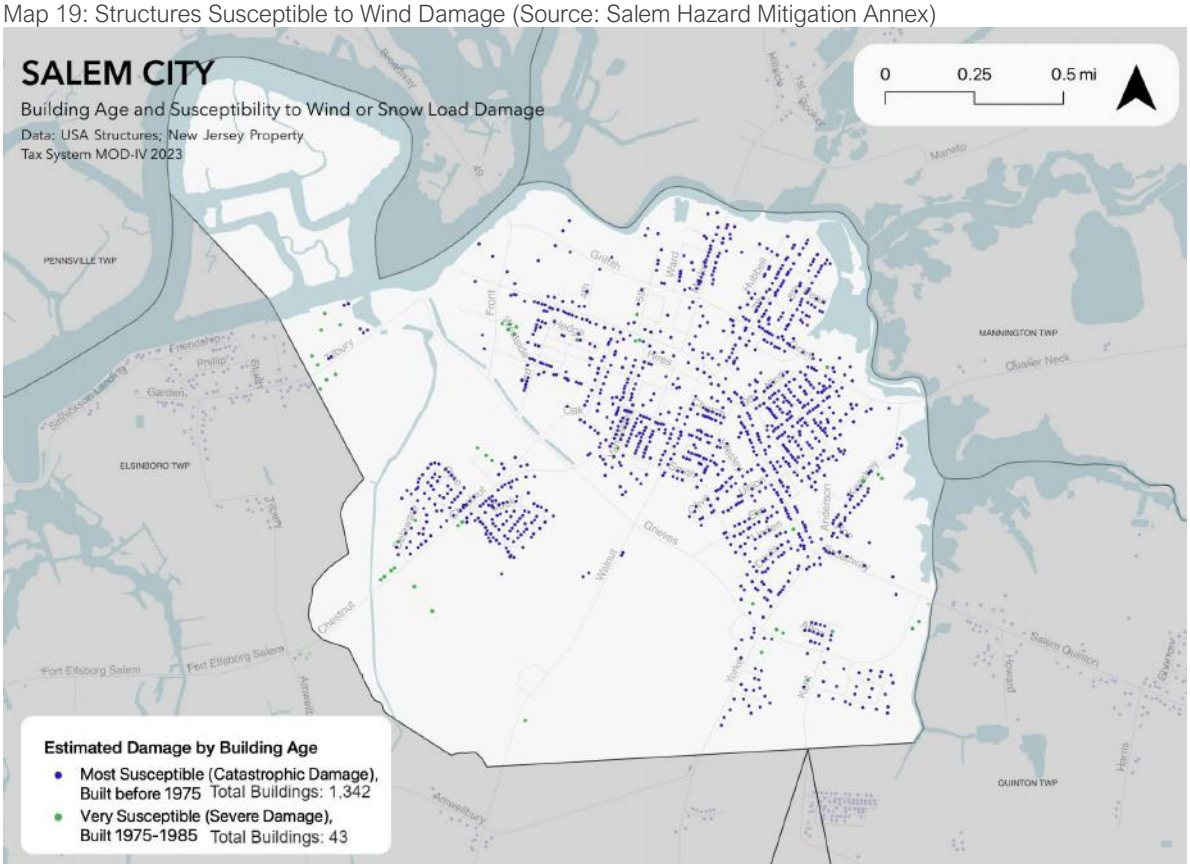
Salem County, New Jersey, faces a relatively low risk from hurricanes, according to the National Risk Index[6] developed by FEMA. With a risk index score for hurricanes placed at 77.4, it falls into the "Relatively Low" category when compared to other hazard types assessed for the county. This score suggests that, while hurricanes are a concern for Salem County, the expected impact is lower compared to other areas in the United States and even within New Jersey. Risk Index scores are calculated using an equation that combines scores for Expected Annual Loss due to natural hazards, Social Vulnerability and Community Resilience. A community's score is represented by its percentile ranking among all other communities at the same level for Risk, Expected Annual Loss, Social Vulnerability and Community Resilience. For example, if a given Census tract's Risk Index percentile for a hazard type is 84.32 then its Risk Index value is greater than 84.32% of all US Census tracts.

To better understand hurricane-driven surge risks, SLOSH (Sea, Lake, and Overland Surges from Hurricanes) maps are included below to highlight the potential impacts. SLOSH is a model developed by the National Weather Service to estimate storm surge heights and extents resulting from different hurricane intensities. The model uses factors such as storm size, intensity, forward speed, and track to predict potential flooding. In Salem, SLOSH maps show that Category 1 hurricanes can produce significant storm surges, highlighting areas of potential flooding in the county. This specific mapping data supports the inclusion of hurricane surge considerations in Salem's mitigation planning.

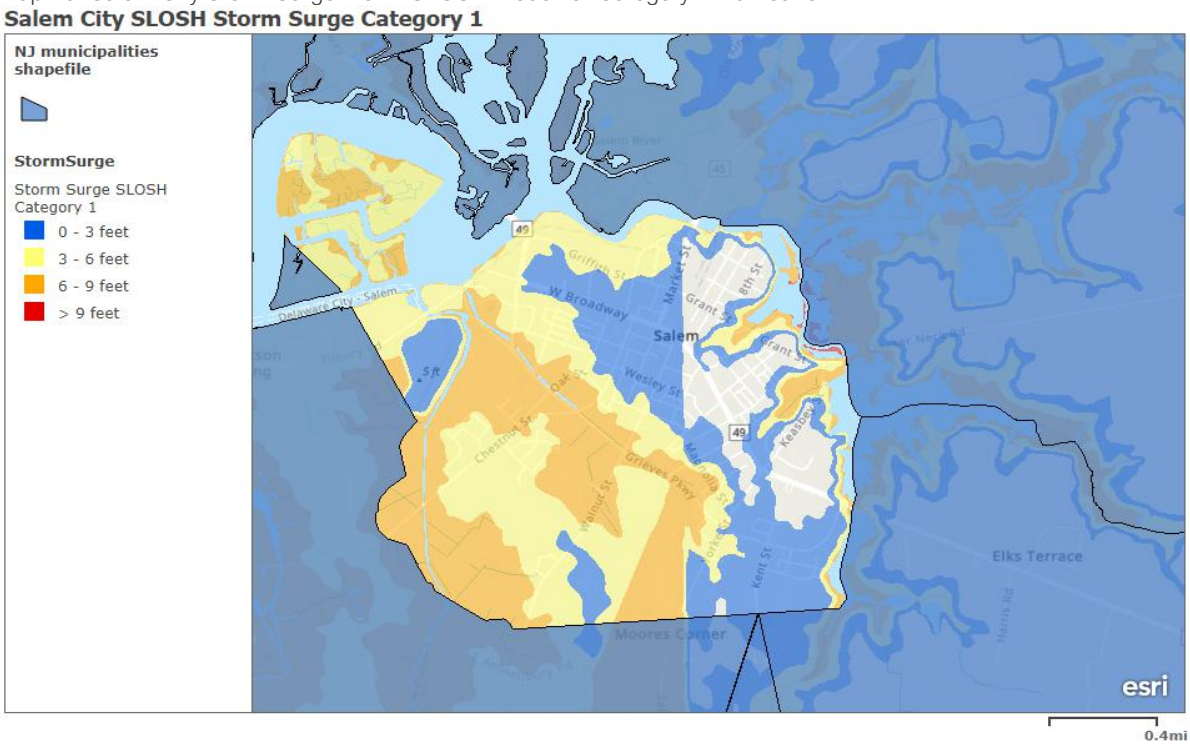
Salem is at a Relatively High Risk rating for Strong Wind, 92 for Salem County, with an annualized frequency of 6.6 events per year. A Strong Wind annualized frequency value represents the average number of recorded Strong Wind hazard occurrences (events) per year over the period of record (34 years). Strong Wind consists of damaging winds, often originating from thunderstorms, that are classified as exceeding 58 miles per hour (mph). Map 19 depicts those structures in Salem most susceptible to high winds. As expected, a majority of homes in the city would be affected by high winds due to their historic nature. These homes were not designed and constructed to account for the changing climate. Maps 20 to 24 depict the SLOSH models for Categories 1 through 4. Even a Category 1 hurricane would cause devastating effects on the city with only a small percentage of the city avoiding storm surge. As the severity of the hurricane increases, the city will face storm surges over 9 feet, with a Category 4 storm causing storm surges of over 9 feet throughout the entire city.

[6] Zuzak, C., E. Goodenough, C. Stanton, M. Mowrer, A.Sheehan, B. Roberts, P. McGuire, and J. Rozelle. 2023. National Risk Index Technical Documentation. Federal Emergency Management Agency, Washington, DC. https://hazards.fema.gov/nri/learn-more

Map 19: Structures Susceptible to Wind Damage (Source: Salem Hazard Mitigation Annex)

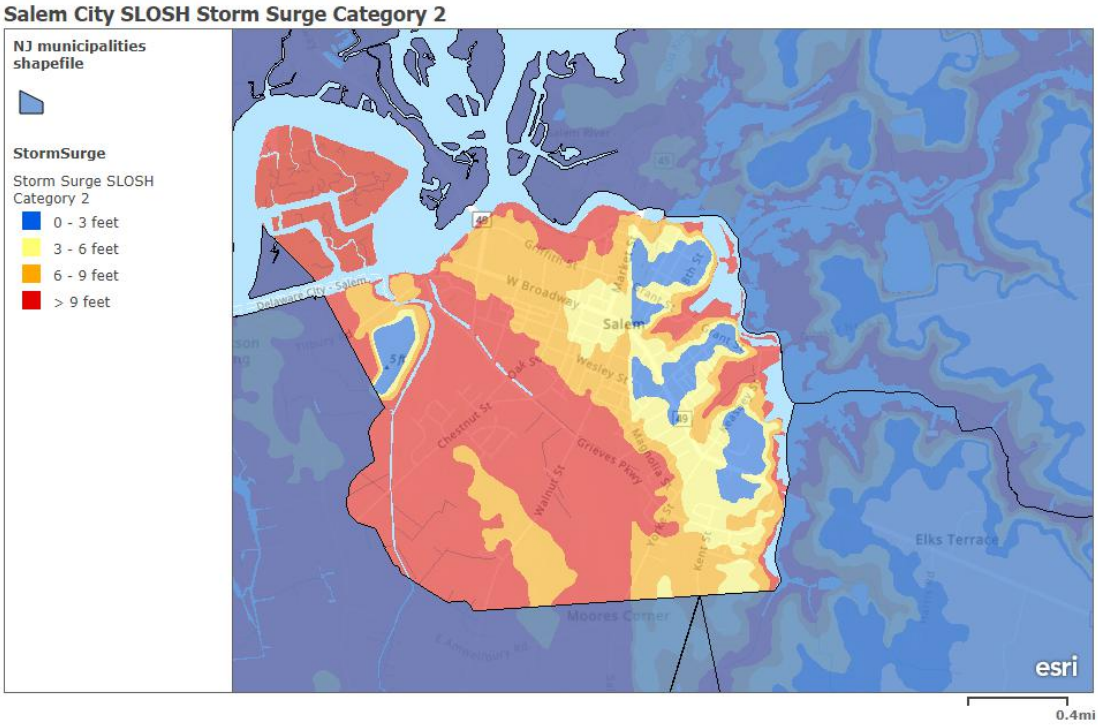


Map 20: Salem City Storm Surge Risk – SLOSH Model for Category 1 Hurricane



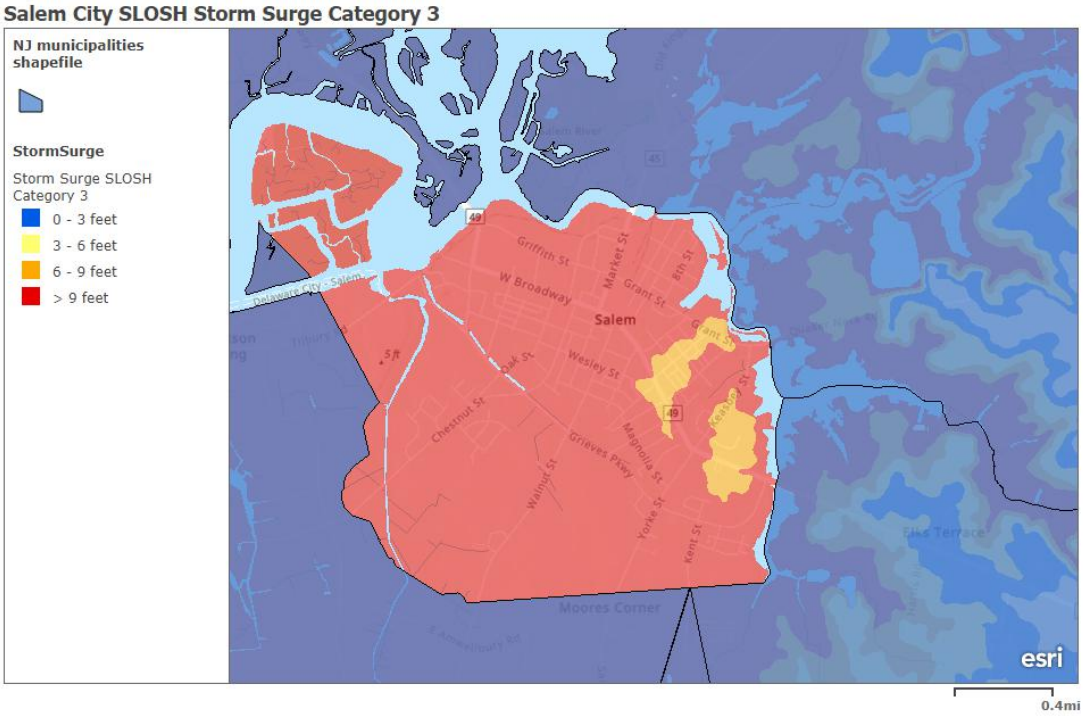
Esri, NASA, NGA, USGS, FEMA | Esri Community Maps Contributors, Delaware FirstMap, New Jersey Office of GIS, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS

Map 21: Salem City Storm Surge Risk – SLOSH Model for Category 2 Hurricane



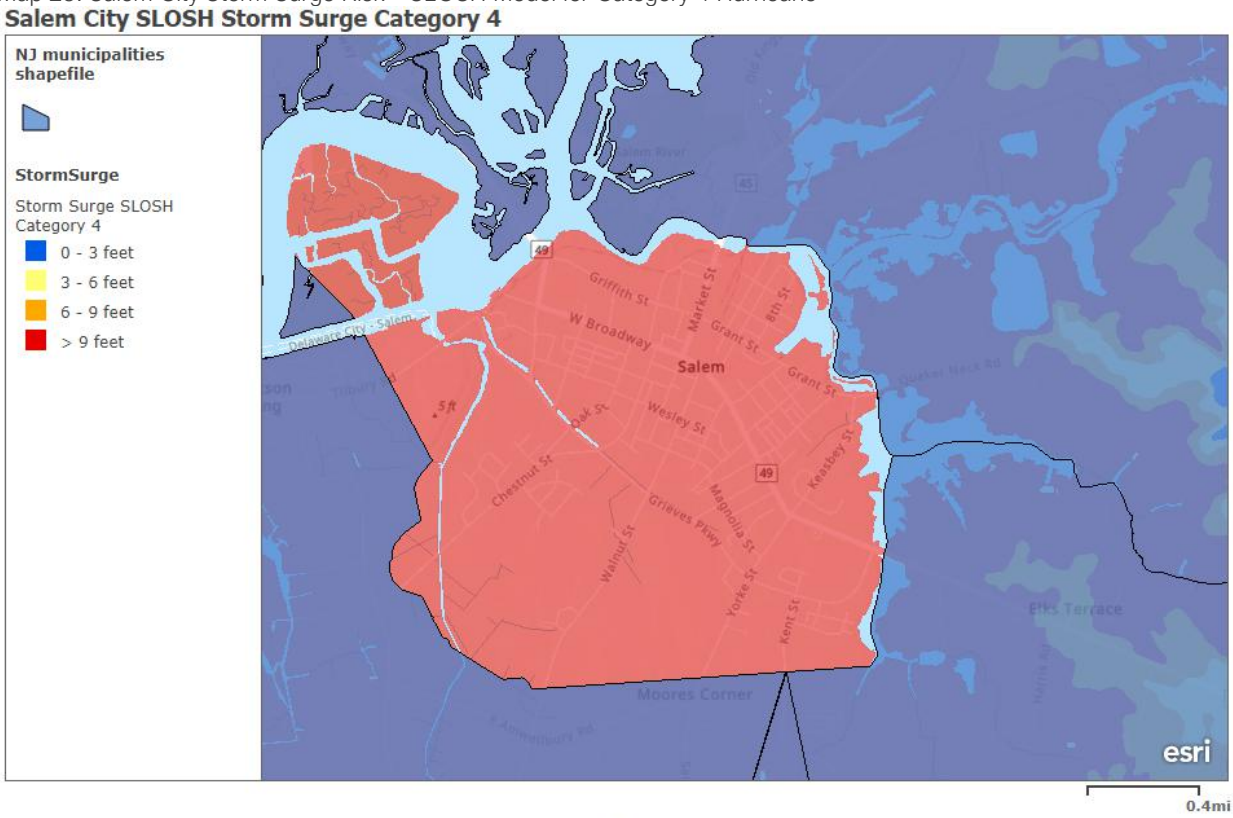
Esri, NASA, NGA, USGS, FEMA | Esri Community Maps Contributors, Delaware FirstMap, New Jersey Office of GIS, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS

Map 22: Salem City Storm Surge Risk – SLOSH Model for Category 3 Hurricane



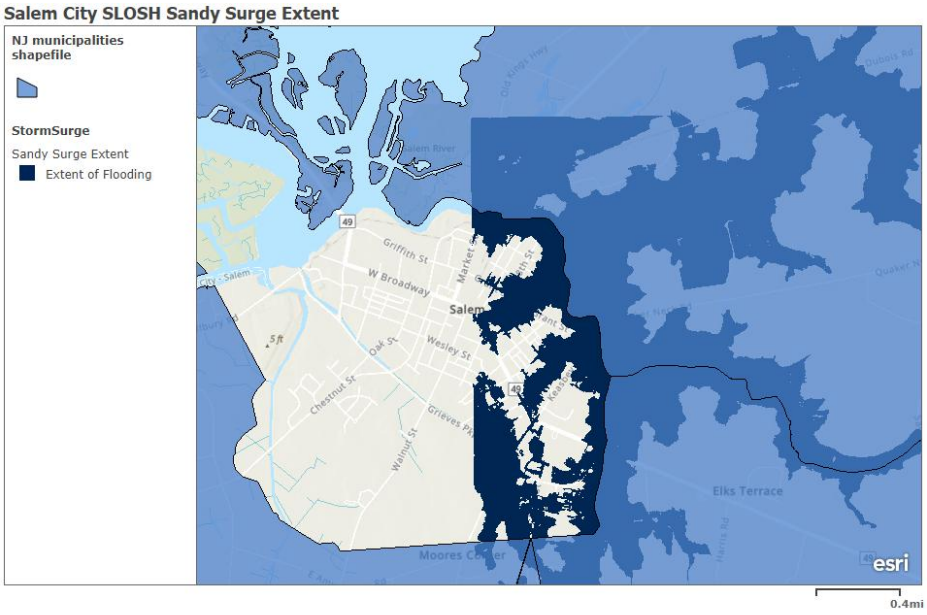
Esri, NASA, NGA, USGS, FEMA | Esri Community Maps Contributors, Delaware FirstMap, New Jersey Office of GIS, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS

Map 23: Salem City Storm Surge Risk – SLOSH Model for Category 4 Hurricane



SLOSH modeling reveals that if a Category 1 or higher hurricane were to impact the area, storm surge could lead to flooding with water levels ranging from 0 to over 9 feet in vulnerable parts of Salem City. The SLOSH maps illustrate these potential inundation areas, underscoring the need for preparedness measures even though the probability of such events remains low.

Superstorm Sandy, which impacted the East Coast in October 2012, was technically classified as a post-tropical cyclone when it made landfall in New Jersey, but it retained hurricane-force winds and caused extensive storm surge flooding similar to a high-category hurricane. Although not a Category 1 or higher hurricane upon landfall, Sandy's size and path generated significant storm surge impacts.



Map 24: Salem City SLOSH Sandy Surge Extent

Salem City's SLOSH model for Sandy's surge extent shows extensive flooding potential across low-lying areas, with large portions of the city susceptible to inundation. The dark blue shading highlights areas that experienced or were at risk of flooding, emphasizing that even storms below hurricane strength can have severe consequences. This underscores the need for preparedness for major storms, as even post-tropical cyclones like Sandy can bring substantial storm surges and flood impacts, particularly in vulnerable low-lying regions.

Ecological Resources

Hurricanes can have profound impacts on ecological resources, altering ecosystems and causing widespread environmental damage. The intense winds and storm surges associated with hurricanes can destroy coastal habitats such as wetlands and salt marshes, which serve as natural buffers against erosion and storms. The city is bordered to the north and east by the Salem River and its associated wetlands, which would be at risk to this damage.

Flooding from heavy rainfall, as previously discussed, can lead to soil erosion, nutrient loss, and contamination of freshwater systems with pollutants, sediments, and debris. The Salem River is a foraging area for critical species such as the Bald Eagle and Great Blue Heron. Wildlife populations are also affected, as hurricanes can disrupt breeding cycles, destroy habitats, and reduce food availability.

Forests may experience significant tree loss and fragmentation, affecting biodiversity and carbon storage. While some ecosystems are resilient and can recover over time, the increasing frequency and intensity of hurricanes due to climate change pose a growing threat to ecological stability, highlighting the need for conservation efforts and habitat restoration.

Vulnerable Populations

Wind and flooding from hurricanes disproportionately affect vulnerable populations, amplifying existing socioeconomic and health disparities. Low-income families may also lack access to resources for evacuation, such as transportation or safe shelters, increasing their exposure to life-threatening conditions. Vulnerable groups, including the elderly, individuals with disabilities, and those with chronic illnesses, face additional challenges in preparing for and recovering from hurricanes, as they may require specialized care or assistance. Communities of color and marginalized groups are often more affected by slow disaster response and recovery efforts, delaying their ability to rebuild. Addressing these disparities requires equitable disaster planning, improved infrastructure, and community-focused recovery efforts that prioritize the needs of at-risk populations.

The National Risk Index recognized Salem as having a "Relatively High" social vulnerability index, scoring 68.65 of the national percentile. Social vulnerability is the susceptibility of social groups to the adverse impacts of natural hazards, including disproportionate death, injury, loss, or disruption of livelihood.

Cultural Resources

The City of Salem has a robust historic district, as discussed in detail in prior sections. Hurricanes and winds can significantly impact these cultural resources. Strong winds and storm surges can cause structural damage to historic properties, leading to the loss of irreplaceable architectural features. Libraries are particularly vulnerable, as water and humidity can irreparably damage collections of documents, artworks, and other cultural materials. Additionally, culturally significant landscapes, such as burial grounds, can be altered or destroyed by flooding and debris.

The loss or degradation of these resources diminishes cultural identity and heritage, underscoring the need for disaster preparedness and recovery plans that prioritize the protection and restoration of cultural assets.

Community Assets

Hurricanes can cause widespread damage to community assets, disrupting essential services, infrastructure, and public spaces. High winds and flooding can destroy roads, bridges, and public transportation systems, hindering mobility and emergency response efforts. Schools and community centers often sustain damage, affecting access to education, healthcare, and social services. Public utilities, such as electricity, water, and communication networks, are frequently compromised, leaving communities without critical resources for days or weeks. Parks, recreation areas, and other shared spaces may be inundated with debris or permanently altered, limiting their use and affecting community well-being.

The financial burden of repairing or rebuilding these assets can strain local governments and prolong recovery, particularly in economically disadvantaged areas such as Salem. Effective disaster planning and resilient infrastructure are essential to minimize these impacts and support community recovery after hurricanes.

Critical Facilities

Hurricanes can severely impact critical facilities, disrupting the essential services they provide to communities. Emergency response centers and fire stations often face operational challenges as high winds and flooding can damage infrastructure, disrupt power supplies, and overwhelm resources. Healthcare facilities may struggle to maintain care for patients, particularly those in critical condition, due

to power outages, water damage, or evacuation needs. Power plants and water treatment facilities are vulnerable to physical damage and operational breakdowns, potentially leaving entire regions without electricity or clean water for extended periods. Communication hubs can be knocked offline, hindering emergency coordination and public safety efforts.

The disruption of these critical facilities not only poses immediate threats to public health and safety but also delays recovery efforts, underscoring the need for robust disaster preparedness, resilient infrastructure, and contingency plans.

D. Drought

While it may seem counter-intuitive, changing climates and weather patterns can contribute to increased droughts and periods without rain, in addition to increasing the risks of flooding. Extended periods of drought, followed by intense storms will become more frequent. Droughts contribute to increased climate change impacts in the city by exacerbating the effects of heat waves and other extreme weather events. For example, during periods of drought, soil moisture levels can be reduced, which can exacerbate heat waves by reducing the amount of evaporative cooling that occurs in vegetation. Additionally, the reduced soil moisture can make it more difficult for the soil to absorb and hold rainwater, resulting in more flash flooding during rain events.

Droughts can reduce the amount of water available for drinking water, irrigation, and other uses, which can create water shortages and increase the need for water rationing or restrictions. Droughts can also impact public health by reducing the availability of clean water, increasing the risk of heat-related illnesses, and contributing to poor air quality due to dust and other particulate matter. These impacts could affect vulnerable populations, such as the elderly and children, in Salem and surrounding areas.

Droughts, along with human activities such as water withdrawals and the discharge of industrial effluent, can lead to an increase in the salinity of the Delaware River. This is measured and tracked by a network of monitoring stations operated by the United States Geological Survey (USGS) and other organizations. These monitoring stations use various methods to measure salinity, including conductivity sensors and water sampling, providing data on salinity levels at various points along the river. In recent years, changes in salinity levels in the Delaware River have been attributed to a combination of factors. During droughts, there is a reduction in freshwater flow and an increase in water withdrawals, which concentrate the river's salt content. Additionally, rising sea levels contribute to saltwater intrusion, especially during periods of lower river flow typically seen in drought conditions. Altered patterns of precipitation and runoff, potentially linked to climate change, further influence these salinity dynamics. The relationship between drought conditions and increased river salinity is thus complex, involving direct effects of reduced freshwater input and indirect influences such as enhanced saltwater intrusion and changes in water usage.

Ecological Resources

In Salem, changes in salinity levels in the Delaware River could have a range of impacts on water resources and ecosystems. For example, increased salinity levels can affect the survival and reproduction of aquatic organisms, including fish, invertebrates, and plants. Changes in salinity levels can also impact water quality, as high salinity levels can increase the solubility of metals and other contaminants and make them more available to aquatic organisms.

In Salem, the concept of "drought-vulnerable" landscapes refers to areas that, while vegetated, are particularly susceptible to the effects of drought due to their ecological characteristics and water needs.

Map 20 shows these areas at risk in Salem. These landscapes play a critical role in the city's ecological balance, but their health and sustainability are at risk under prolonged dry conditions.

Wetlands (256 acres, 15% of city area): Despite being water-rich environments, wetlands are vulnerable to drought as their ecosystems are highly dependent on water levels. Prolonged drought can lead to a decrease in water levels, affecting the biodiversity and the ecological services they provide, such as water purification and habitat for wildlife.

Agricultural Lands (208 acres, 12% of city area): These areas are essential for food production but are highly susceptible to drought. Insufficient rainfall can lead to soil degradation, reduced crop yields, and increased need for irrigation, which in turn can strain local water resources.

Forests (127 acres, 4% of city area): Forests, while typically resilient, can be significantly affected by drought. Extended dry periods can lead to reduced tree growth, increased susceptibility to pests and diseases, and a heightened risk of wildfires. These effects not only impact the forest ecosystem but also reduce their ability to provide cooling and moisture retention in the urban landscape.

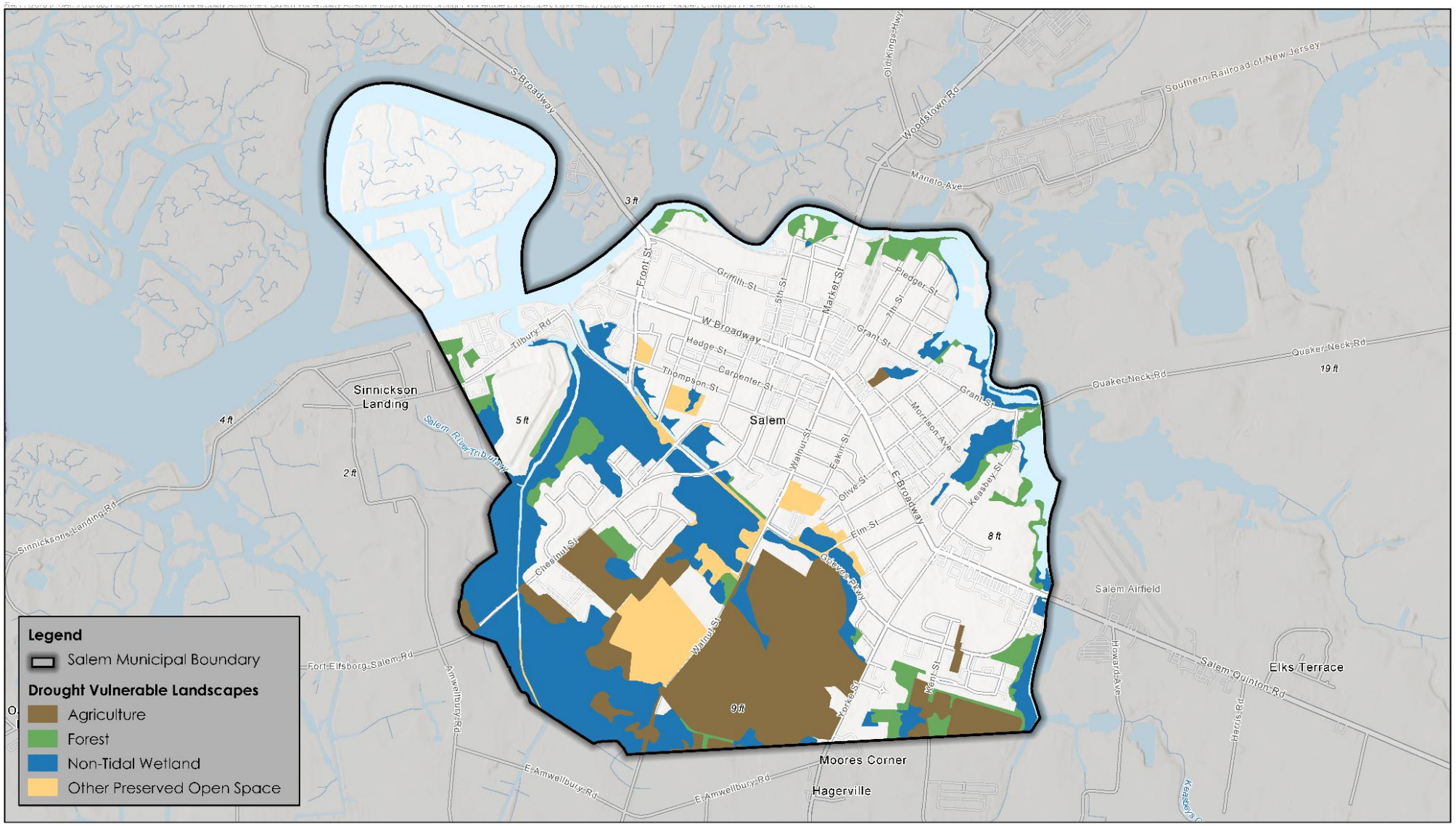
In light of these vulnerabilities, it becomes crucial to integrate strategies that enhance the resilience of these landscapes to drought. This includes implementing sustainable water management practices, promoting drought-resistant vegetation, and ensuring the protection and careful management of these critical ecological areas. By doing so, Salem can not only safeguard these vital landscapes but also enhance its overall environmental health and resilience against climate change impacts.

Cultural Assets

Drought can cause damage to buildings In a number of ways, including building subsidence, damage to underground utilities, and higher erosion risks. The contraction of soil away from building foundations can result in cracking foundations, damaged pipes, sloping floors, and warped window and door openings.[7] Historic communities such as Salem may be especially vulnerable to these risks. Although it is not possible to evaluate the risks to specific structures, Salem should account for the potential that additional resources will need to be dedicated to preserving historic structures.

[7] Raizner Slania. “How a Drought Can Damage Commercial Properties.” https://www.raiznerlaw.com/blog/how-a-drought-can-damage-commercial-properties/#:~:text=When%20soil%20has%20low%20moisture,warped%20window%20and%20door%20openings.

Map 25: Drought Vulnerable Landscapes



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NOTES:
1. Agriculture, forest and non-tidal wetlands (2015 land use/ land cover) obtained from the NJDEP GIS website: www.nj.gov/dep/gis/
2. Open spaces obtained from the N.J. Geographic Information Network (NJGIN) Open Data portal: https://njgin.nj.gov/
3. Salem municipal boundary obtained from New Jersey Geographic Information Network (NJGIN) Open Data portal: https://njgin.nj.gov/
4. Basemap obtained from ESRI basemap services.

Spatial Reference: NAD 1983 2011 StatePlane New Jersey FIPS 2900 Ft US

0 700 1,400 Foot

DROUGHT VULNERABLE LANDSCAPES

RESILIENT NJ VULNERABILITY ASSESSMENT
BROWNFIELD REDEVELOPMENT SOLUTIONS, INC.
CITY OF SALEM, SALEM COUNTY, NEW JERSEY

Vulnerable Populations and Overburdened Communities

Drought disproportionately affects vulnerable populations, exacerbating existing inequalities and challenges. Low-income families often struggle to afford rising costs of water and food, as drought reduces agricultural yields and drives up prices. Communities reliant on farming, fishing, or other natural resources face loss of income and livelihoods, deepening poverty and food insecurity. Vulnerable groups, such as the elderly, children, and those with pre-existing health conditions, are at higher risk of dehydration and heat-related illnesses due to limited access to adequate water and cooling resources.

As previously mentioned, Salem has a preponderance of individuals who fall within these vulnerable categories. Many of the residents are people living below the poverty limit (41% of the city's population), followed by people aged 17 or younger (32% of the city's population), people with a disability (22% of the city's population), households with no vehicle available (22% of the city's households), and people aged 65 or older (15% of the city's population).

Addressing these impacts requires targeted support, such as financial assistance, access to clean water, and inclusive policies that prioritize the needs of the most affected.

Community Assets and Critical Facilities

Salem's drinking water, sourced from the Delaware River, is treated by the Salem City Water Department, which operates a water treatment plant serving approximately 8,000 customers in the area. During drought conditions, the department faces several challenges in maintaining a sufficient and safe water supply. Reduced river levels can limit water availability, necessitating careful management of the resource. The decreased flow also leads to increased salinity and contaminant concentration, making the treatment process more complex and costly. Consequently, the department must intensify its water quality monitoring and possibly adjust treatment processes to ensure safety standards are met. In response to these challenges, the department might implement water conservation measures and restrictions to sustain supply.

Additionally, effective public communication becomes vital to inform residents about water use guidelines and conservation efforts. Prolonged drought conditions also place stress on the existing water infrastructure, potentially leading to more frequent repairs or the need for upgrades. These factors combined require the Salem City Water Department to adapt its operations significantly to ensure the reliable provision of safe drinking water during drought periods.

E. Planning and Land Use

Understanding the mix of land uses within a city and how they are distributed can help to identify areas that are more vulnerable to environmental risks such as flooding and urban heat island effects, as well as the potential impacts of climate change. Additionally, by analyzing the relationship between flood risk and land use, it is possible to identify areas that are most at risk and prioritize interventions to reduce the risks and impacts of flooding. This can include policies and interventions that reduce the use of low-lying or wetland areas for residential, commercial, or industrial activities, as well as measures to protect and restore natural ecosystems that offer natural protection against flood risk. Table 19 presents various categories of land use cover along with a brief description of each.

Table 19: Land Use/Cover Categories

Land Use /Cover Category	Brief Explanation
Residential	Areas designated for housing and living spaces, including single-family homes, apartments, and condominiums.
Wetlands	Ecologically sensitive areas typically saturated with water, either permanently or seasonally, supporting distinct ecosystems and wildlife.
Mixed/Other Urban Land	Zones that blend residential, commercial, and sometimes industrial uses, promoting diverse functionality within the same area.
Agriculture	Land used for farming activities, including crop cultivation and livestock rearing, contributing to local food production.
Commercial	Areas primarily dedicated to business activities like retail stores, offices, and service providers, often characterized by higher foot traffic and commercial buildings.
Industrial	Zones designated for manufacturing, warehousing, and other industrial operations, often involving large facilities and infrastructure.
Forest	Areas covered with trees and underbrush, providing habitats for wildlife and playing a crucial role in local ecology and air quality.
Barren Land	Land with little to no vegetation, often due to natural conditions or previous land use, including rocky terrain, sand, or cleared land.
Recreational Land	Areas allocated for recreational purposes such as parks, sports fields, and public open spaces, contributing to community well-being and leisure.

Salem has a relatively diverse mix of land uses, as evidenced by the 2015 Land Use/Land Cover data. Residential areas cover approximately 31% of the city's land, while wetlands make up a significant proportion with 29% of the city's land area. Urban land use, which includes mixed-use areas, accounts for 17% of the land area, while agricultural land use covers 12%. Commercial and industrial development makes up approximately 9% and 5%, respectively. Forested areas cover just 4% of the city's land, although barren land makes up about 3%, and recreational land covers less than 1%. The distribution of these land uses could have implications for the city's exposure and vulnerability to various environmental risks, including flooding and the urban heat island effect.

Land Use and Flooding

The analysis of relationship between flood risk and land use in Salem City revealed that most land uses within the city are affected by flood risk to some degree.

Table 20: Mapped Flood Areas and Land Use / Land Cover provides information on the distribution of mapped flood areas across different land uses and land cover, the total acreage of each type, and the percentage of each type of land use and land cover that falls within the current Flood Hazard Area (FHA), the Inundation Risk Zone (IRZ), and the Climate-Adjusted Flood Elevation (CAFE).

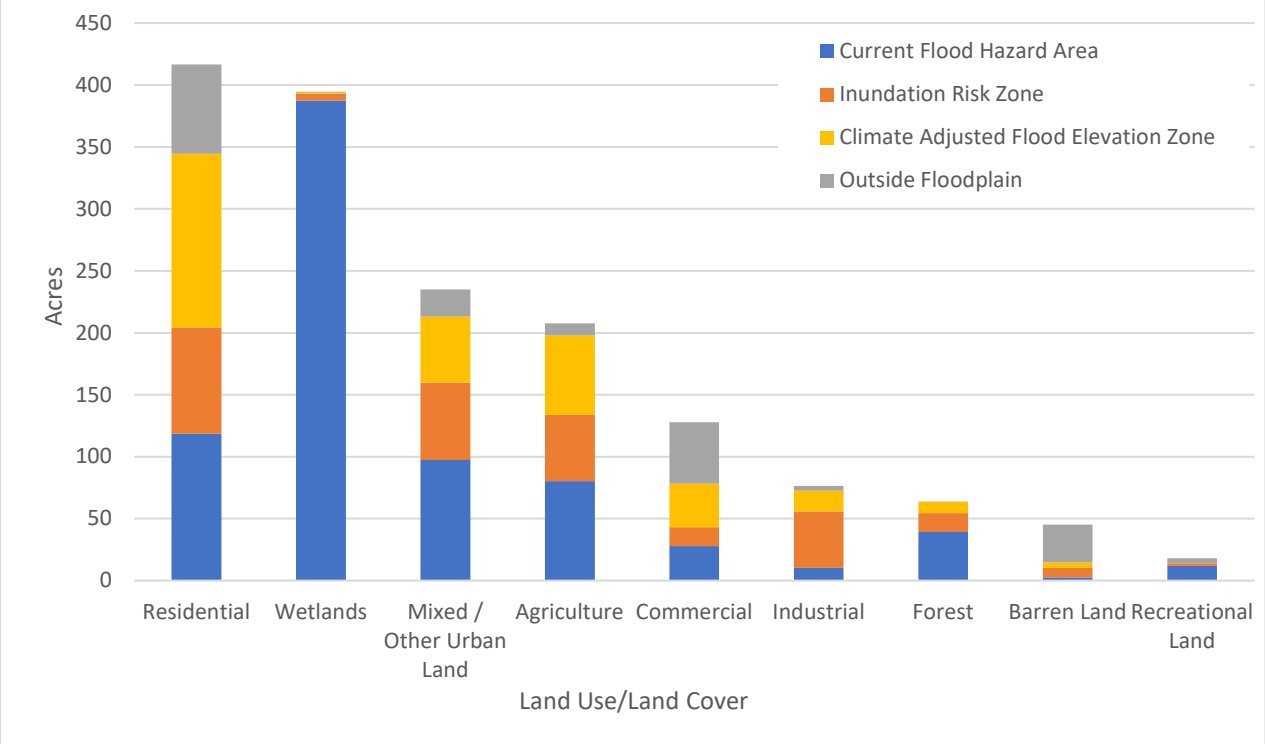
Table 20: Mapped Flood Areas and Land Use / Land Cover

2015 Land Use / Land Cover	Total Acreage	% in Current FHA	% in IRZ	% in CAFE
Residential	416	28%	49%	83%
Wetlands	394	98%	100%	100%

Mixed/Other Urban Land	235	41%	68%	91%
Agriculture	208	39%	64%	95%
Commercial	128	22%	34%	61%
Industrial	76	13%	73%	95%
Forest	64	62%	86%	100%
Barren Land	45	6%	23%	32%
Recreational Land	18	65%	76%	77%

This information is also presented graphically, in graph 2, showing how different land uses and land covers in Salem are exposed to varying degrees of flood risk. The graph provides a representation of the information provided in Table 20.

Graph 1: Mapped Flood Areas and Land Use / Land Cover



Maps 26: Flood Areas and Land Use / Land Cover, and 21: Land Use and Cover Existing and Future 1% Storm together provide a comprehensive overview of Salem's areas and corresponding land uses affected by the increased flood risk, by illustrating the flood hazard areas, the inundation risk zones, and the climate-adjusted flood elevation across the city. The maps delineate the areas that are highly vulnerable to flooding due to the proximity to the water body edges, their low elevations, or a combination of both factors, with different colors representing various flood zone hazards. They also indicate the location of different land uses, such as residential, commercial, industrial, agriculture, forest, wetland, and mixed/other urban land, using different symbols, shapes, and colors.

By providing an overview of the areas of the city and corresponding land uses impacted by flood risks, the map assists stakeholders, planners, and policymakers in developing and implementing effective flood resilience strategies. The map can also inform land-use planning decisions by identifying areas within the city that may be more suitable or less appropriate for particular land uses based on their flood risk and vulnerability levels.

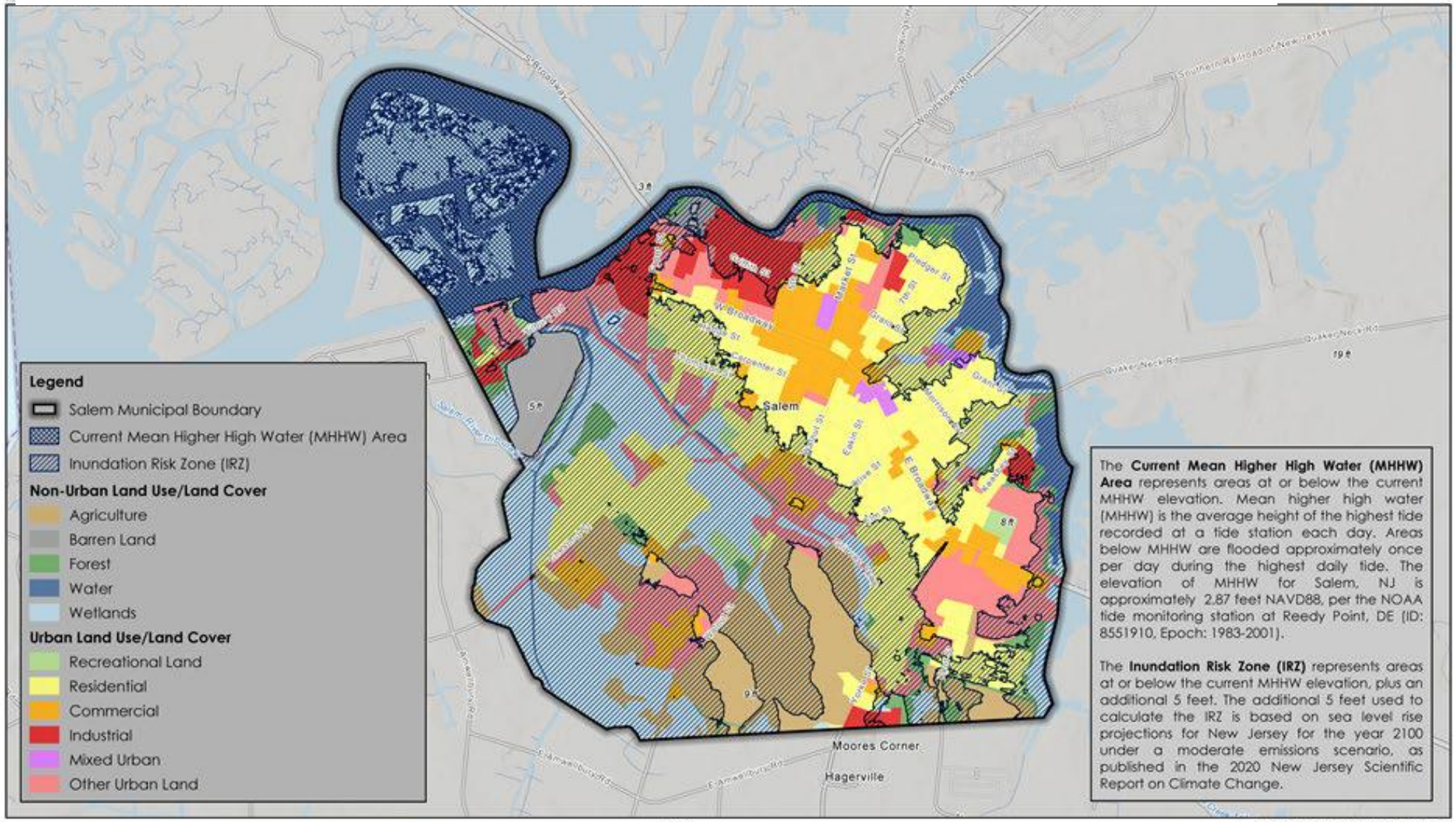
Key Areas for Consideration:

1. Residential Zones: Areas identified with high flood risk might be less suitable for future residential developments. For instance, regions near the waterfront or low-lying areas prone to flooding should be evaluated for either enhanced flood defenses or potential rezoning to non-residential uses. Existing residential areas in high-risk zones may require retrofitting or the implementation of flood-proofing measures.
2. Commercial and Industrial Areas: Areas located in high-risk flood zones should be assessed for potential relocation or the implementation of robust flood mitigation infrastructure.
3. Agricultural Lands: Agricultural areas in flood plains might be suitable due to the natural irrigation benefits of occasional flooding, but persistent high-risk flooding can render these lands unproductive. Alternative uses or flood mitigation measures might need to be explored for these areas.
4. Green Spaces and Recreational Areas: Flood-prone areas can be effectively utilized as parks, recreational spaces, or for green infrastructure like rain gardens and wetlands. These uses can absorb floodwaters and reduce the impact on more vulnerable land uses.
5. Historic or Cultural Zones: The focus should be on preserving these sites through adaptive measures rather than rezoning.

Implications for Policies and Regulations:

- Zoning Regulations: Reassessment of zoning regulations based on flood risk can lead to more resilient development. This may include restricting certain types of development in high-risk areas or mandating flood-resistant construction practices.
- Building Codes and Ordinances: Updating building codes to include flood-resilient construction methods, especially in high-risk areas, can mitigate damage and protect investments.
- Public Awareness and Engagement: Educating the public about flood risks and involving them in resilience planning can lead to more community-oriented and sustainable solutions.

Map 26: Flood Areas and Land Use / Land Cover



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NOTES:
1. 2015 Land Use/Land Cover obtained from the NJDEP GIS website: www.state.nj.us/dep/gis/
2. Current MHHW area and IRZ produced using NJ Adapt Flood Mapper: https://www.njfloodmapper.org/
3. Salem municipal boundary obtained from New Jersey Geographic Information Network (NJGIN) Open Data portal: https://njgin.nj.gov/
4. Basemap obtained from ESRI basemap services.

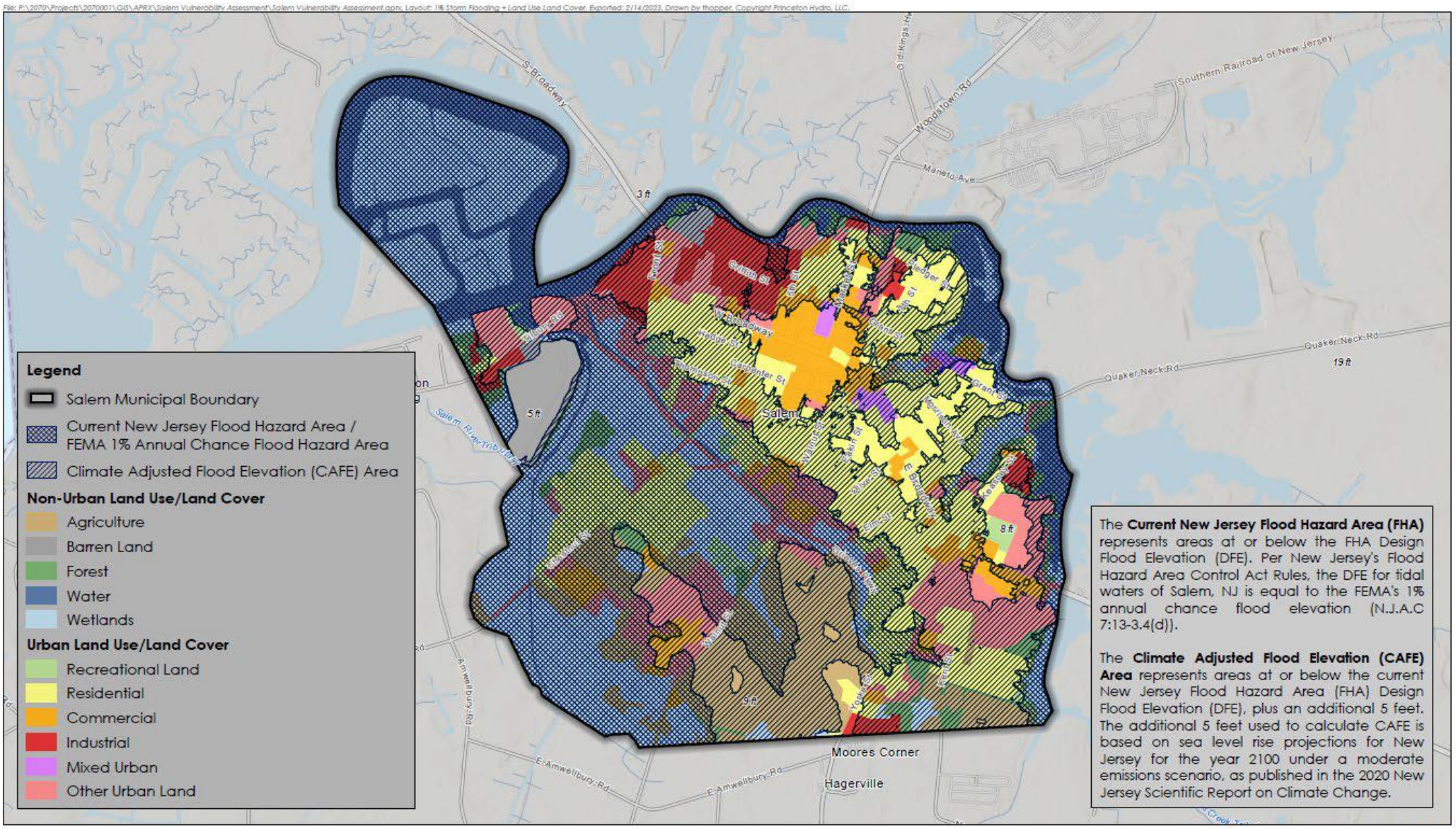
Spatial Reference: NAD 1983 2011 StatePlane New Jersey FIPS 2900 ft US

0 700 1,400 Feet

LAND USE/LAND COVER IN EXISTING AND FUTURE TIDAL INUNDATION AREAS

RESILIENT NJ VULNERABILITY ASSESSMENT
BROWNFIELD REDEVELOPMENT SOLUTIONS, INC.
CITY OF SALEM, SALEM COUNTY, NEW JERSEY

Map 27: Land Use and Cover Existing and Future 1% Storm



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NOTES:
1. 2015 Land Use/Land Cover obtained from the NJDEP GIS website: www.state.nj.us/dep/gis/
2. FEMA 1% Annual Chance Flood Hazard Area, effective 06/15/2016, obtained from FEMA Flood Map Service Center: https://msc.fema.gov/portal/
3. CAFE area produced using NJ Adapt Flood Mapper: https://www.njfloodmapper.org/
4. Salem municipal boundary obtained from New Jersey Geographic Information Network (NJGIN) Open Data portal: https://njgin.nj.gov/
5. Basemap obtained from ESRI basemap services.

Spatial Reference: NAD 1983 2011 StatePlane New Jersey FIPS 2900 Ft US

0 700 1,400 Feet

LAND USE/LAND COVER IN EXISTING AND FUTURE 1% STORM FLOODPLAINS

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Land Use and Extreme Weather Events

As previously discussed, Salem is likely to experience an increase in extreme weather events, and the precipitation and high winds that accompany them. While these events will not differentiate across land uses, the impacts they have will. Such events will exacerbate flooding and have the potential to cause damage both due to flooding and wind. Land uses that are particularly susceptible to damages from these sources are the built environment: residential, commercial, industrial, and mixed / other urban. Historic resources in particular are vulnerable, due to the age and construction materials likely to be in place.

Land Use and Temperature

As previously discussed and illustrated in Map 16, Land Use / Land Cover in Urban Heat Island Severity Areas, land use is a significant predictor of heat islands. Industrial areas are most likely to be located in heat severity areas, along with agriculture and commercial areas. Residential areas are a particular source of concern, particularly with vulnerable populations. Water, wetlands, and recreational areas are the least likely to be impacted. This provides valuable information to policymakers looking to mitigate these impacts, as additional tree canopy can be added to areas that currently are at greater risk for severe heat.

Land Use and Droughts

The areas most susceptible to droughts are those whose land uses are in the categories of agriculture, forest, non-tidal wetlands, and other open space, as previously depicted in Map 20. Because of these landscapes are highly dependent upon a predictable range of water, extended periods of drought can stress vegetation, leaving the area open to invasive species, the vegetation more susceptible to disease, and the soil exposed to erosion factors that can strip critical nutrients, making it more difficult for the landscape to recover.

V. Build Out Analysis

A build-out analysis is crucial for understanding the potential environmental impacts of future development. By considering the maximum zoning potential, the analysis provides insights into how full development might affect the city, especially in terms of exposure to environmental risks like urban heat islands and flooding.

At present, city records show 194 developable vacant properties in the City of Salem totaling 146 acres. These properties were examined to determine the maximum amount of development permitted on site by current zoning. Both the underlying zoning and the zoning in the Waterfront Redevelopment Zone Plan were accounted for. In districts where both residential and commercial or industrial are permitted, residential was assumed as both the most likely scenario and the one posing the greatest risk to lives. This build-out analysis shows a maximum of 203 residential dwelling units and 19 industrial units permitted to be built.

Implications of Full Build-Out in Salem:

Urban Heat Island Effect: Increasing the developed land area could intensify the urban heat island effect. More buildings, roads, and other impervious surfaces can lead to higher temperatures in urban areas compared to surrounding rural areas. This necessitates the integration of green infrastructure, such as parks, green roofs, and tree planting, to mitigate this effect.

Flooding Risks: With more development, especially in flood-prone areas, the city may face increased vulnerability to flooding. This underscores the importance of strategic planning and the implementation of flood-resilient design in new developments, including permeable surfaces and adequate drainage systems.

Of the 203 potential residential units projected in the build-out analysis, 94 of them are in the FEMA 1% flood zone, 106 of them are in the inundation zone, and 149 of them are in the CAFE zone.

Environmental Sustainability: The potential increase in developed areas calls for sustainable development practices. This includes considering the ecological impact of new developments, preserving natural habitats, and ensuring that growth does not come at the expense of environmental health.

Infrastructure Demand: More development leads to increased demand for infrastructure such as roads, utilities, and public services. Planning for this growth requires a comprehensive approach to ensure that the infrastructure is sustainable and resilient.

Social and Economic Impacts: Increased development could have social and economic implications, including changes in housing availability, community dynamics, and economic opportunities. These changes need to be managed in a way that benefits the entire community.

A full build-out analysis in Salem, NJ, reveals not just the potential for growth, but also the need for careful, sustainable, and resilient planning. Balancing development with environmental conservation and risk mitigation is key to ensuring a livable and sustainable future for the city.

ZONING CATEGORIES IN SALEM

R-1 Residence: This zoning category is for moderate -density, single-family detached dwellings on at least 1/6 of an acre.

R-2 Residence: Like R-1, this zoning category allows moderate-density single-family detached dwellings, but with a minimum lot size of 1/8 of an acre.

PA Planned Apartment Districts: special provision for low lot coverage, low density with a minimum lot size of 4 acres, apartment development in designated portions of residence districts where deemed appropriate.

RL-C Residence-Limited Commercial: This category accommodates a mix of moderate-density housing types and limited commercial uses, with a minimum lot size of 1/8 of an acre

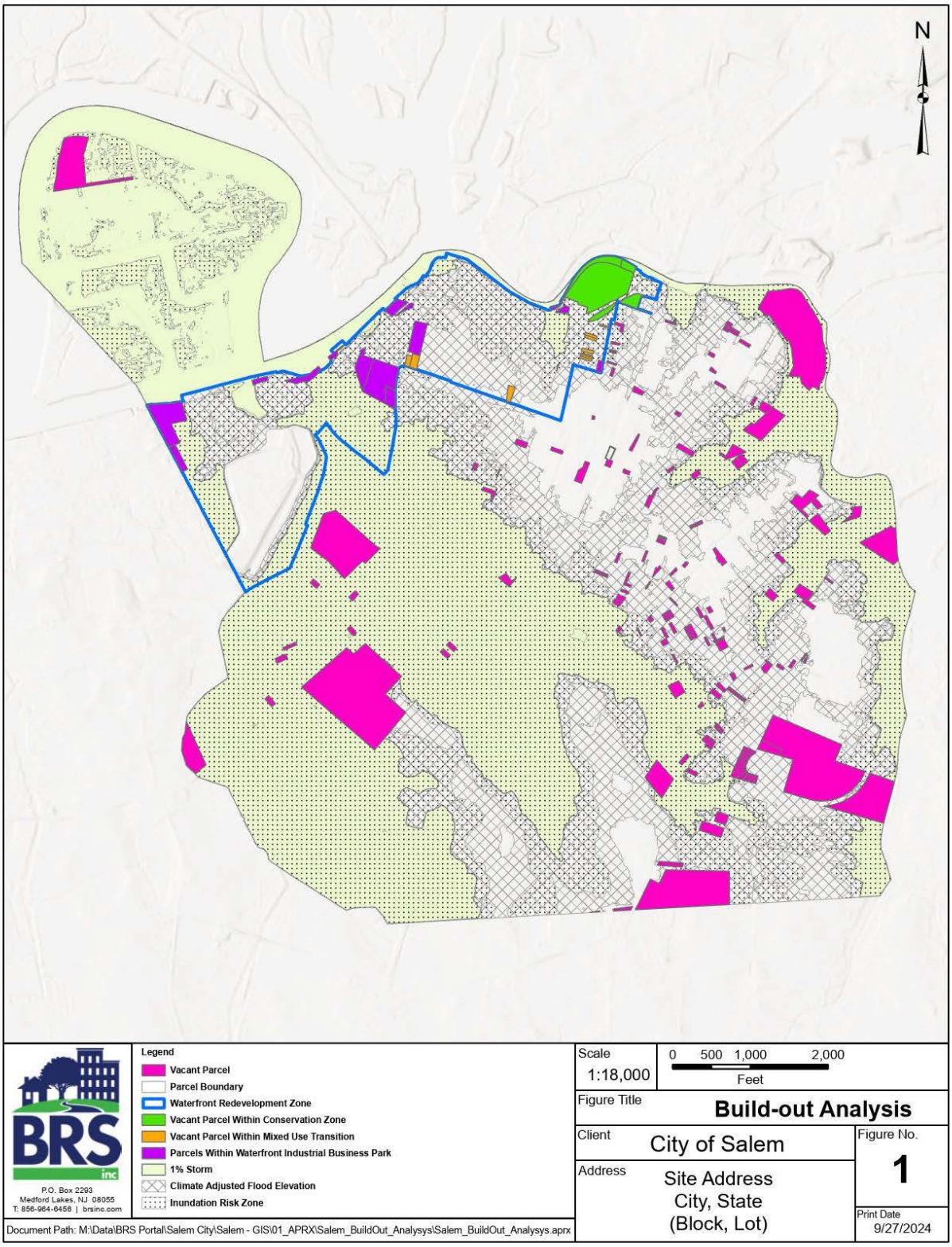
C-1 Retail Commercial: This category allows for compact commercial establishments, such as corner stores.

C-2 General Commercial: This category permits more extensive commercial uses, such as shopping centers, supermarkets, or larger retailers.

M-1 Light Manufacturing: In this category, the land uses are primarily light industrial, research, and development-related activities.

M-2 General Manufacturing: This zoning category accommodates heavier industry and manufacturing uses.

The effective Zoning Map in Salem is dated April 22, 1976, revised July 1, 1977.



Map 28: Salem City Build Out

Zoning

Zoning is closely related to land use and is intended toto carry out the vision of the Master Plan. However, many communities, including Salem, have outdated zoning regulations which can be reactive rather than forward looking. Zoning regulates what types of development and activities are acceptable on particular properties (such as residential, commercial or industrial), the densities of those developments (from low-density housing such as single family homes to high-density such as high-rise apartment buildings), the height of buildings, the amount of space structures may occupy, the location of a building on the lot (setbacks), the proportions of the types of space on a lot, such as how much landscaped space, impervious surface, on-site circulation and whether or not parking is provided.

The breakdown of the existing zoning in Salem is provided in Table 21, below.

Table 21: Acres of land and percentages by Zoning Categories

Zone	Total Acres	Percent of Total
R-1 Residence	858	49%
M-2 General Manufacturing	391	22%
R-2 Residence	288	16%
M-1 Light Manufacturing	102	6%
C-1 Retail Commercial	45	3%
RL-C Residence-Limited Commercial	44	2%
C-2 General Commercial	34	2%
Salem-Wide Total	1,761	100%

The zoning districts determine what uses are permitted where in the municipality. The Zoning regulations specify the types of permissible uses, site development standards (such as setbacks, lot coverage, and building heights), permitted signage, and parking requirements. They define the parameters for new development and can help ensure that new buildings and structures are safe, accessible, and environmentally responsible.

The State of New Jersey has flood zoning regulations that prohibits any new development within designated floodways, which all municipalities, including Salem must comply with. Floodways are areas identified as being an extremely hazardous area due to the velocity of floodwaters, potential floating debris and projectiles, and erosion potential.

Table 22: Salem Zoning Districts

Zoning District	Description	Minimum Lot Size	Density/Development Standards
R-1	Residential single family	7,200 sq. ft.	One unit per lot
R-2	Residential single family and semidetached	7,200 sq. ft. – single 3,600 sq. ft. – per family semidetached	
PA	Planned Apartment	4 acres for overall development	Low lot coverage, low-density apartment development (No vacant properties meet

			minimum lot size requirements)
RL-C	Residence – Limited Commercial	Same as R-2 for residential, no minimum for commercial	Residential as in R-2, along with office uses
C-1	Retail Commercial	Same as R-2 for residential, no minimum for commercial	Supports retail, restauraunts, and similar scale commercial
C-2	General Commercial	Same as R-2 for residential, no minimum for commercial	Supports larger commercial uses such as shopping centers and warehouses
M-1	Light Manufacturing	No minimum for industrial	Lighter manufacturing and assembly uses
M-2	General Manufacturing	No minimum for industrial	Heavier industrial uses separated from residential areas

Based on the designated zones and land use of the 1,190 acres zoned for residential uses (including R-1, R-2, and RL-C), only 35% or 416 acres have been built out. For commercial uses (including C-1 and C-2) of the total 79 acres zoned in the City, 128 acres have been built out, or 162%, indicating the challenge with outdated zoning ordinances. Industrial zones (M-1 and M-2) comprise over 492 acres in the city (28%) and based on the 2015 land use is only 16% built out.

Both Graph 3, Zoning Acres in Flood Areas, as well as Table 23, Flood Areas and Zoning, depict each zone in the city, the total acreage of each, and the respective acreage within the current Flood Hazard Area (FHA), the Inundation Risk Zone (IRZ), and the Climate-Adjusted Flood Elevation (CAFE).

Graph 2: Zoning Acres in Flood Areas

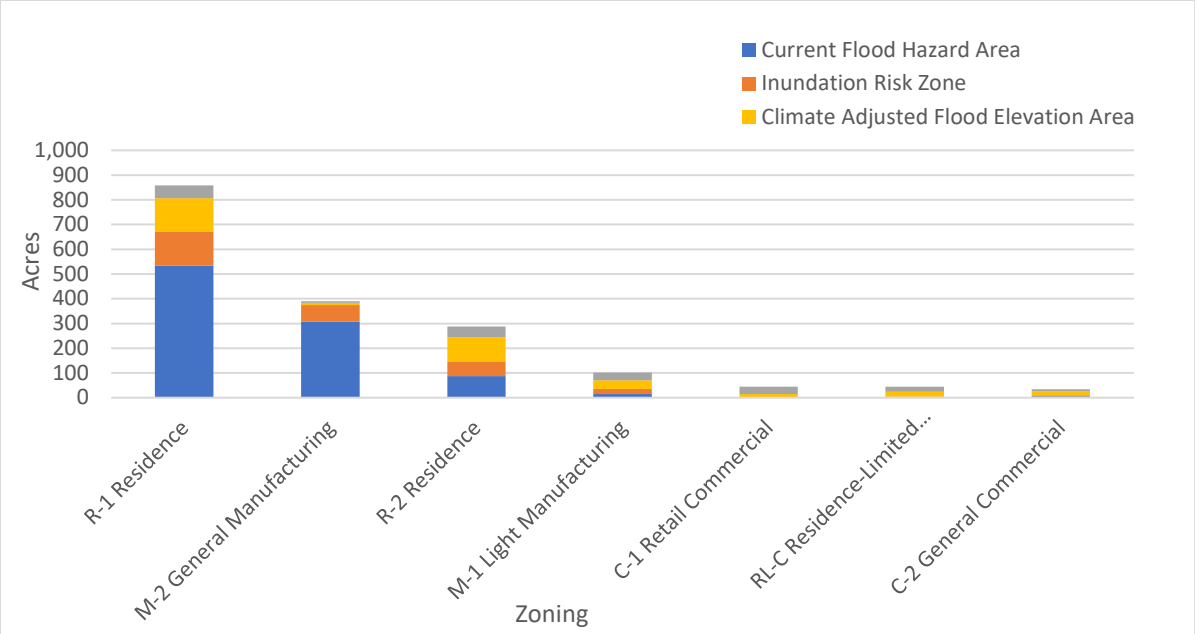


Table 23: Flood Areas and Zoning

Zoning	Total Acres in Entire City	FEMA 1% Annual Chance Flood Hazard / Existing New Jersey Flood Hazard Area	Inundation Risk Zone	Climate Adjusted Flood Elevation (CAFE) Zone	Expansion of floodplain (FEMA 1% to IRZ)	Expansion of floodplain (IRZ to CAFE)	Outside Floodplain
R-1 Residence	858.2	533.3	672.1	807.0	138.8	134.9	51.3
M-2 General Manufacturing	390.6	306.6	374.2	383.1	67.6	8.9	7.5
R-2 Residence	287.8	87.8	146.6	243.6	58.9	97.0	44.2
M-1 Light Manufacturing	101.5	14.8	35.4	70.3	20.6	34.9	31.1
C-1 Retail Commercial	44.5	0.3	1.4	14.3	1.1	12.9	30.2
RL-C Residence-Limited Commercial	44.4	3.3	4.9	24.3	1.7	19.4	20.1
C-2 General Commercial	34.4	5.7	9.1	24.8	3.3	15.7	9.6
Total Acres	1,761	952	1,244	1,567	292	324	194

Table 24: Mapped Flood Areas and Zoning lists each zone in the city, the total acreage of each zone, and the respective percentage within the current Flood Hazard Area (FHA), the Inundation Risk Zone (IRZ), and the Climate-Adjusted Flood Elevation (CAFE).

Table 24: Mapped Flood Areas and Zoning

Zone	Total Acres	Percent of Total	% in Current FHA	% in IRZ	% in CAFE
R-1 Residence	858	49%	62%	78%	94%
M-2 General Manufacturing	391	22%	78%	96%	98%
R-2 Residence	288	16%	30%	51%	85%
M-1 Light Manufacturing	102	6%	15%	35%	69%
C-1 Retail Commercial	45	3%	1%	3%	32%
RL-C Residence-Limited Commercial	44	2%	7%	11%	55%
C-2 General Commercial	34	2%	17%	26%	72%
Salem-Wide Total	1,761	100%	54%	71%	89%

Some notable findings from these tables include:

1. High Vulnerability in Residential and Manufacturing Zones:
    - The R-1 Residence zone, covering 858.2 acres (49% of the city), is highly susceptible to flooding. Approximately 62% of this area is in the FEMA 1% Annual Chance Flood Hazard Area, increasing to 78% in the Inundation Risk Zone (IRZ), and 94% in the Climate Adjusted Flood Elevation (CAFE) Zone.
    - The M-2 General Manufacturing zone, covering 390.6 acres (22% of the city), shows a similar pattern of high flood risk, with 78% in the FEMA flood hazard area, escalating to 96% in the IRZ and 98% in the CAFE Zone.
2. Significant Flood Expansion in Light Manufacturing and Commercial Areas:
    - The M-1 Light Manufacturing and C-1 Retail Commercial zones demonstrate notable expansions in floodplain coverage when moving from the FEMA 1% area to the CAFE Zone. M-1 Light Manufacturing zone sees an increase from 15% in the FEMA flood hazard area to 69% in the CAFE Zone. For C-1 Retail Commercial, this increase is from 1% to 32%.
3. Residential-Limited Commercial and General Commercial Zones:
    - The RL-C Residence-Limited Commercial and C-2 General Commercial zones cover smaller areas (44.4 acres and 34.4 acres, respectively) but show a substantial increase in flood risk in the CAFE Zone (55% for RL-C and 72% for C-2).
4. Overall City Vulnerability:
    - Overall, Salem shows a significant vulnerability to flooding. About 54% of the city's total area is within the FEMA 1% flood hazard area, which increases to 71% in the IRZ and 89% in the CAFE Zone.

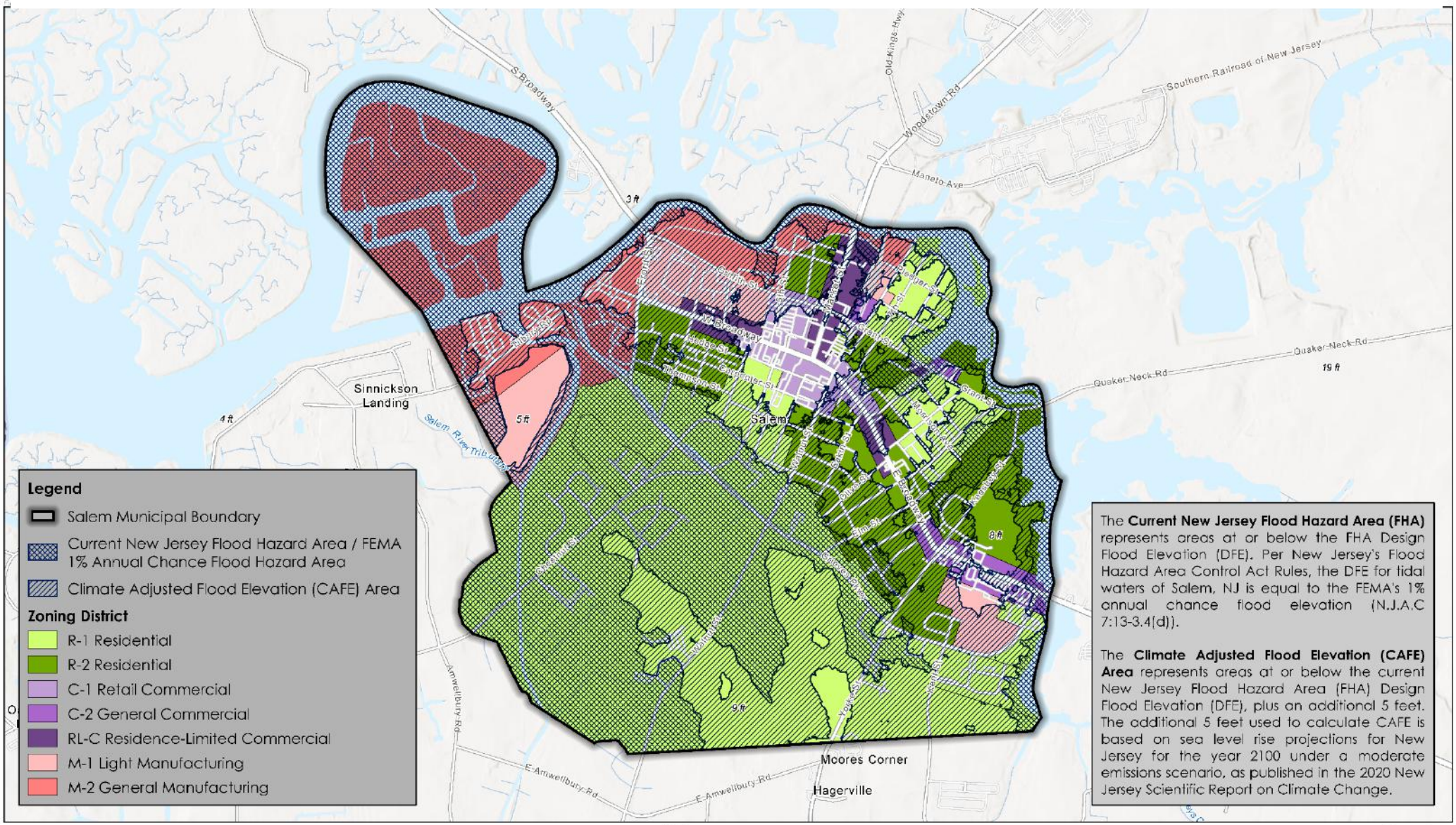
5. Expansion of Floodplain:
    - The floodplain expansion is significant when comparing impacts in the FEMA 1% area, the IRZ, and CAFE Zone. The total acres affected are 292 acres from FEMA 1% to IRZ and an additional 324 acres from IRZ to CAFE.

Implications:

- These findings indicate that a large proportion of Salem, especially residential and manufacturing zones, is at high risk for flooding. This has critical implications for urban planning, emergency preparedness, and infrastructure development.
- The expansion of floodplains into areas not traditionally considered at high risk for flooding, particularly in the light manufacturing and commercial zones, necessitates revisiting and updating flood mitigation strategies and zoning regulations.
- The data underscores the need for comprehensive flood risk management and resilience planning to protect communities and critical infrastructure in Salem.

Map 29: Zoning in Existing and Future 1% Storm Flood Areas, along with Map 30: Zoning in Existing and Future Tidal Inundation Areas, provides a comprehensive overview of Salem's the areas within the city, along with their corresponding zoning, that are affected by the increased flood risk.

Map 29: Zoning in Existing and Future 1% Storm Floodplains



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NOTES:
1. Zoning districts provided by the City of Salem.
2. FEMA 1% Annual Chance Flood Hazard Area, effective 06/16/2016, obtained from FEMA Flood Map Service Center: https://msc.fema.gov/portal/
3. CAFE area produced using NJ Adapt Flood Mapper: https://www.njfloodmapper.org/
4. Salem municipal boundary obtained from New Jersey Geographic Information Network (NJGIN) Open Data portal: https://njgin.nj.gov/
5. Basemap obtained from ESRI basemap services.

Spatial Reference: NAD 1983 2011 StatePlane New Jersey FIPS 2900 F US

0 700 1,400 Feet

ZONING IN EXISTING AND FUTURE 1% STORM FLOODPLAINS

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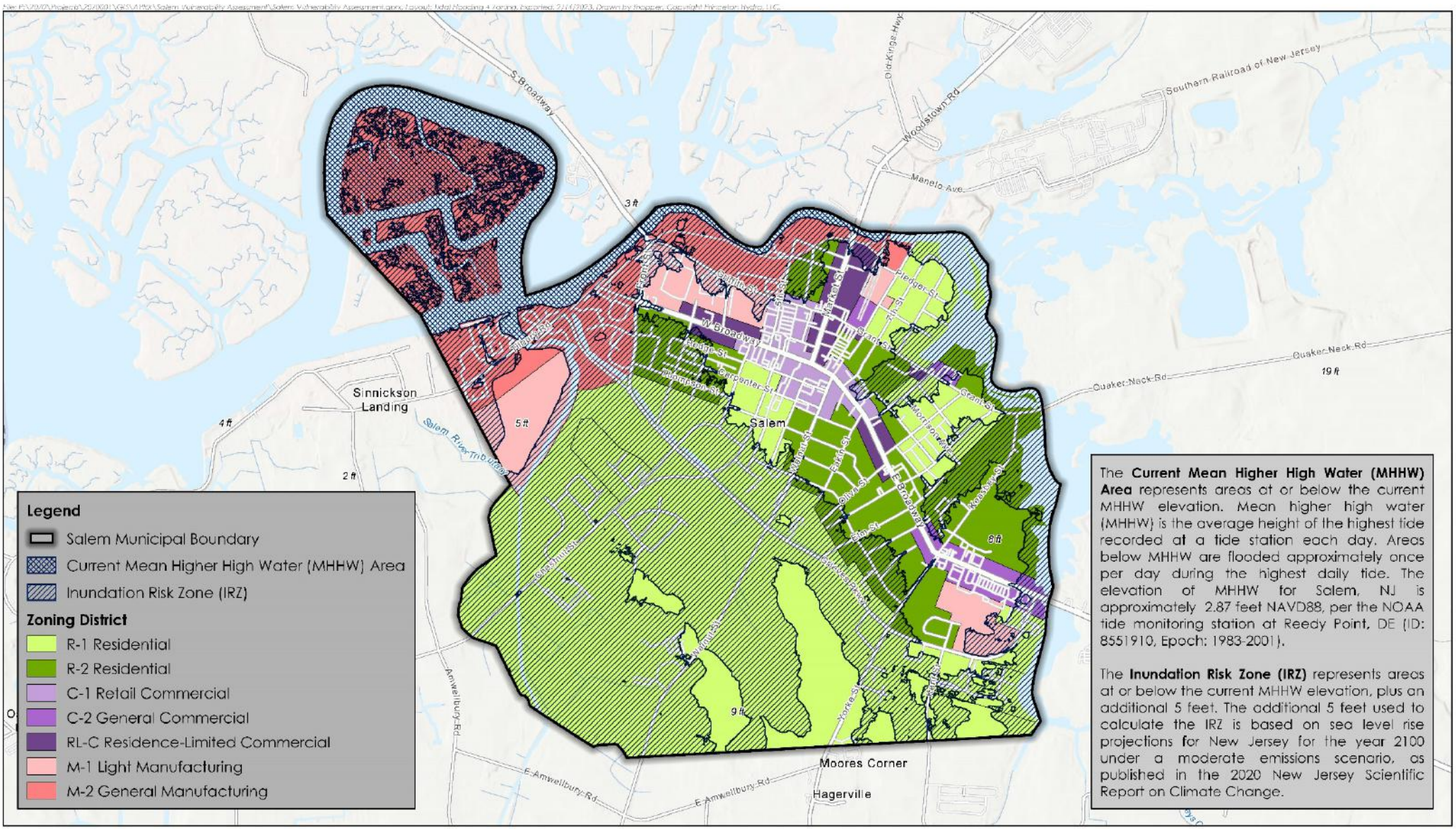
Map 30: Zoning in Existing and Future Tidal Inundation Areas



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NOTES:
1. Zoning districts provided by the City of Salem.
2. Current MHHW area and IRZ produced using NJ Adapt Flood Mapper: https://www.njfloodmapper.org/
3. Salem municipal boundary obtained from New Jersey Geographic Information Network (NJGIN) Open Data portal: https://njgin.nj.gov/
4. Basemap obtained from ESRI basemap services.

Spatial Reference: NAD 1983 2011 StatePlane New Jersey FIPS 2900 Ft US

0 700 1,400 Feet

ZONING IN EXISTING AND FUTURE TIDAL INUNDATION AREAS

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VI. Impacts of Natural Hazards on Relevant Elements of the Master Plan

The City's Comprehensive Master Plan was developed in 1974 and provided a summary of current conditions and an inventory of the community population, housing, services and transportation. It provided an overview of the City capital budget, an employment analysis, and a review of future land use projections. A brief summary of the objectives and policies follows:

1. Encourage types of development and uses which, while consistent with other policies and goals, will increase the financial capability of the City to provide required community services and facilities;
2. Preserve and strengthen the four basic roles of Salem: a residential community, a County seat, a regional commercial center, and a source of industrial employment;
3. Prevent the spread of haphazard and incompatible mixtures of residential, commercial and industrial development;
4. Provide for adequate and diversified housing supply in attractive healthful and safe environments;
5. Continue the City's program to eliminate substandard housing;
6. Maintain an active and viable central business district;
7. Encourage the location of additional industries in appropriate areas, and the continued expansion of existing industries;
8. Provide for adequate community facilities, including programs to meet social, cultural and recreational needs;
9. Provide for safe and convenient circulation within the City and to points beyond;
10. Protect to the maximum extent possible and promote the best use of the remaining open spaces in the City.

The 1974 Comprehensive Plan has subsequently been reexamined in 1978, 1982, 1989, 1996, 2002, and most recently in 2012. The 2012 Re-examination Report explains that since the original planning document was created, the City has undergone a dramatic decline in population and industrial activity that has changed the community of Salem. New activities have emerged to shape the future of the City. The 2012 Re-examination Report states that despite all the changes over the years, the originally stated goals and objectives enumerated in the 1974 Master Plan are still relevant to guide the future development of the City of Salem.

Two elements were added to the Master Plan to guide the City policies on Housing and Historic Preservation. The Historic Preservation Element was added in 1991 and the Housing Element was amended in 2001. Furthermore, several redevelopment plans were prepared for targeted areas including the Port District, Main Street and Waterfront Area to help spur much-needed economic growth and development. These plans haven't yet seen redevelopment projects that have impacted the buildout analysis. See Map 25: Economic Development Features In Existing And Future 1% Storm Floodplains

Additional emphasis in the Master Plan needs to be added or amended to include natural hazards due to climate change. These goals of the Master Plan and the latest 2012 Re-Examination Report stated above are likely to be impacted by climate change, particularly the impact of natural hazards such as floods, temperatures sea level rise, hurricanes and drought which may affect the safety and welfare of the city's residents. Specifically:

Goal 2: The spread of haphazard and incompatible mixtures of development could contribute to a more significant risk of flooding and other natural disasters in vulnerable areas, affecting public safety.

Goal 3: Climate change can impact housing availability and affordability through increased property damage and destruction, higher insurance costs, and impacts on household budgets due to energy costs and resilience measures.

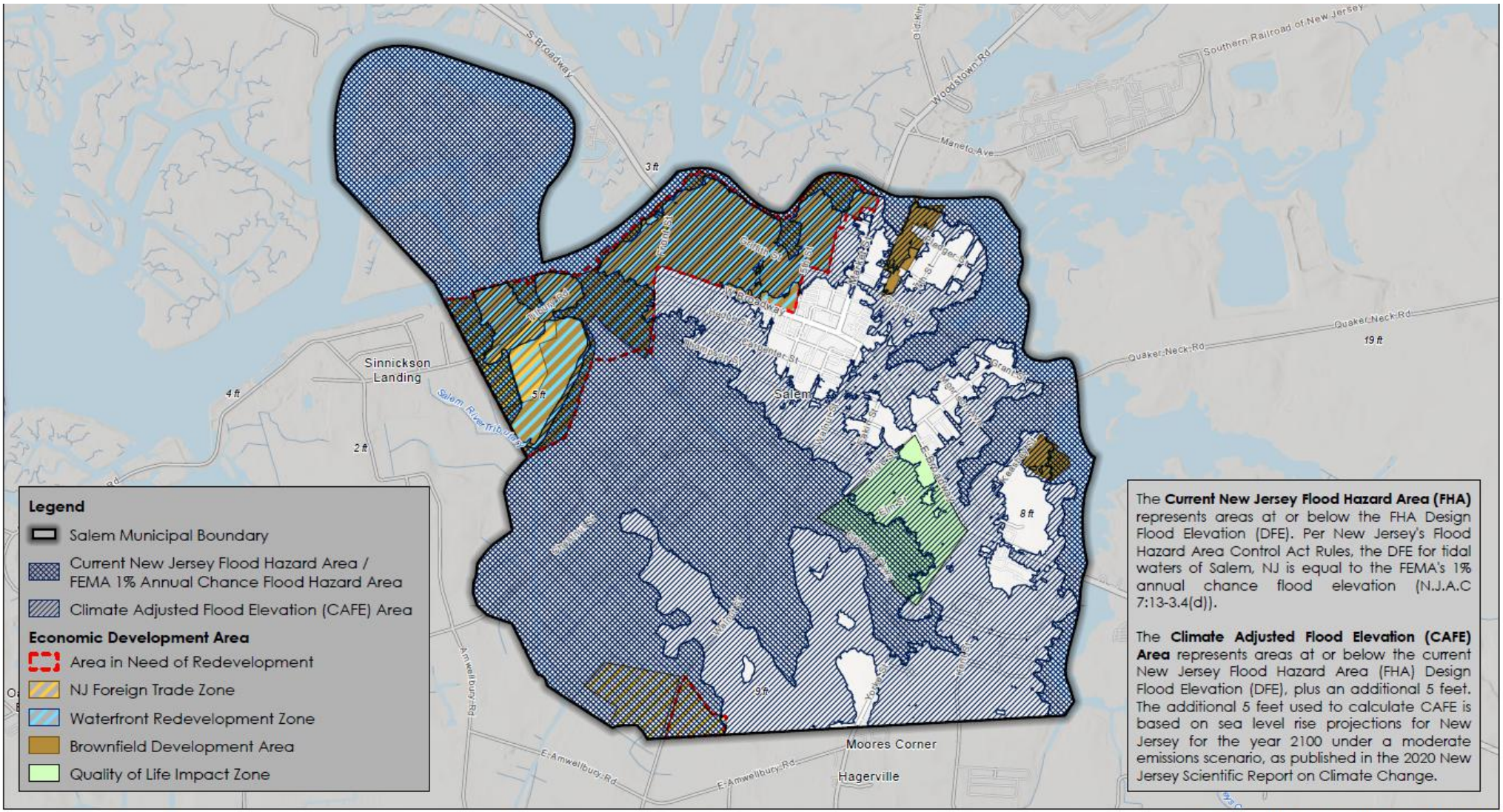
Goal 4: Climate change impacts on social, cultural, and recreational resources such as parks, trails, cultural events, and public transportation due to flooding, extreme weather events, and other disasters require careful planning and management.

Goal 5: Transportation infrastructure can be vulnerable to natural hazards and extreme weather events, leading to disruptions in economic activity and mobility.

Goal 6: Open spaces and natural habitats within the community can provide essential ecosystem services such as buffering against sea-level rise and storm surge. Preserving open space is essential to maintain these benefits and support a more sustainable and resilient community.

With the support of the State of New Jersey Department of Community Affairs, Local Planning Services, the City of Salem will undergo a Master Plan process in 2024, the plan will include the CCRHVA and develop a plan for the City that includes the climate related challenges.

Map 31: Economic Development Features In Existing And Future 1% Storm Floodplains



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NOTES:
1. Waterfront redevelopment zone obtained from the City of Salem, NJ.
2. Other economic development features obtained from the NJ Geographic Information Network (NJGIN) Open Data portal: https://njgin.nj.gov/.
3. FEMA 1% Annual Chance Flood Hazard Area, effective 06/15/2016, obtained from FEMA Flood Map Service Center: https://msc.fema.gov/portal/
4. CAFE area produced using NJ Adapt Flood Mapper: https://www.njfloodmapper.org/
5. Trenton municipal boundary obtained from New Jersey Geographic Information Network (NJGIN) Open Data portal: https://njgin.nj.gov/
6. Basemap obtained from ESRI basemap services.

Spatial Reference: NAD 1983 2011 StatePlane New Jersey FIPS 2900 Ft US

ECONOMIC DEVELOPMENT FEATURES IN EXISTING AND FUTURE 1% STORM FLOODPLAINS

RESILIENT NJ VULNERABILITY ASSESSMENT
BROWNFIELD REDEVELOPMENT SOLUTIONS, INC.
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Housing Element and Impact on Affordable Housing

The City's Housing Element and Fair Share plan was originally prepared in 1987 and amended in 2001 and 2002. Salem City provided adequate affordable housing and rehabilitation of housing and received COAH certification of their Housing Element and Fair Share Plan. The City adopted the Carpenter Street Redevelopment Plan in 2000 to address its need for Rehabilitation. This included an estimated 63 properties to be considered for rehabilitated or constructed affordable housing.

The current affordable housing in Salem is listed in the Critical Facilities table. All but one of the properties are affected by flooding in one capacity or another. Moving forward, the City of Salem must address these affordable housing areas and apply stormwater management techniques to minimize the risks to these vulnerable areas. The City needs to update its Housing Element and Fair Share Plan to address these needs.

Historic Preservation Element

The Historic Preservation Element was added to Salem's Master Plan in 1991, and it recognized that Salem has a long and significant history, and that conserving that heritage is a necessary community goal. As such, it is important to take climate impacts into account when determining the means for preserving historic landmarks, as their vulnerability to hazards will be increasing. The Historic Preservation Element should be updated to reflect these threats, and to provide specific information on strategies to protect this heritage, through stormwater diversion, thoughtful design techniques, and forward thinking construction measures during rehabilitation work.

Circulation Plan Element

The Circulation Plan Element of the Master Plan dates to 1978, when the plan was first introduced. It is critical that this portion of the plan take into account climate vulnerabilities during the next plan update. Specifically, evacuation routes should be considered to ensure that vulnerable populations are able to safely evacuate during extreme storms, flooding, or other climate related emergencies. Likewise, consideration should be given to the ability of residents to access emergency services such as cooling stations and medical facilities.

Redevelopment Areas

Salem Council adopted the Salem Waterfront Redevelopment Zone Plan in March 2018. The Redevelopment Area encompasses roughly 212 acres and 142 parcels within the City, portions of which were previously designated as Areas in Need of Redevelopment, and are currently in a New Jersey Department of Environmental Protection (DEP) Brownfield Development Area (BDA). The Redevelopment Area consists largely of active and vacant industrial sites, former gasoline service stations, a former heating oil storage facility, and the closed Salem Sanitary Landfill. The Plan proposes a Waterfront Industrial Business Park Zone, a Mixed-Use Transition Zone, and a Conservation/Preservation Zone.

The Mayor and City Council of Salem adopted Resolution 13-152 declaring the entirety of the City of Salem as an "Area in Need of Rehabilitation" pursuant to N.J.A.A. 40A:12A-1 in 2022. In June 2022, the City of Salem passed Ordinance No. 22-07 Adopting a Redevelopment Plan for the entirety of the City of Salem. This city-wide Redevelopment Plan provides a more focused approach for redevelopment and rehabilitation for the entire City, addressing the deteriorating conditions within the City and stimulating private investment through the designation of the entire City an "Area in Need of Rehabilitation". The City seeks to alleviate the conditions of blight found in the Rehabilitation Area and supports the use of property

in the area in a manner which will better serve the public health, safety, and welfare of the community and region.

The Redevelopment Plan states the following goals and objectives:

1. Eliminate those conditions that cause the Rehabilitation Area to be considered an "Area in Need of Rehabilitation".
2. Stimulate private investment in the Rehabilitation Area by assembling sites and assisting as necessary and appropriate to support such rehabilitation.
3. Make available the full range of benefits and inducements for the Rehabilitation Area, including federal, state, county and local government funding.
4. Foster public-private partnerships to accomplish revitalization of the Rehabilitation Area in a manner that best serves the needs of the community, strengthens the local economy, attracts residents to the area, and contributes to the continuing vitality of the city.

The City of Salem is currently undertaking a Preliminary Investigation Study to determine if the Grieves Parkway site should be established as a non-condemnation area in need of redevelopment.

All rehabilitation and redevelopment areas must be carried out in a way to address the findings of the CCRHVA. The location of development or preservation of green space must be strategically completed with the vulnerability results in mind. A rehabilitation or redevelopment plan should be prepared that establishes specific standards and building requirements to promote resiliency and sustainability.

Strategies

This section outlines a series of targeted strategies and guidelines, to address Salem City's vulnerabilities to climate-related hazards, such as flooding from sea-level rise, riverine flooding, extreme weather events, extreme heat, and drought. These strategies are not only a blueprint for building a more resilient Salem but also serve as a commitment to preserving our community's ecological, cultural, and socio-economic fabric in the face of these unprecedented challenges. By implementing these strategies, Salem aspires to set a standard for climate resilience, ensuring a safer, more sustainable future for all its residents.

1. Flooding:
    - Devote more land to natural barriers like wetlands to absorb overflow, such as along Keasbey Creek and Mud Diggers Ditch to store and manage water that isn't draining during storm events.
    - Stormwater Management Upgrades: Increase maintenance of stormwater and sewer systems and integrate green infrastructure to handle heavy rainfall and reduce overflow.
    - Integrated Green Infrastructure: Develop an integrated network of green infrastructure, including bioswales, rain gardens, and retention basins, to manage stormwater naturally.
    - Upgraded Drainage Infrastructure: Modernize and expand stormwater drainage systems to accommodate increased runoff volumes, incorporating smart technology for adaptive management.
    - Stormwater Utility Fees: Implement a stormwater utility fee based on the impervious surface area of properties to fund infrastructure improvements and incentivize permeable surfaces.
    - Flood-Proofing: Implement retrofit programs for vulnerable homes including raising structures and waterproofing.

- Stormwater-Resilient Development: Encourage new developments in vulnerable areas to incorporate stormwater management solutions, such as permeable pavements and rainwater harvesting systems, through zoning reforms.
- Elevate critical transportation infrastructure in flood-prone areas to ensure continuity during flooding. This includes bus route 468 and 401 along Broadway and Market Streets.
- Adaptation for Stormwater Challenges: Enhance drainage systems around key transit routes to prevent urban stormwater flooding from disrupting services.
- Develop community-based disaster response plans with evacuation routes and shelters, focusing on accessibility for vulnerable populations.
- Structural Assessment and Reinforcement: Conduct detailed structural assessments of the Town Bank and Fenwick Creek levees to identify vulnerabilities and implement necessary reinforcements or upgrades.
- Update Emergency Action Plans: Ensure that all levee systems have up-to-date EAPs and inundation maps to enhance emergency response and evacuation strategies.
- Community Engagement and Awareness: Increase community awareness about levee systems, their status, and the actions residents should take during a levee failure event.
- Economic Programs: Launch initiatives supporting sustainable, flood-resilient industries, providing job opportunities and economic aid to those in poverty.
- Healthcare and Social Services: Enhance services with a focus on reaching vulnerable populations during floods, including mobile health units and targeted outreach.
- Financial Assistance and Insurance: Help and encourage insurance for high-risk flood areas to manage recovery costs effectively.
- Green Infrastructure: Implement urban forests and rain gardens to mitigate flooding and create communal recreational spaces.

2. Drought:
    - Water Conservation and Extreme Temperature Ordinances: Develop ordinances for drought and extreme heat events.
    - Water-Smart Landscaping Incentives: Promote xeriscaping and drought-tolerant native plants through rebates or tax incentives for property owners.
    - Community Water Saving Initiatives: Encourage community participation in water conservation through challenges, education programs, and public recognition of water-saving achievements.

3. Extreme Heat:
    - Cool Roofs and Green Roofs: Mandate or incentivize the installation of cool and green roofs on buildings to reduce heat absorption.
    - Expanded Urban Canopy: Launch a large-scale tree planting initiative targeting streets, parks, and residential areas to provide shade and cooling.
    - Public Cooling Centers: Establish accessible cooling centers in public buildings like schools and libraries, particularly in neighborhoods with vulnerable populations.

4. Extreme Weather (Including Hurricanes and Storms)
    - Enhanced Forecasting and Warning Systems: Invest in weather forecasting technologies and communication systems for timely public warnings.

- Robust Utility Infrastructure: Strengthen power lines, water pipes, and other utility infrastructures to withstand high winds and flooding, including the use of underground cabling where feasible.
- Disaster-Resilient Planning: Ensure new developments and infrastructure projects are designed with resilience in mind, incorporating green spaces, water-absorbent surfaces, and emergency access routes.
- Transportation Infrastructure Improvement: Improve roads and bridges to maintain access to key facilities during extreme weather events. Improve systems for hurricane response.
- Relocation of Critical Facilities: Assess and potentially relocate critical facilities out of high-risk areas.

5. Sea Level Rise:
    - Explore potential for sea walls and tide gates to protect against rising sea levels and storm surges. There are intermediate steps such as updates to the bulkhead areas at the waterfront business corridor.
    - Retrofit homes in vulnerable areas with waterproofing, and raising where possible.
    - Develop community-based disaster response plans with evacuation routes and shelters, focusing on accessibility for vulnerable populations.
    - Target buyout programs in areas most at risk, offering fair compensation and support for
    - relocation.

Recommended Ordinances to be considered:

Floodplain Management Ordinances: Regulations to manage development in flood-prone areas, including requirements for elevated structures and specific construction standards to mitigate flood risk.

Zoning Ordinances for Environmental Protection: Zoning laws that protect ecological areas and limit development in sensitive regions, aiding in flood control and ecosystem preservation.

Green Infrastructure Ordinances: Mandates for integrating green infrastructure, like green roofs and permeable pavements, in new developments and major renovations, to enhance natural water absorption and reduce runoff.

Building Codes for Resilience: Updating building codes to ensure that all new constructions and major renovations are resilient to flooding and other climate-related hazards.

Incentive Programs for Resilient Development: Establishing incentives for developers and homeowners to incorporate flood-resilient features in their projects, such as tax breaks or expedited permit processes.

ATTACHMENT 1: Methodology

The CCRHVA for Salem was conducted using a systematic methodology that integrated various data sets and spatial analysis. The project team aimed to assess the community's vulnerability to climate change impacts and identify the most vulnerable areas and assets. The team collaborated with the Bureau of Climate Resilience Planning (BCRP) within the New Jersey Department of Environmental Protection (NJDEP) to guide the project.

During the assessment, the project team analyzed existing data, collected new information, and conducted outreach efforts to learn about the community's priorities and concerns, including how residents experience impacts and the most critical assets that require protection. This involved conducting interviews with representatives of government departments to get more information on their experience.

The methodology included an assessment of various subjects, such as critical infrastructure, community assets, cultural resources, land use and zoning, vulnerable populations, and ecological resources. By assessing these subjects, the project team identified areas and assets that were potentially more vulnerable to climate change impacts and provided policymakers with information to prioritize investments in adaptation and mitigation strategies.

Impact Analysis Subjects

- Critical Infrastructure
- Community Assets
- Cultural Resources
- Land Use and Zoning
- Vulnerable Populations

Ecological Resources

The methodology for the CCRHVA of Salem provided a comprehensive understanding of the potential hazards facing the community. The project team brought together existing resources, data, and online tools, and analyzed relevant information for assessing vulnerability to climate change impacts. Ultimately, these findings were used to provide recommendations for policymakers.

Impacts and Hazards

Climate change impacts and hazards are different but interconnected concepts. Climate change impacts refer to any physical, ecological, or societal effect of climate change that is observed or expected and that affects or will affect natural and human systems. Climate change impacts can be positive, negative, or neutral and can be either direct or indirect. Examples are changes in temperature, precipitation, ocean acidity, ocean levels, and frequency or intensity of weather events.

Climate change hazards occur when these impacts negatively affect a community as potential sources of harm. This includes high winds, flooding, drought, and extreme heat that present damage or harm to human or natural systems. Hazards can lead to adverse outcomes depending on how vulnerable and exposed a given system or population is to their impacts.

In discussing climate change, it is important to consider both impacts and hazards. Climate change impacts are often discussed in the context mitigation of climate change and require action at multiple scales and sectors, including policy, societal, and individual levels. The context in which hazards are discussed tends to be more focused on risk management and disaster preparedness, where the emphasis is on reducing vulnerabilities and building resilience to weather-related events.

Vulnerability Assessments and Hazard Mitigation Plans

In New Jersey, the law that governs the development of Hazard Mitigation Plans is the Disaster Control Act of 1987, which is administered by the New Jersey Office of Emergency Management (NJOEM). According to FEMA's (Federal Emergency Management Agency) guidelines, Hazard Mitigation Plans

(HMPs) must be updated at least once every five years to remain eligible for federal funding under FEMA's Hazard Mitigation Assistance (HMA) Grant Programs. In compliance with FEMA's guidelines, the NJOEM requires that all county and municipal governments in the state prepare and maintain a Hazard Mitigation Plan that outlines strategies to reduce the risk of natural hazards and disasters.

In addition to the five-year update requirement, the plan should be based on scientific and technical data, consider the results of risk assessments, and involve stakeholders and the public in the planning process. A CCRHVA, resilience action plan, and a hazard mitigation plan are important tools used in disaster risk reduction and management. While they have similar objectives of reducing the potential impact of hazards on human and natural systems, they differ in their scope and time frame.

A CCRHVA aims to identify the most vulnerable groups, sectors, and systems to hazards and assess their capacity to cope with potential damages or disruptions. It is primarily concerned with how climate change hazards affect different parts of a community and determines how vulnerable each part is.

A Resilience Action Plan determines what actions can be taken to minimize the impacts of potential hazards and build resilience. The CCRHVA and action plan are usually carried out as a part of the adaptation planning process and involves stakeholders at the local, state, or national level.

A hazard mitigation plan, on the other hand, is a document that identifies and assesses hazard risks, proposes ways to reduce or eliminate risk exposure, and prioritizes mitigation measures for implementation. The hazard mitigation plan is typically focused on reducing the impact of natural hazards and disasters and is part of Disaster Risk Reduction (DRR) and Management. It usually involves multiple agencies and stakeholders, assessment of various types of hazards, and prioritization of actions based on risk assessments.

A CCRHVA and action plan should inform the development of a hazard mitigation plan. The CCRHVA can help identify the areas of highest risk and help determine the mitigation actions that will be most effective for those areas. Similarly, a hazard mitigation plan can build upon and expand the work done through a CCRHVA to reduce the exposure of vulnerable groups and systems to natural hazards. By working together, these plans can help communities reduce their risk exposure and build resilience to the impacts of climate change and other hazards. Salem County is undergoing an update and revision of their Hazard Mitigation Plan, and the city is coordinating with the County to share data and information.

Vulnerable Populations

The methodology employed in the CCRHVA incorporates a detailed approach to identifying areas and populations at risk due to climate change impacts. The assessment specifically includes various demographic groups that are often more vulnerable to these impacts. Below is an expanded explanation of the vulnerable populations considered in the analysis:

1. Elderly Population: This group includes individuals aged 65 and above. Elderly populations are particularly vulnerable to extreme weather conditions such as heatwaves and cold snaps, and they may also have limited mobility or resources to adapt to or recover from climate-related events.
2. Youth Population: This category encompasses individuals aged 17 and younger. Children and teenagers can be more susceptible to health risks from poor air quality and extreme temperatures. They also rely heavily on adult care and infrastructure, such as schools, which can be disrupted by climate events.

3. **Disabled Population**: This segment includes individuals with physical or mental disabilities. They may face additional challenges during climate emergencies, such as barriers in accessing evacuation routes or health care services and might require special accommodations during such events.
4. **Low-Income Population**: Populations living in poverty are often more affected by climate change impacts due to limited resources to adapt or respond to environmental hazards. They may live in areas with inadequate infrastructure or lack access to resources that can help mitigate the effects of climate change.

    Total Population: The overall population was considered to assess the broad impact across the entire community, including all demographics.

    Total Households: The total number of households within the area was analyzed to understand how many units could potentially be impacted by climate change, considering factors like housing stability and density.
5. **Households Without Vehicles**: This group represents households that do not have access to a vehicle, which can be a critical limitation during evacuations or in accessing resources during climate emergencies.

Spatial analysis was crucial in integrating these demographic layers into a comprehensive vulnerability map. The mapping highlights urban heat island severity areas, tree canopy coverage, populations vulnerable to extreme heat and poor air quality, and flood-prone regions. By understanding where these vulnerable populations are located and how they overlap with environmental risk factors, the CCRHVA can inform targeted strategies to enhance resilience and provide support where it is most needed.

Flooding

Coastal Flooding

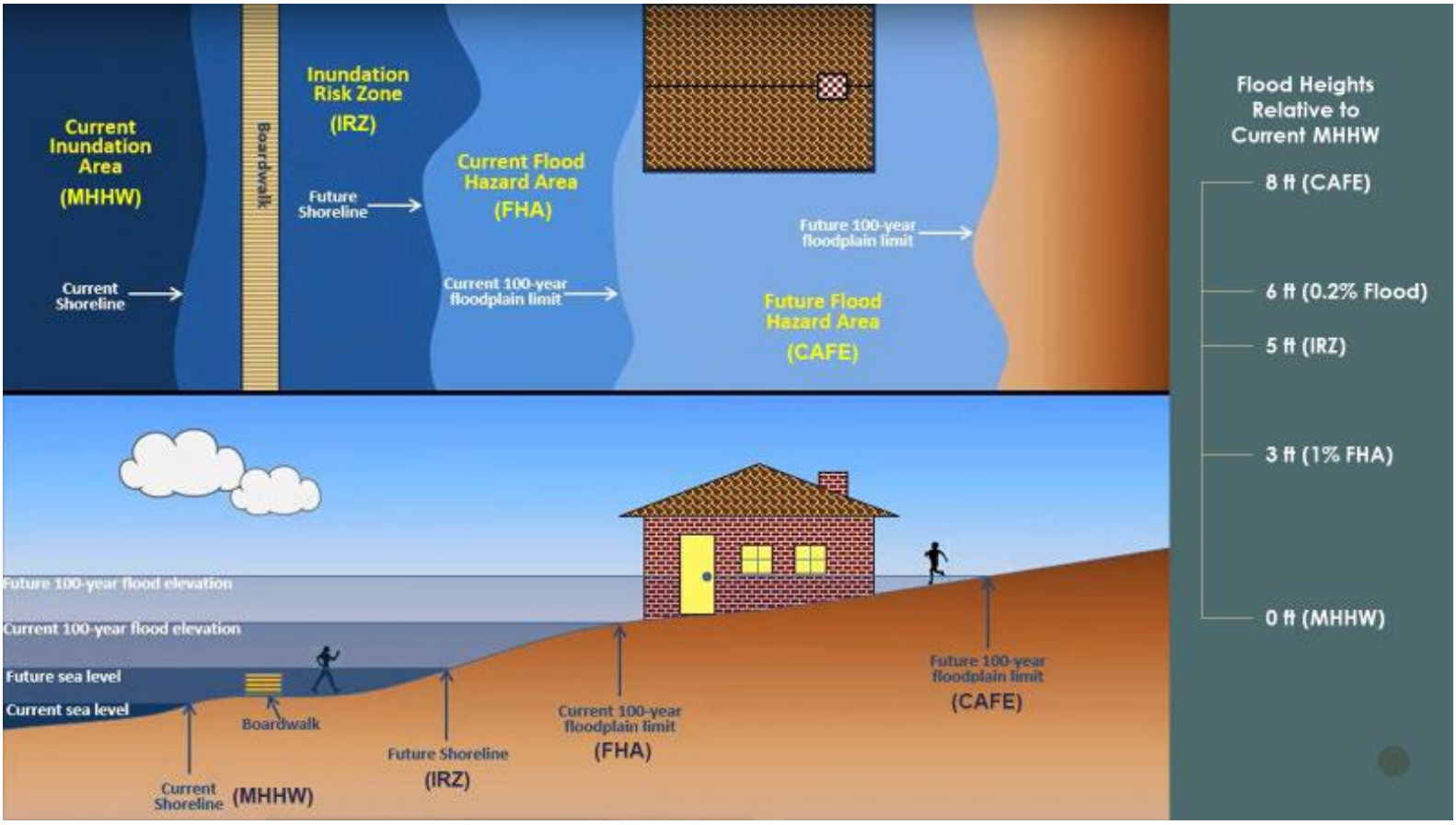
As Salem is a coastal community with tidal influences, sea level rise is an important impact to consider. Flooding poses various challenges to Salem, including increased coastal flooding, erosion, and saltwater intrusion into coastal aquifers. These impacts can have significant implications for the city's infrastructure, economy, and natural environment. By integrating sea level rise into the CCRHVA, Salem gains a comprehensive understanding of the potential risks and vulnerabilities associated with coastal areas.

Supplemental Table 1: Description of Coastal Flood Area Types

Flood Area Type	Description
Mean Higher High Water (MHHW)	The average of the higher high-water height of each tidal day. Approximately 2.87 feet (NAVD88) per the NOAA tidal monitoring station at Reedy Point, DE (Epoch 1983 – 2001).
Inundation Risk Zone (IRZ)	Areas at or below the current MHHW elevation, plus an additional 5 feet, based on sea level rise projections for New Jersey for the year 2100 under a moderate emissions scenario, as published in the 2020 New Jersey Scientific Report on Climate Change.

The Mean Higher High Water (MHHW) depicts the average of the higher high-water height of each tidal day; areas falling in this zone are subject to regular nuisance flooding. To account for projected Sea Level Rise, an additional 5 feet was added to develop the Inundation Risk Zone (IRZ); this provides a picture of

projected flooding based upon Sea Level Rise. The addition of five feet by 2100 is based on moderate-emissions scenarios, and was selected as a measure to guide Salem's strategic response to potential flood risks and climate change impacts.



Supplemental Figure 1: Graphic representation of the flood scenarios evaluated. Source: Princeton Hydro

To identify flood-prone areas, the methodology relied on data obtained from the FEMA Flood Map Service Center. This dataset provided flood hazard area maps for the 1% annual chance flood and Current Mean Higher High Water (MHHW) Area. By overlaying these flood hazard areas with Salem city boundaries, critical infrastructure and vulnerable populations within the flood hazard areas were able to be identified.

The Salem municipal boundary data obtained from the NJGIN Open Data portal was used to overlay this data, helping to identify critical infrastructure and populations as well as vulnerable habitats and flood-prone areas.

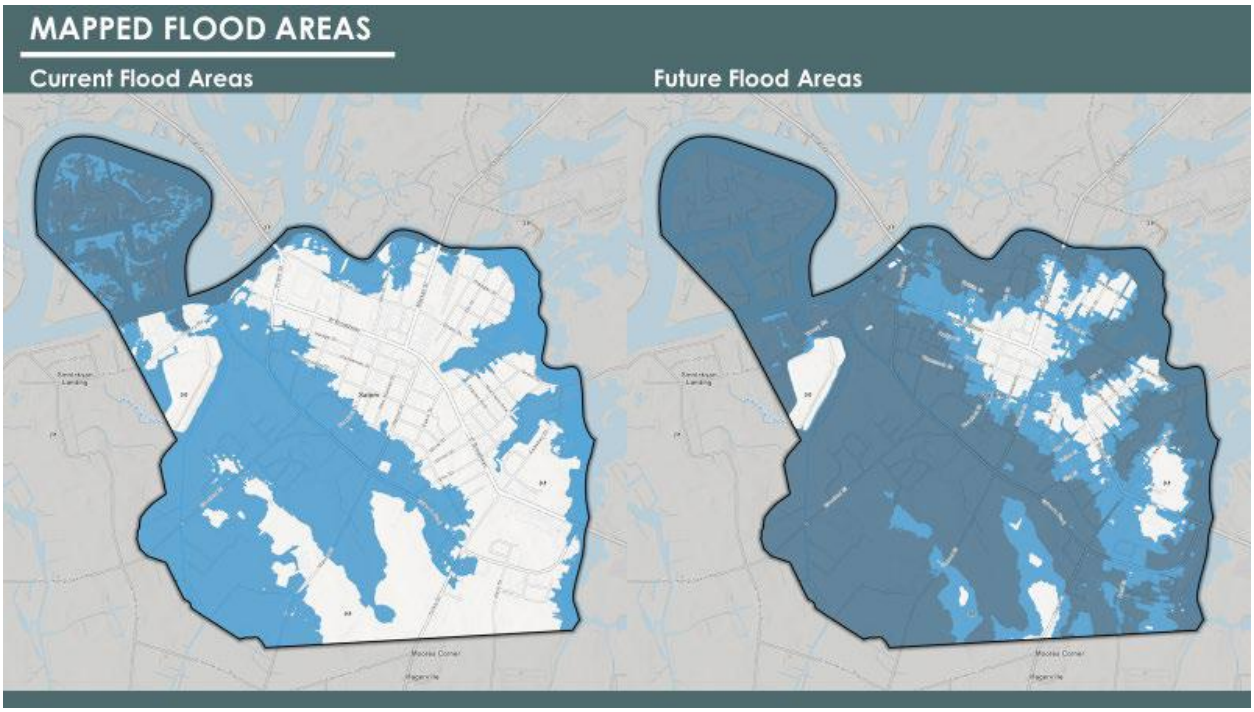
Fluvial (Riverine) and Pluvial (Stormwater) Flooding

In addition to the impacts from sea level rise, Salem is vulnerable to impacts from fluvial flooding (when rivers overtop) and pluvial (flooding not related to surface waters, generally due to insufficient drainage). This occurs when the water level in a surface water body such as the Salem River or Keasbey Creek rises and overtops its bank, and when the water overwhelms the ability of the system to drain. This can be caused by excessive precipitation. FEMA Flood Zone AE and New Jersey Tidal Flood Hazard Area (FHA) are flood areas considered in the CCRHVA that capture such flood hazards more commonly associated

with storm events. Flood Zone AE is a special flood hazard area where properties have a 1% probability of experiencing a flood event of significant magnitude. Detailed modeling for projected increases in river flooding is not yet available for Salem. Because Salem is tidally impacted, to estimate the extent of fluvial and pluvial flooding that could occur under climate impacts, five feet was added to the FHA to produce the Climate Adjusted Flood Elevation (CAFE) Area. This is used to assess the potential impact of storm-related floods and can provide an estimate of the losses that could result from such floods.

Supplemental Table 2: Description of Fluvial Flood Area Types

Flood Area Type	Description
FEMA Flood Zone AE / New Jersey Tidal Flood Hazard Area	1% annual chance flood. Also known as the '100-year flood' or 'base flood'.
NJ Tidal Climate Adjusted Flood Elevation (CAFE) Area	Depicts the geographic extent of the future flood hazard by adding 5 ft to the Base Flood as a proxy for the anticipated increase in flooding with anticipated climate impacts under a moderate emissions scenario by 2100.



Supplemental Figure 2: Overview of the flood areas mapped out for Salem. Current conditions is on the Left, predicted flood area due to climate impacts is depicted on the right. Dark Blue = Current MHHW / Future Inundation Risk Zone, Light Blue = Current 1% Flood Hazard Area / Future Climate Adjusted Flood Hazard Area. Source: Princeton Hydro.

Tree Canopy Coverage

To assess the tree canopy coverage, the methodology relied on a Normalized Difference Vegetation Index (NDVI) using 2019 near-infrared imagery obtained from the National Agriculture Imagery Program (NAIP). While the tree canopy is approximate, this method helped identify areas that have more tree cover and may be less vulnerable to the impacts of climate change, such as increased temperatures.

Tree canopy coverage can act as a natural cooling mechanism and help reduce the urban heat island effect. By overlaying the tree canopy layer with the population density layer, the methodology can identify

areas with less tree coverage and higher levels of population density, which may be more vulnerable to extreme heat events.

Extreme Heat

To identify urban heat island severity areas, the methodology relied on data obtained from The Trust for Public Land. This dataset provided information on the severity of urban heat islands, which occurs when cities are hotter than their surrounding rural areas. Urban areas typically have fewer trees and more impervious surfaces, such as pavement and buildings, which absorb and re-radiate heat from the sun.

The severity of urban heat islands is measured on a scale of 1 to 5, with 1 being a relatively mild heat area, and 5 being a severe heat area. The absolute values of heat above the mean values were classified into 4 classes using the Jenks Natural Breaks classification method[8].

By overlaying the urban heat island severity layer with the vulnerable populations layer, areas with high levels of vulnerability to extreme heat events were identified. This can help policymakers prioritize interventions to reduce urban heat island severity and its impacts.

Data Sources

The following data sources were used for this CCRHVA:

- Center for Disease Control (CDC), Social Vulnerability Index (SVI) for 2018: This dataset provided information on vulnerable populations based on multiple social factors, such as poverty, education, age, race/ethnicity, housing, and disability, to help identify areas where vulnerable populations may be at greater risk from the impacts of climate change, such as extreme heat events.
- U.S. Census, American Community Survey (ACS), 2014-2018: This dataset provided the demographic characteristics of the population to help identify areas with higher concentrations of vulnerable populations.
- National Agriculture Imagery Program (NAIP): This dataset provided near-infrared imagery to assess the tree canopy coverage to help identify areas that have more tree cover and may be less vulnerable to the impacts of climate change, such as increased temperatures.
- The Trust for Public Land, Urban Heat Island Severity for US Cities: This dataset provided information on the severity of urban heat islands to help identify areas with high levels of vulnerability to extreme heat events.
- FEMA Flood Map Service Center: This dataset provided flood hazard area maps to help identify flood-prone areas and critical infrastructure.
- NJFloodmapper: This dataset was used to assist with analysis of the impact of Sea Level Rise in one foot increments up to five feet.
- NJGIN Open Data portal: This dataset provided the Salem municipal boundary data to overlay with other data layers and identify vulnerable populations and critical infrastructure.
- Landscape Project v3.3: This dataset provided the data for special species habitat in NJ.

[8] For more information, see: Brewer CA, Pickle L. Evaluation of methods for classifying epidemiological data on choropleth maps in series. Ann Assoc Am Geogr 92(4):662–81. 2003.

- NOAA Climate at a Glance County Mapping was used to identify county level temperature trends.
- NOAA tide monitoring station at Reedy Point, DE: This dataset provided information on the mean higher high water (MHHW) elevation for Salem, NJ, to identify flood-prone areas and critical infrastructure.
- 2020 New Jersey Scientific Report on Climate Change: This dataset provided the sea level rise projections for New Jersey in 2100, under a moderate emissions scenario.

These data sources and relevant data sets can be accessed for further reference and analysis. Data and information for each subject area were gathered, including historical trends, projected changes, and current conditions.

Additional Modeling Data

The full vulnerability assessment contains many maps to demonstrate at risk areas, found in Attachment 2 using the scenarios described above. The scenarios were conceived as a high-level planning tool and aren't intended to be applied on an individual property basis. NJDEP retained Michael Baker Associates to model fluvial flooding in the 9 Sandy impacted counties. The New Jersey Department of Transportation (NJDOT) then took over and completed the modeling for the remainder of the state. While this data and projections were very similar to findings of this CCRHVA in Salem, the data is not consistent for the other areas of the state and therefore came with several disclaimers, including the following:

The NJDOT does not recommend the use of the results on the Delaware River and recommends the use of alternate or more detailed methodology.

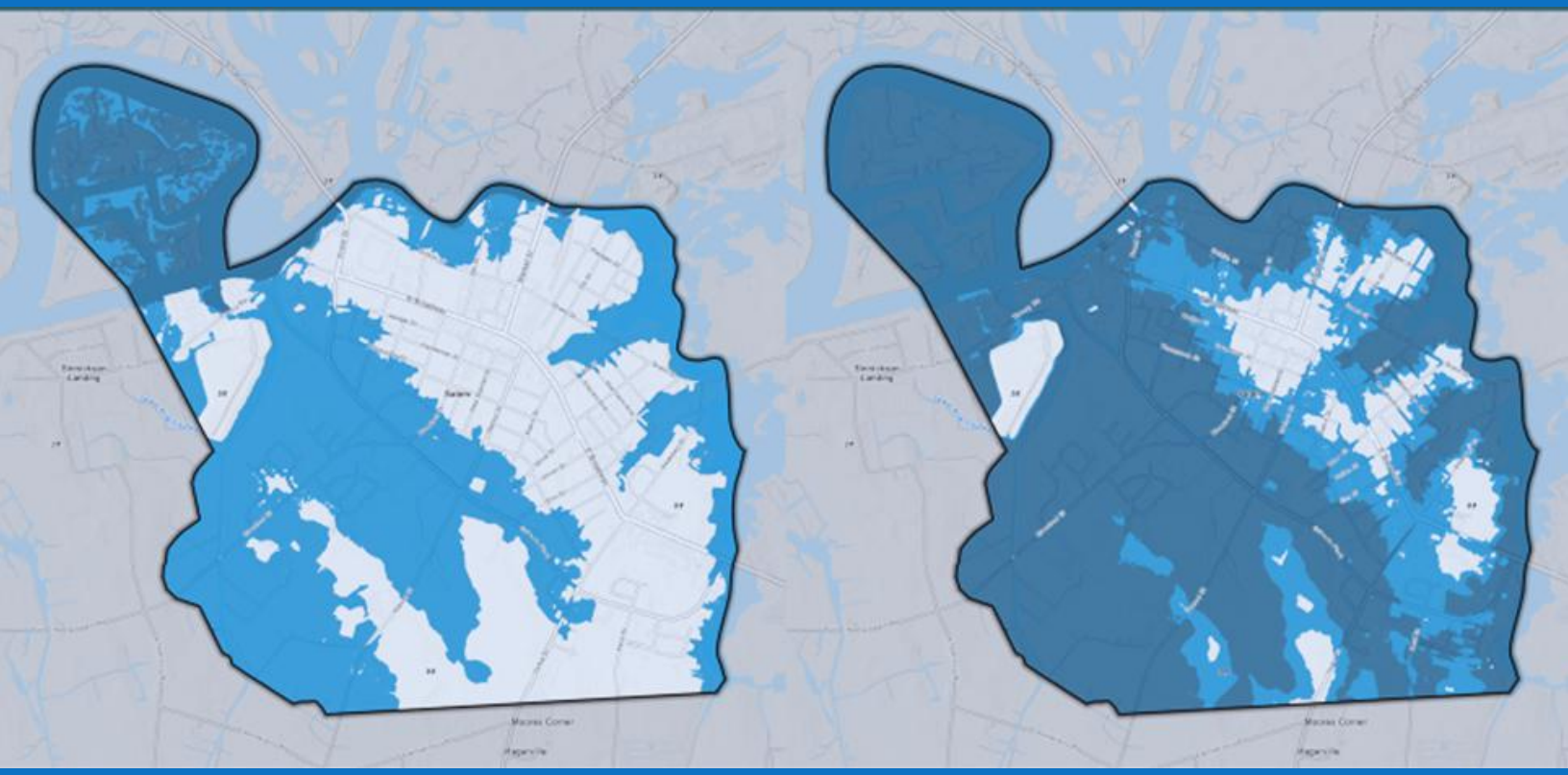
Because of this, while maps of the projected impacts are included in Attachment 3 to this CCRHVA, the analysis is based on the NJDEP and project team projections. The following maps are included in Attachment 3 for NJDOT modeling data, along with the full terms and conditions for use of the data:

- NJDOT SLR FHA Flooding + CAFE
- NJDOT SLR FHA Flooding + Community Assets
- NJDOT SLR FHA Flooding + Critical Facilities
- NJDOT SLR FHA Flooding + Cultural Resources
- NJDOT SLR FHA Flooding + Ecological Resources
- NJDOT SLR FHA Flooding + Economic Development
- NJDOT SLR FHA Flooding + Land Use Land Cover
- NJDOT SLR FHA Flooding + Open Space
- NJDOT SLR FHA Flooding + Overburdened Communities
- NJDOT SLR FHA Flooding + Population Vulnerable to Flooding
- NJDOT SLR FHA Flooding + Special Status Species Habitat
- NJDOT SLR FHA Flooding + Zoning
- NJDOT SLR FHA Flooding

CLIMATE CHANGE-RELATED HAZARD VULNERABILITY ASSESSMENT

ATTACHMENT 2: MAPPING PACKAGE

RESILIENTSALEM



NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION

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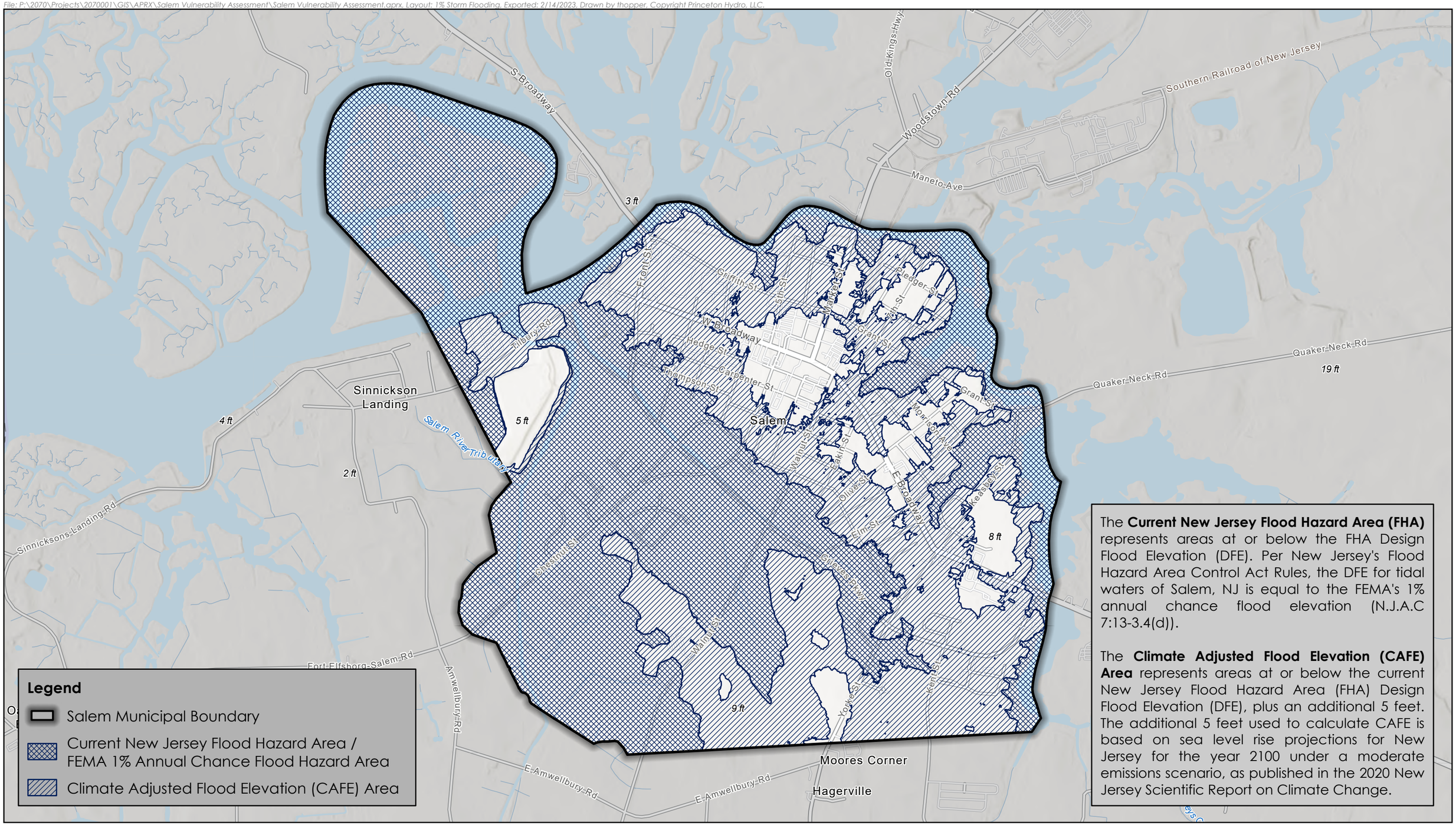

Legend

- Salem Municipal Boundary
- Current New Jersey Flood Hazard Area / FEMA 1% Annual Chance Flood Hazard Area
- Climate Adjusted Flood Elevation (CAFE) Area

The **Current New Jersey Flood Hazard Area (FHA)** represents areas at or below the FHA Design Flood Elevation (DFE). Per New Jersey's Flood Hazard Area Control Act Rules, the DFE for tidal waters of Salem, NJ is equal to the FEMA's 1% annual chance flood elevation (N.J.A.C 7:13-3.4(d)).

The **Climate Adjusted Flood Elevation (CAFE) Area** represents areas at or below the current New Jersey Flood Hazard Area (FHA) Design Flood Elevation (DFE), plus an additional 5 feet. The additional 5 feet used to calculate CAFE is based on sea level rise projections for New Jersey for the year 2100 under a moderate emissions scenario, as published in the 2020 New Jersey Scientific Report on Climate Change.

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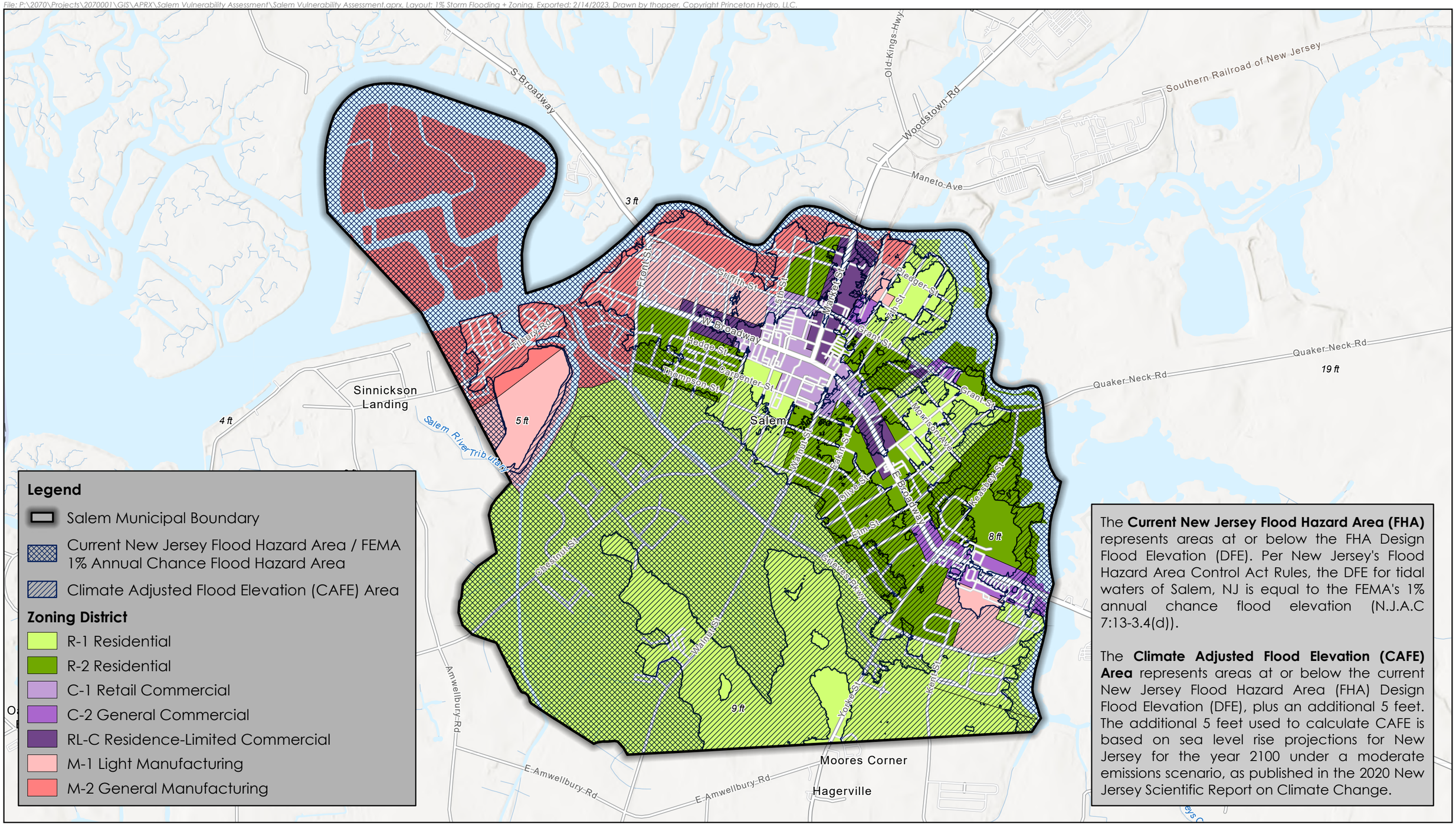
NOTES:
1. Open spaces obtained from the NJ Geographic Information Network (NJGIN) Open Data portal: https://njgin.nj.gov/
2. FEMA 1% Annual Chance Flood Hazard Area, effective 06/15/2016, obtained from FEMA Flood Map Service Center: https://msc.fema.gov/portal/
3. CAFE area produced using NJ Adapt Flood Mapper: https://www.njfloodmapper.org/
4. Salem municipal boundary obtained from New Jersey Geographic Information Network (NJGIN) Open Data portal: https://njgin.nj.gov/
5. Basemap obtained from ESRI basemap services.

Spatial Reference: NAD 1983 2011 StatePlane New Jersey FIPS 2900 Ft US

0 700 1,400 Feet

EXISTING AND FUTURE 1% STORM FLOODPLAINS

RESILIENT NJ VULNERABILITY ASSESSMENT
BROWNFIELD REDEVELOPMENT SOLUTIONS, INC.
CITY OF SALEM, SALEM COUNTY, NEW JERSEY



Legend

- Salem Municipal Boundary
- Current New Jersey Flood Hazard Area / FEMA 1% Annual Chance Flood Hazard Area
- Climate Adjusted Flood Elevation (CAFE) Area

Zoning District

- R-1 Residential
- R-2 Residential
- C-1 Retail Commercial
- C-2 General Commercial
- RL-C Residence-Limited Commercial
- M-1 Light Manufacturing
- M-2 General Manufacturing

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NOTES:
1. Zoning districts provided by the City of Salem.
2. FEMA 1% Annual Chance Flood Hazard Area, effective 06/15/2016, obtained from FEMA Flood Map Service Center: https://msc.fema.gov/portal/
3. CAFE area produced using NJ Adapt Flood Mapper: https://www.njfloodmapper.org/
4. Salem municipal boundary obtained from New Jersey Geographic Information Network (NJGIN) Open Data portal: https://njgin.nj.gov/
5. Basemap obtained from ESRI basemap services.

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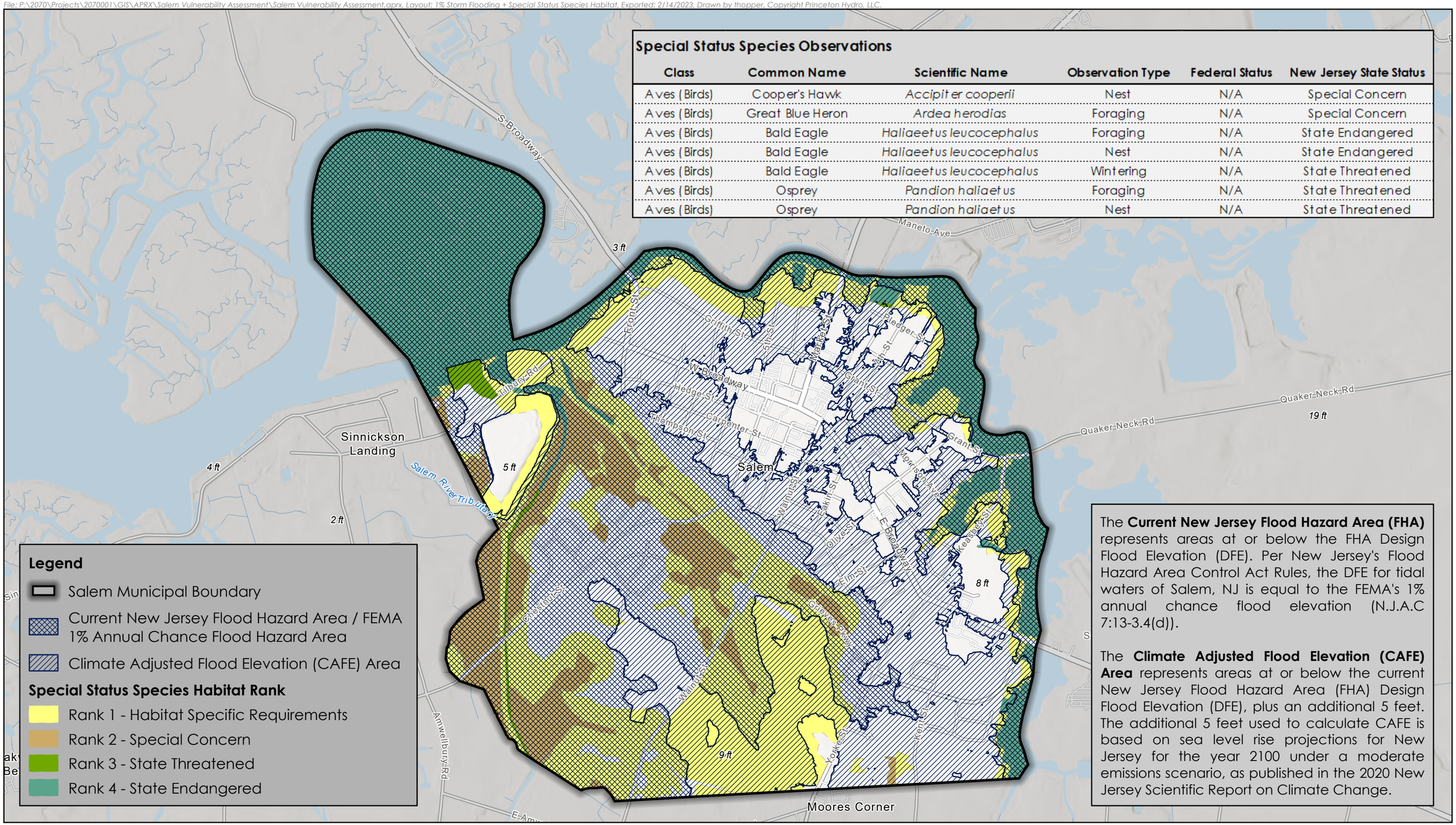
0 700 1,400 Feet

ZONING IN EXISTING AND FUTURE 1% STORM FLOODPLAINS

RESILIENT NJ VULNERABILITY ASSESSMENT
BROWNFIELD REDEVELOPMENT SOLUTIONS, INC.
CITY OF SALEM, SALEM COUNTY, NEW JERSEY

Special Status Species Observations

Class	Common Name	Scientific Name	Observation Type	Federal Status	New Jersey State Status
Aves (Birds)	Cooper's Hawk	*Accipiter cooperii*	Nest	N/A	Special Concern
Aves (Birds)	Great Blue Heron	*Ardea herodias*	Foraging	N/A	Special Concern
Aves (Birds)	Bald Eagle	*Haliaeetus leucocephalus*	Foraging	N/A	State Endangered
Aves (Birds)	Bald Eagle	*Haliaeetus leucocephalus*	Nest	N/A	State Endangered
Aves (Birds)	Bald Eagle	*Haliaeetus leucocephalus*	Wintering	N/A	State Threatened
Aves (Birds)	Osprey	*Pandion haliaetus*	Foraging	N/A	State Threatened
Aves (Birds)	Osprey	*Pandion haliaetus*	Nest	N/A	State Threatened



Legend

- Salem Municipal Boundary
- Current New Jersey Flood Hazard Area / FEMA 1% Annual Chance Flood Hazard Area
- Climate Adjusted Flood Elevation (CAFE) Area

Special Status Species Habitat Rank

- Rank 1 - Habitat Specific Requirements
- Rank 2 - Special Concern
- Rank 3 - State Threatened
- Rank 4 - State Endangered

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The **Climate Adjusted Flood Elevation (CAFE) Area** represents areas at or below the current New Jersey Flood Hazard Area (FHA) Design Flood Elevation (DFE), plus an additional 5 feet. The additional 5 feet used to calculate CAFE is based on sea level rise projections for New Jersey for the year 2100 under a moderate emissions scenario, as published in the 2020 New Jersey Scientific Report on Climate Change.

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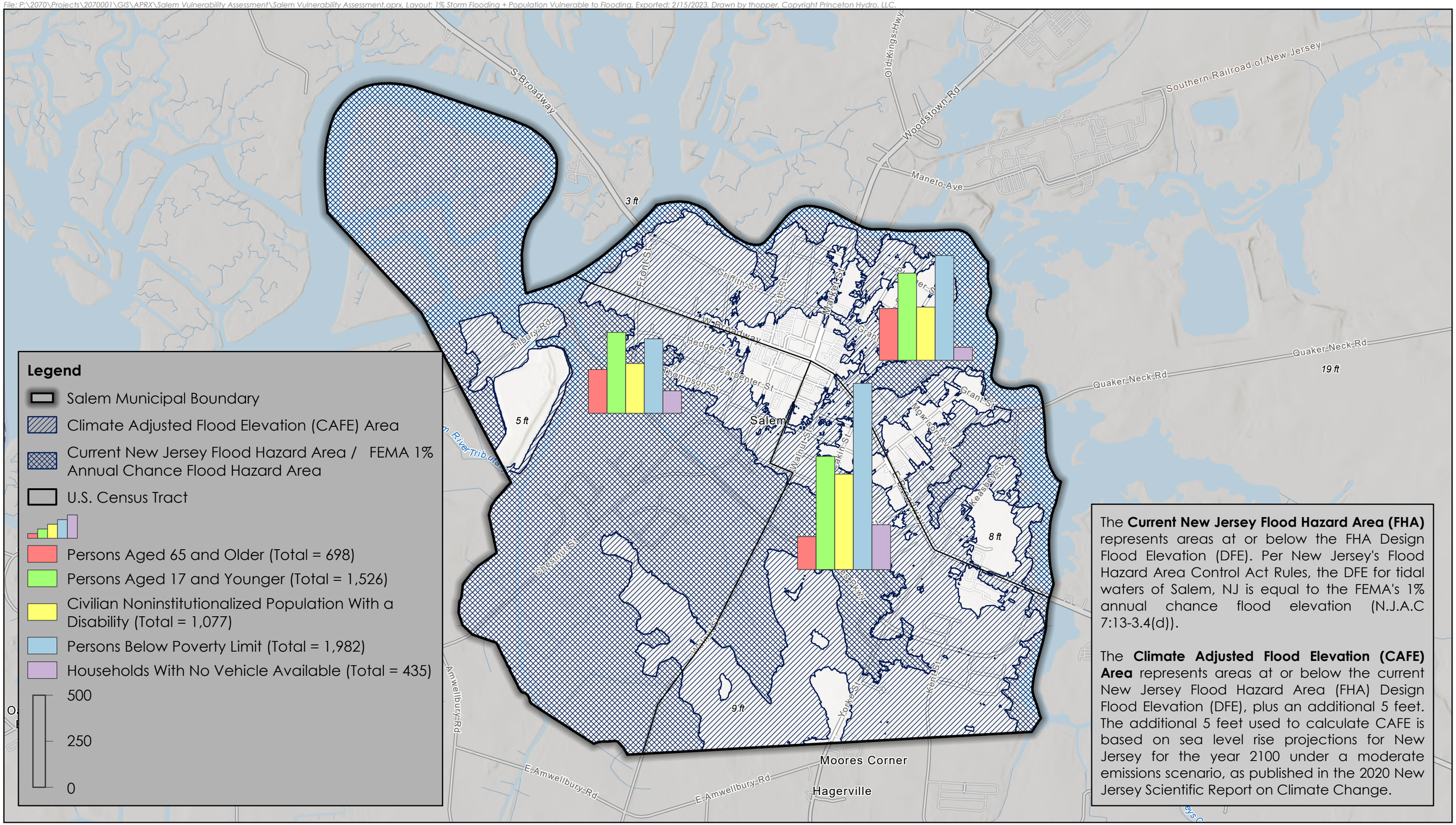
NOTES:
1. Special status species habitat from the Landscape Project, v3.3, obtained from the NJDEP GIS website: www.state.nj.us/dep/gis/
2. FEMA 1% Annual Chance Flood Hazard Area, effective 06/15/2016, obtained from FEMA Flood Map Service Center: https://msc.fema.gov/portal/
3. CAFE area produced using NJ Adapt Flood Mapper: https://www.njfloodmapper.org/
4. Salem municipal boundary obtained from New Jersey Geographic Information Network (NJGIN) Open Data portal: https://njgin.nj.gov/
5. Basemap obtained from ESRI basemap services.

Spatial Reference: NAD 1983 2011 StatePlane New Jersey FIPS 2900 Ft US

0 700 1,400 Feet

SPECIAL STATUS SPECIES HABITAT IN EXISTING AND FUTURE 1% STORM FLOODPLAINS

RESILIENT NJ VULNERABILITY ASSESSMENT
BROWNFIELD REDEVELOPMENT SOLUTIONS, INC.
CITY OF SALEM, SALEM COUNTY, NEW JERSEY



Legend

- Salem Municipal Boundary
- Climate Adjusted Flood Elevation (CAFE) Area
- Current New Jersey Flood Hazard Area / FEMA 1% Annual Chance Flood Hazard Area
- U.S. Census Tract
- Persons Aged 65 and Older (Total = 698)
- Persons Aged 17 and Younger (Total = 1,526)
- Civilian Noninstitutionalized Population With a Disability (Total = 1,077)
- Persons Below Poverty Limit (Total = 1,982)
- Households With No Vehicle Available (Total = 435)

500

250

0

The **Current New Jersey Flood Hazard Area (FHA)** represents areas at or below the FHA Design Flood Elevation (DFE). Per New Jersey's Flood Hazard Area Control Act Rules, the DFE for tidal waters of Salem, NJ is equal to the FEMA's 1% annual chance flood elevation (N.J.A.C 7:13-3.4(d)).

The **Climate Adjusted Flood Elevation (CAFE) Area** represents areas at or below the current New Jersey Flood Hazard Area (FHA) Design Flood Elevation (DFE), plus an additional 5 feet. The additional 5 feet used to calculate CAFE is based on sea level rise projections for New Jersey for the year 2100 under a moderate emissions scenario, as published in the 2020 New Jersey Scientific Report on Climate Change.

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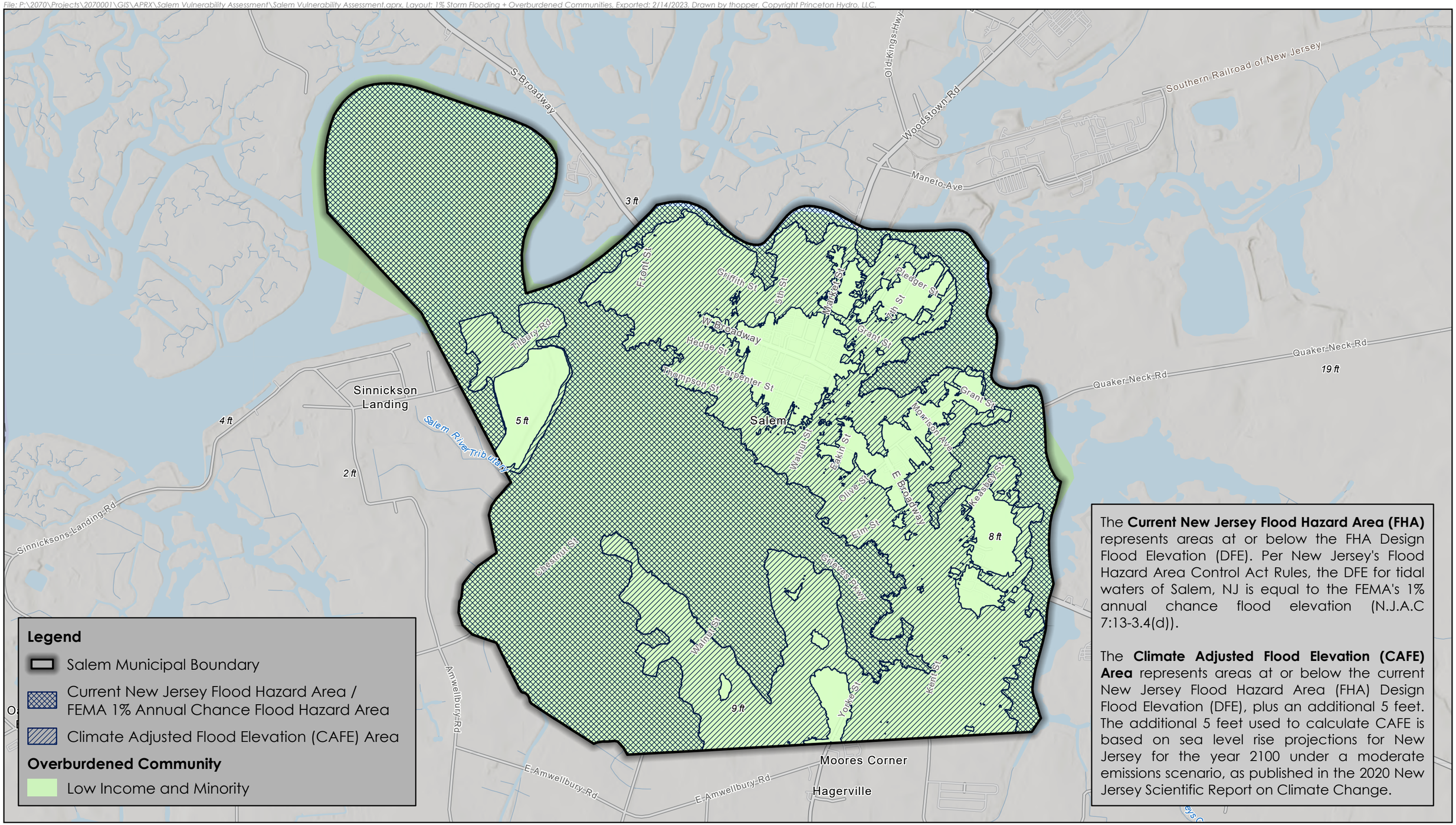
NOTES:
1. Vulnerable populations obtained from the Center for Disease Control (CDS), Social Vulnerability Index (SVI) for 2018. Population estimates are based on the U.S. Census, American Community Survey (ACS), 2014-2018.
2. FEMA 1% Annual Chance Flood Hazard Area, effective 06/15/2016, obtained from FEMA Flood Map Service Center: https://msc.fema.gov/portal/
3. CAFE area produced using NJ Adapt Flood Mapper: https://www.njfloodmapper.org/
4. Salem municipal boundary obtained from New Jersey Geographic Information Network (NJGIN) Open Data portal: https://njgin.nj.gov/
5. Basemap obtained from ESRI basemap services.

Spatial Reference: NAD 1983 2011 StatePlane New Jersey FIPS 2900 Ft US

0 700 1,400 Feet

VULNERABLE POPULATIONS AND EXISTING AND FUTURE 1% STORM FLOODPLAINS

RESILIENT NJ VULNERABILITY ASSESSMENT
BROWNFIELD REDEVELOPMENT SOLUTIONS, INC.
CITY OF SALEM, SALEM COUNTY, NEW JERSEY



Legend

- Salem Municipal Boundary
- Current New Jersey Flood Hazard Area / FEMA 1% Annual Chance Flood Hazard Area
- Climate Adjusted Flood Elevation (CAFE) Area

Overburdened Community

- Low Income and Minority

The **Current New Jersey Flood Hazard Area (FHA)** represents areas at or below the FHA Design Flood Elevation (DFE). Per New Jersey's Flood Hazard Area Control Act Rules, the DFE for tidal waters of Salem, NJ is equal to the FEMA's 1% annual chance flood elevation (N.J.A.C 7:13-3.4(d)).

The **Climate Adjusted Flood Elevation (CAFE) Area** represents areas at or below the current New Jersey Flood Hazard Area (FHA) Design Flood Elevation (DFE), plus an additional 5 feet. The additional 5 feet used to calculate CAFE is based on sea level rise projections for New Jersey for the year 2100 under a moderate emissions scenario, as published in the 2020 New Jersey Scientific Report on Climate Change.

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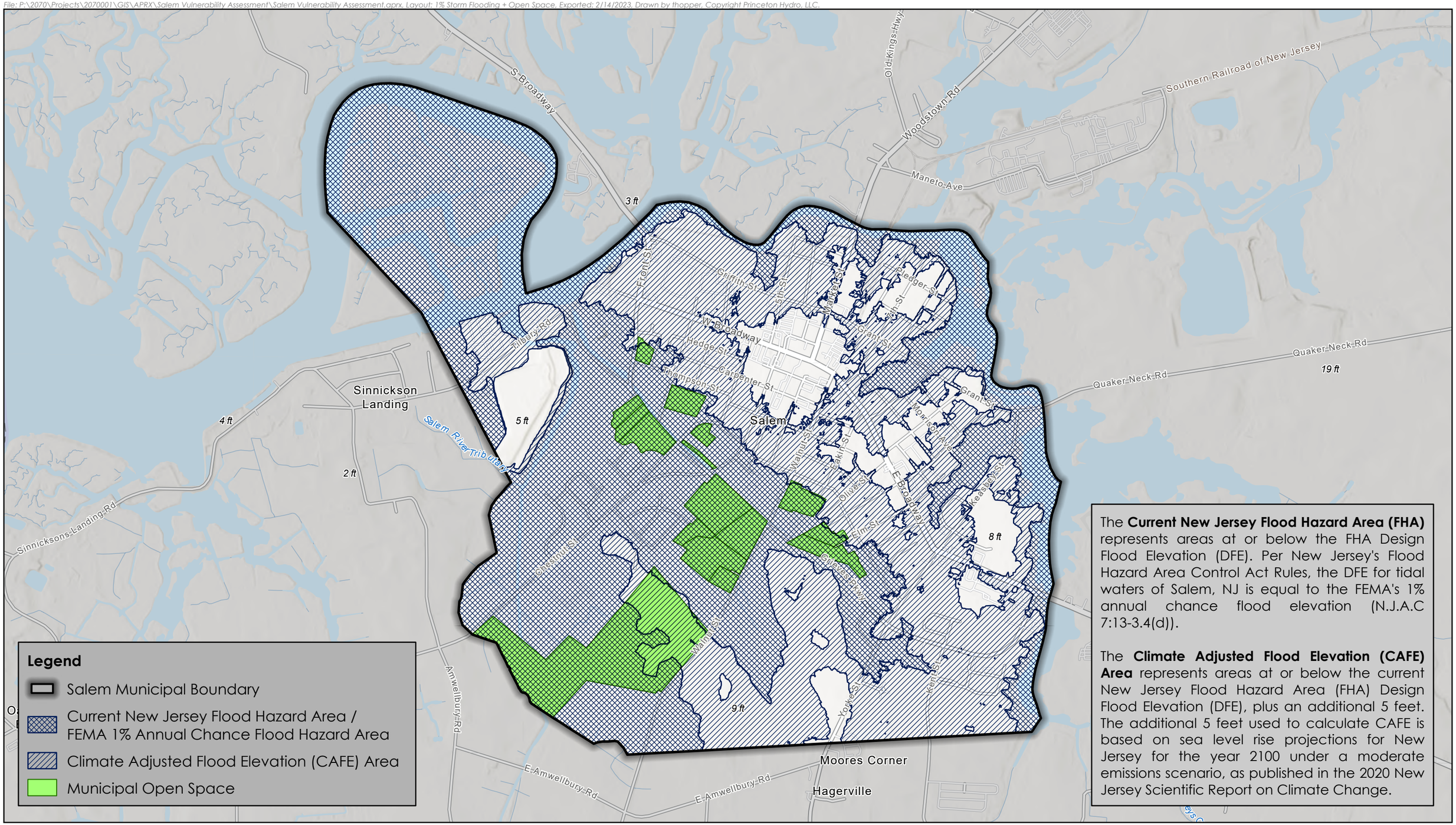
NOTES:
1. Overburdened communities under the NJ Environmental Justice Law obtained from the NJDEP GIS website: www.state.nj.us/dep/gis/
2. FEMA 1% Annual Chance Flood Hazard Area, effective 06/15/2016, obtained from FEMA Flood Map Service Center: https://msc.fema.gov/portal/
3. CAFE area produced using NJ Adapt Flood Mapper: https://www.njfloodmapper.org/
4. Salem municipal boundary obtained from New Jersey Geographic Information Network (NJGIN) Open Data portal: https://njgin.nj.gov/
5. Basemap obtained from ESRI basemap services.

Spatial Reference: NAD 1983 2011 StatePlane New Jersey FIPS 2900 Ft US

0 700 1,400 Feet

OVERBURDENED COMMUNITIES IN EXISTING AND FUTURE 1% STORM FLOODPLAINS

RESILIENT NJ VULNERABILITY ASSESSMENT
BROWNFIELD REDEVELOPMENT SOLUTIONS, INC.
CITY OF SALEM, SALEM COUNTY, NEW JERSEY



Legend

- Salem Municipal Boundary
- Current New Jersey Flood Hazard Area / FEMA 1% Annual Chance Flood Hazard Area
- Climate Adjusted Flood Elevation (CAFE) Area
- Municipal Open Space

The **Current New Jersey Flood Hazard Area (FHA)** represents areas at or below the FHA Design Flood Elevation (DFE). Per New Jersey's Flood Hazard Area Control Act Rules, the DFE for tidal waters of Salem, NJ is equal to the FEMA's 1% annual chance flood elevation (N.J.A.C 7:13-3.4(d)).

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NOTES:
1. Open spaces obtained from the NJ Geographic Information Network (NJGIN) Open Data portal: https://njgin.nj.gov/
2. FEMA 1% Annual Chance Flood Hazard Area, effective 06/15/2016, obtained from FEMA Flood Map Service Center: https://msc.fema.gov/portal/
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4. Salem municipal boundary obtained from New Jersey Geographic Information Network (NJGIN) Open Data portal: https://njgin.nj.gov/
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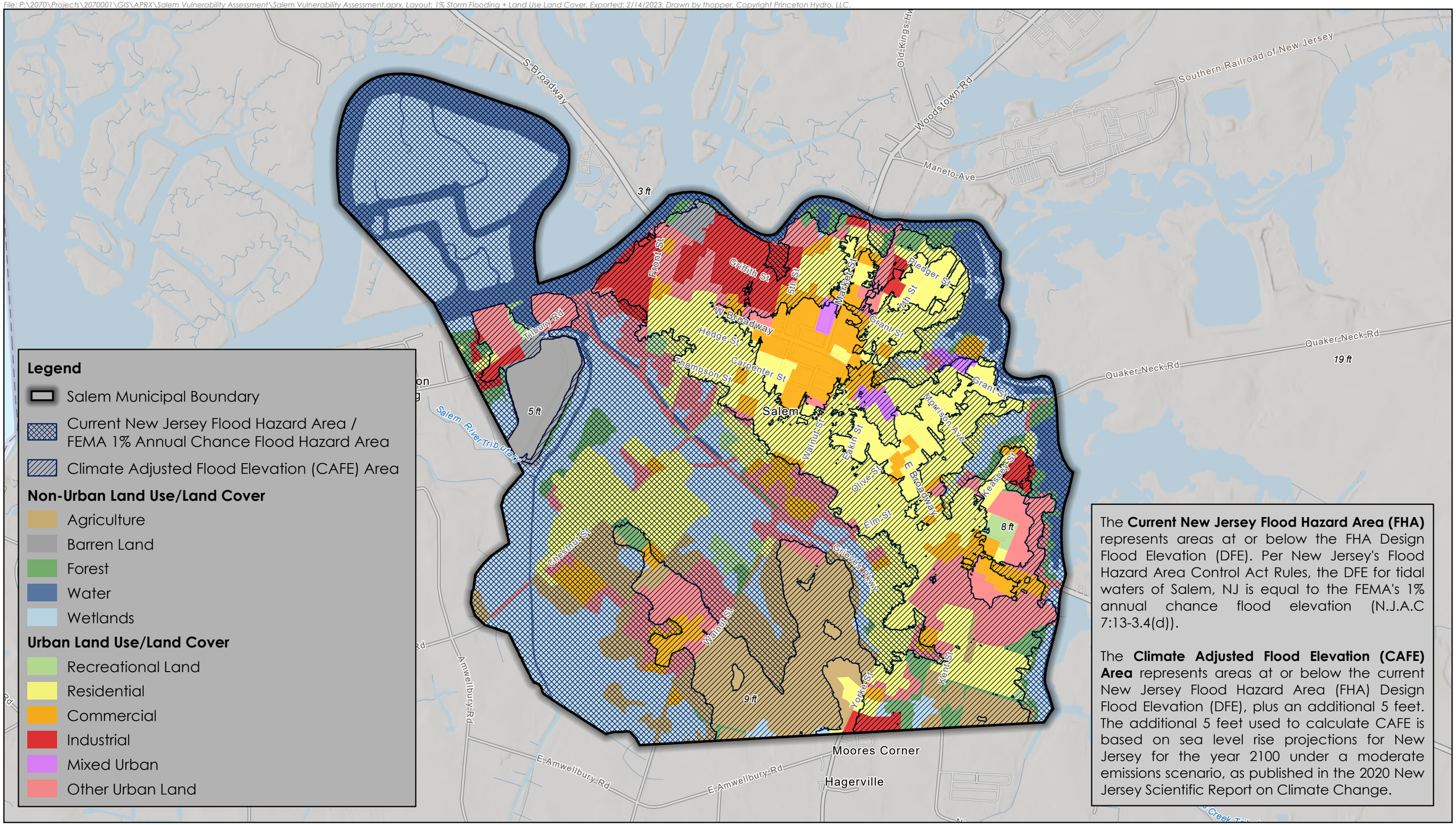
Spatial Reference: NAD 1983 2011 StatePlane New Jersey FIPS 2900 Ft US

0 700 1,400 Feet

OPEN SPACE IN EXISTING AND FUTURE 1% STORM FLOODPLAINS

RESILIENT NJ VULNERABILITY ASSESSMENT
BROWNFIELD REDEVELOPMENT SOLUTIONS, INC.
CITY OF SALEM, SALEM COUNTY, NEW JERSEY



Legend

- Salem Municipal Boundary
- Current New Jersey Flood Hazard Area / FEMA 1% Annual Chance Flood Hazard Area
- Climate Adjusted Flood Elevation (CAFE) Area

Non-Urban Land Use/Land Cover

- Agriculture
- Barren Land
- Forest
- Water
- Wetlands

Urban Land Use/Land Cover

- Recreational Land
- Residential
- Commercial
- Industrial
- Mixed Urban
- Other Urban Land

The **Current New Jersey Flood Hazard Area (FHA)** represents areas at or below the FHA Design Flood Elevation (DFE). Per New Jersey's Flood Hazard Area Control Act Rules, the DFE for tidal waters of Salem, NJ is equal to the FEMA's 1% annual chance flood elevation (N.J.A.C 7:13-3.4(d)).

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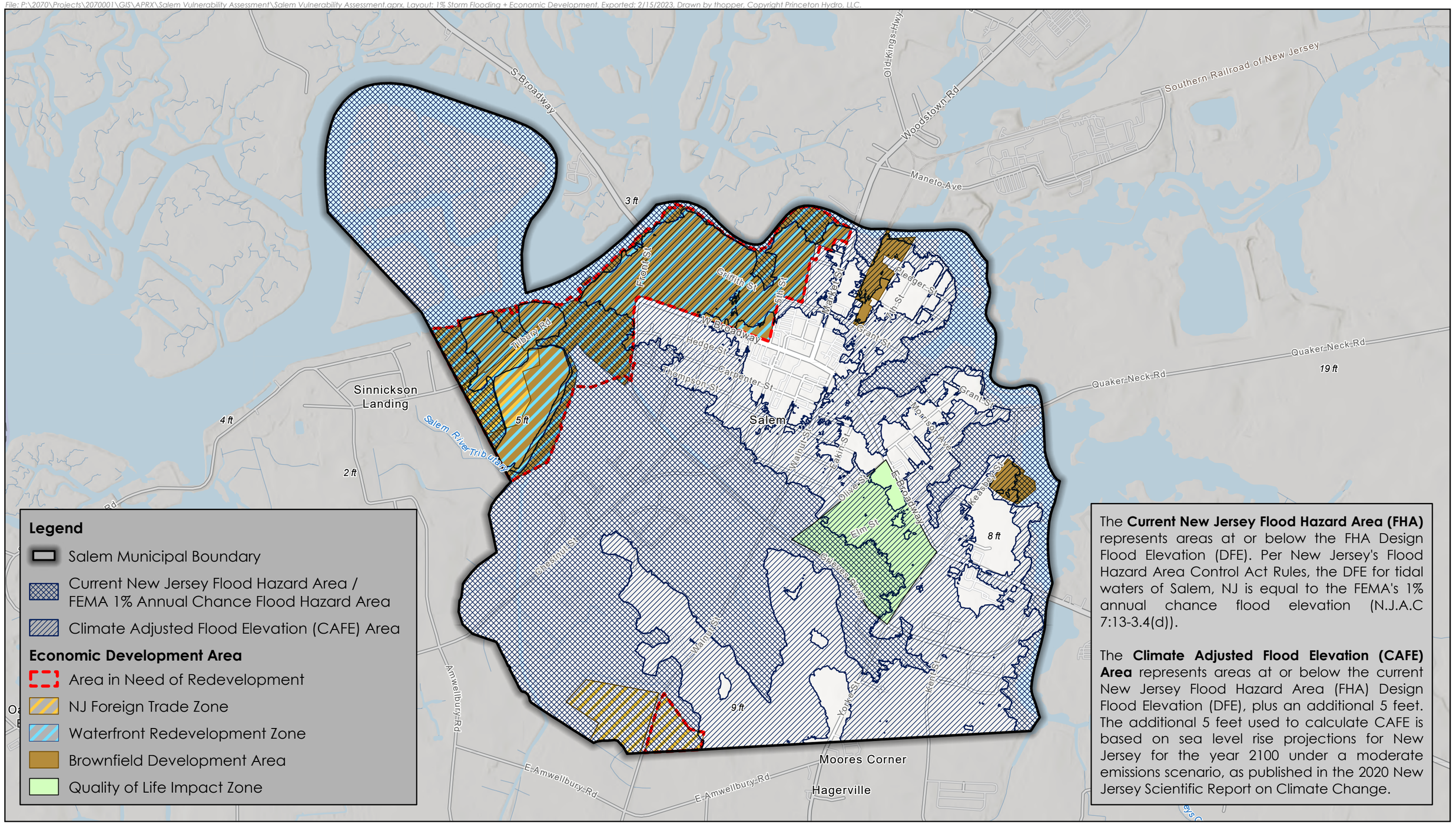
NOTES:
1. 2015 Land Use/Land Cover obtained from the NJDEP GIS website: www.state.nj.us/dep/gis/
2. FEMA 1% Annual Chance Flood Hazard Area, effective 06/15/2016, obtained from FEMA Flood Map Service Center: https://msc.fema.gov/portal/
3. CAFE area produced using NJ Adapt Flood Mapper: https://www.njfloodmapper.org/
4. Salem municipal boundary obtained from New Jersey Geographic Information Network (NJGIN) Open Data portal: https://njgin.nj.gov/
5. Basemap obtained from ESRI basemap services.

Spatial Reference: NAD 1983 2011 StatePlane New Jersey FIPS 2900 Ft US

0 700 1,400 Feet

LAND USE/LAND COVER IN EXISTING AND FUTURE 1% STORM FLOODPLAINS

RESILIENT NJ VULNERABILITY ASSESSMENT
BROWNFIELD REDEVELOPMENT SOLUTIONS, INC.
CITY OF SALEM, SALEM COUNTY, NEW JERSEY



Legend

- Salem Municipal Boundary
- Current New Jersey Flood Hazard Area / FEMA 1% Annual Chance Flood Hazard Area
- Climate Adjusted Flood Elevation (CAFE) Area

Economic Development Area

- Area in Need of Redevelopment
- NJ Foreign Trade Zone
- Waterfront Redevelopment Zone
- Brownfield Development Area
- Quality of Life Impact Zone

The **Current New Jersey Flood Hazard Area (FHA)** represents areas at or below the FHA Design Flood Elevation (DFE). Per New Jersey's Flood Hazard Area Control Act Rules, the DFE for tidal waters of Salem, NJ is equal to the FEMA's 1% annual chance flood elevation (N.J.A.C 7:13-3.4(d)).

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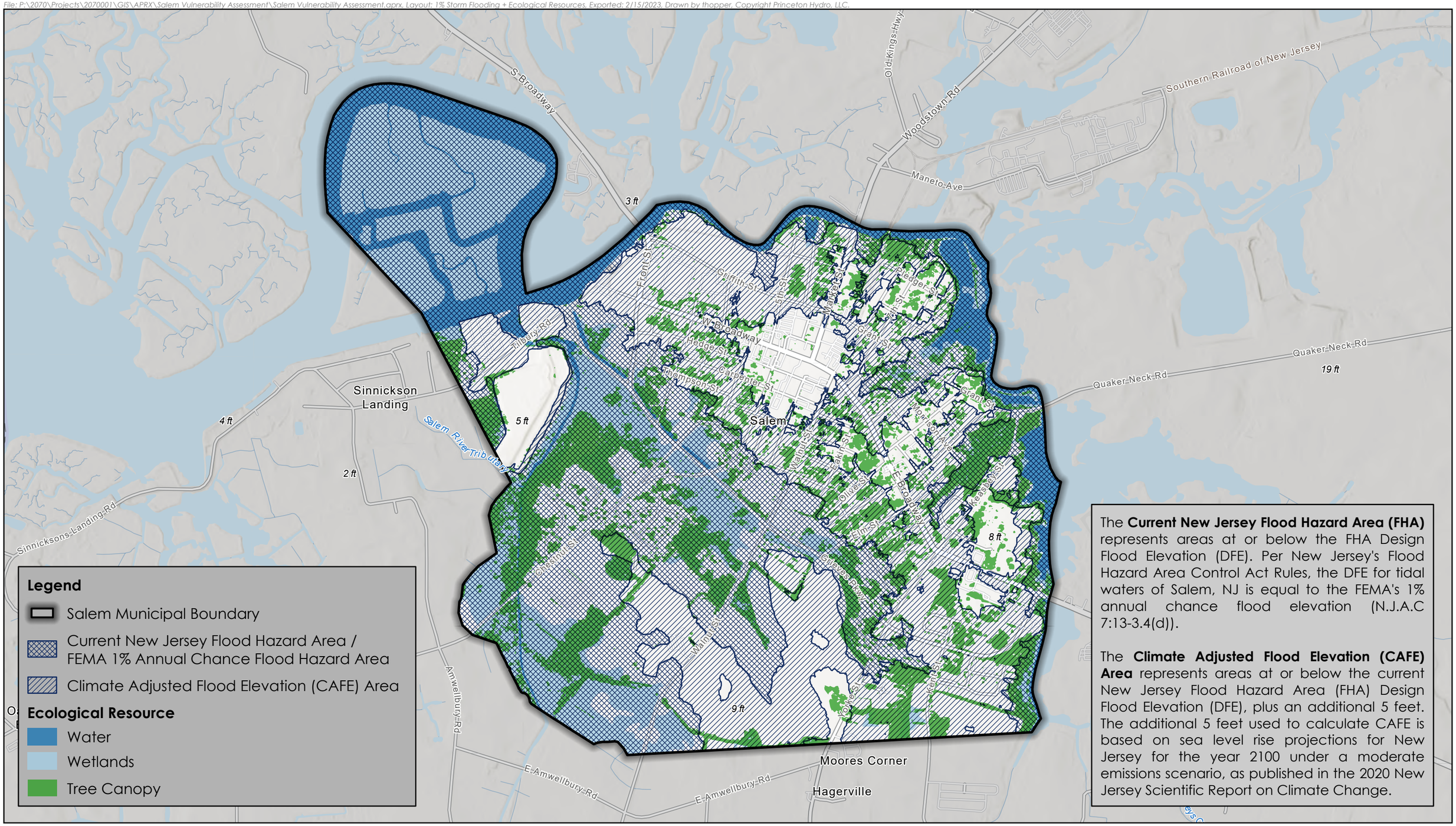
NOTES:
1. Waterfront redevelopment zone obtained from the City of Salem, NJ.
2. Other economic development features obtained from the NJ Geographic Information Network (NJGIN) Open Data portal: https://njgin.nj.gov/.
3. FEMA 1% Annual Chance Flood Hazard Area, effective 06/15/2016, obtained from FEMA Flood Map Service Center: https://msc.fema.gov/portal/
4. CAFE area produced using NJ Adapt Flood Mapper: https://www.njfloodmapper.org/
5. Trenton municipal boundary obtained from New Jersey Geographic Information Network (NJGIN) Open Data portal: https://njgin.nj.gov/
6. Basemap obtained from ESRI basemap services.

Spatial Reference: NAD 1983 2011 StatePlane New Jersey FIPS 2900 Ft US

0 700 1,400 Feet

ECONOMIC DEVELOPMENT FEATURES IN EXISTING AND FUTURE 1% STORM FLOODPLAINS

RESILIENT NJ VULNERABILITY ASSESSMENT
BROWNFIELD REDEVELOPMENT SOLUTIONS, INC.
CITY OF SALEM, SALEM COUNTY, NEW JERSEY



Legend

- Salem Municipal Boundary
- Current New Jersey Flood Hazard Area / FEMA 1% Annual Chance Flood Hazard Area
- Climate Adjusted Flood Elevation (CAFE) Area

Ecological Resource

- Water
- Wetlands
- Tree Canopy

The **Current New Jersey Flood Hazard Area (FHA)** represents areas at or below the FHA Design Flood Elevation (DFE). Per New Jersey's Flood Hazard Area Control Act Rules, the DFE for tidal waters of Salem, NJ is equal to the FEMA's 1% annual chance flood elevation (N.J.A.C 7:13-3.4(d)).

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NOTES:
1. Water and wetlands (2015 Land Use/Land Cover) obtained from the NJDEP GIS website: www.state.nj.us/dep/gis/
2. Tree canopy is approximate. Canopy areas delineated through a Normalized Difference Vegetation Index (NDVI) using 2019 near-infrared imagery obtained from the National Agriculture Imagery Program (NAIP).
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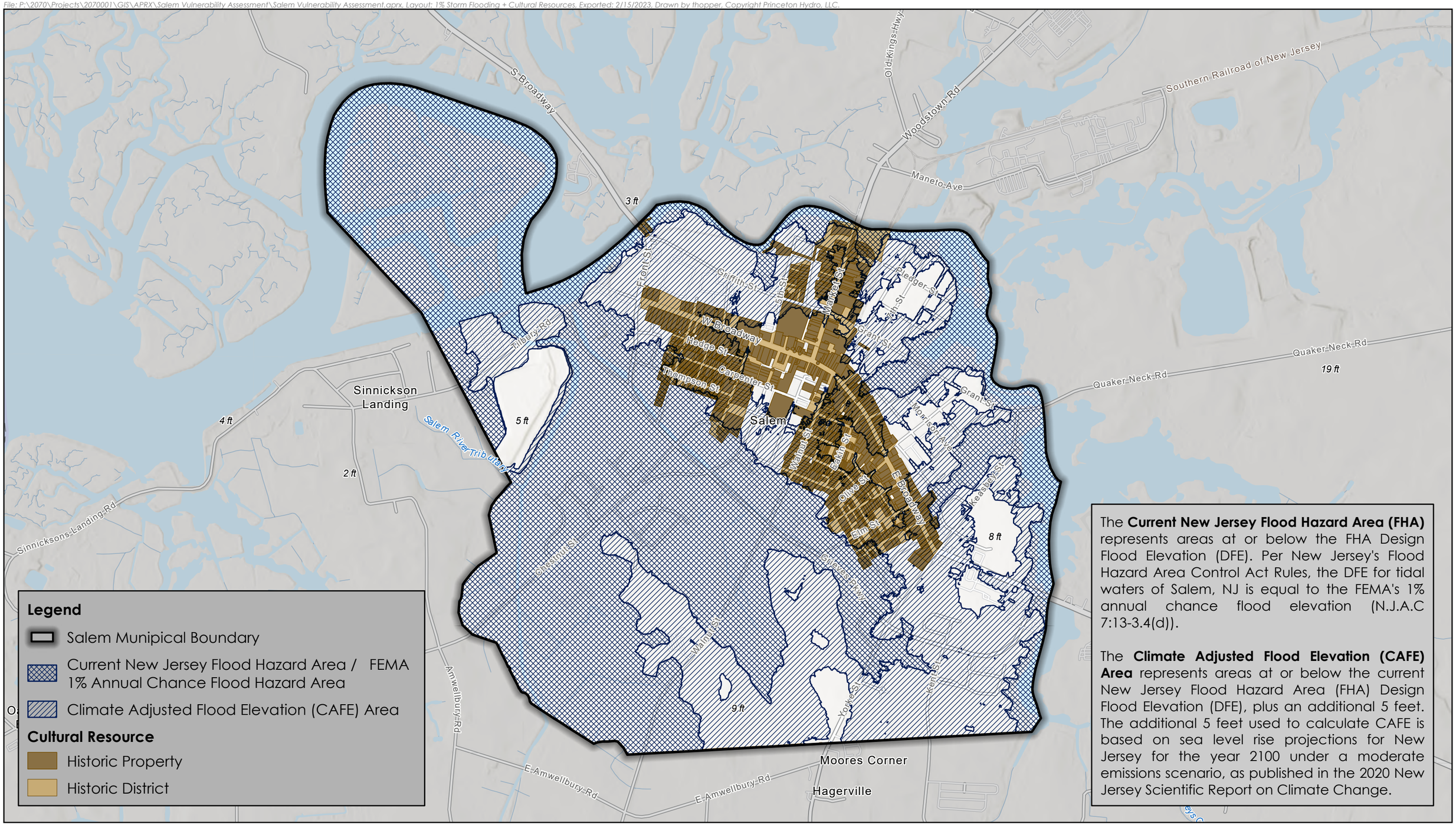
Spatial Reference: NAD 1983 2011 StatePlane New Jersey FIPS 2900 Ft US

0 700 1,400 Feet

ECOLOGICAL RESOURCES IN EXISTING AND FUTURE 1% STORM FLOODPLAINS

RESILIENT NJ VULNERABILITY ASSESSMENT
BROWNFIELD REDEVELOPMENT SOLUTIONS, INC.
CITY OF SALEM, SALEM COUNTY, NEW JERSEY



Legend

- Salem Munipical Boundary
- Current New Jersey Flood Hazard Area / FEMA 1% Annual Chance Flood Hazard Area
- Climate Adjusted Flood Elevation (CAFE) Area

Cultural Resource

- Historic Property
- Historic District

The **Current New Jersey Flood Hazard Area (FHA)** represents areas at or below the FHA Design Flood Elevation (DFE). Per New Jersey's Flood Hazard Area Control Act Rules, the DFE for tidal waters of Salem, NJ is equal to the FEMA's 1% annual chance flood elevation (N.J.A.C 7:13-3.4(d)).

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NOTES:
1. Historic properties and districts obtained from NJDEP GIS website: www.state.nj.us/dep/gis/.
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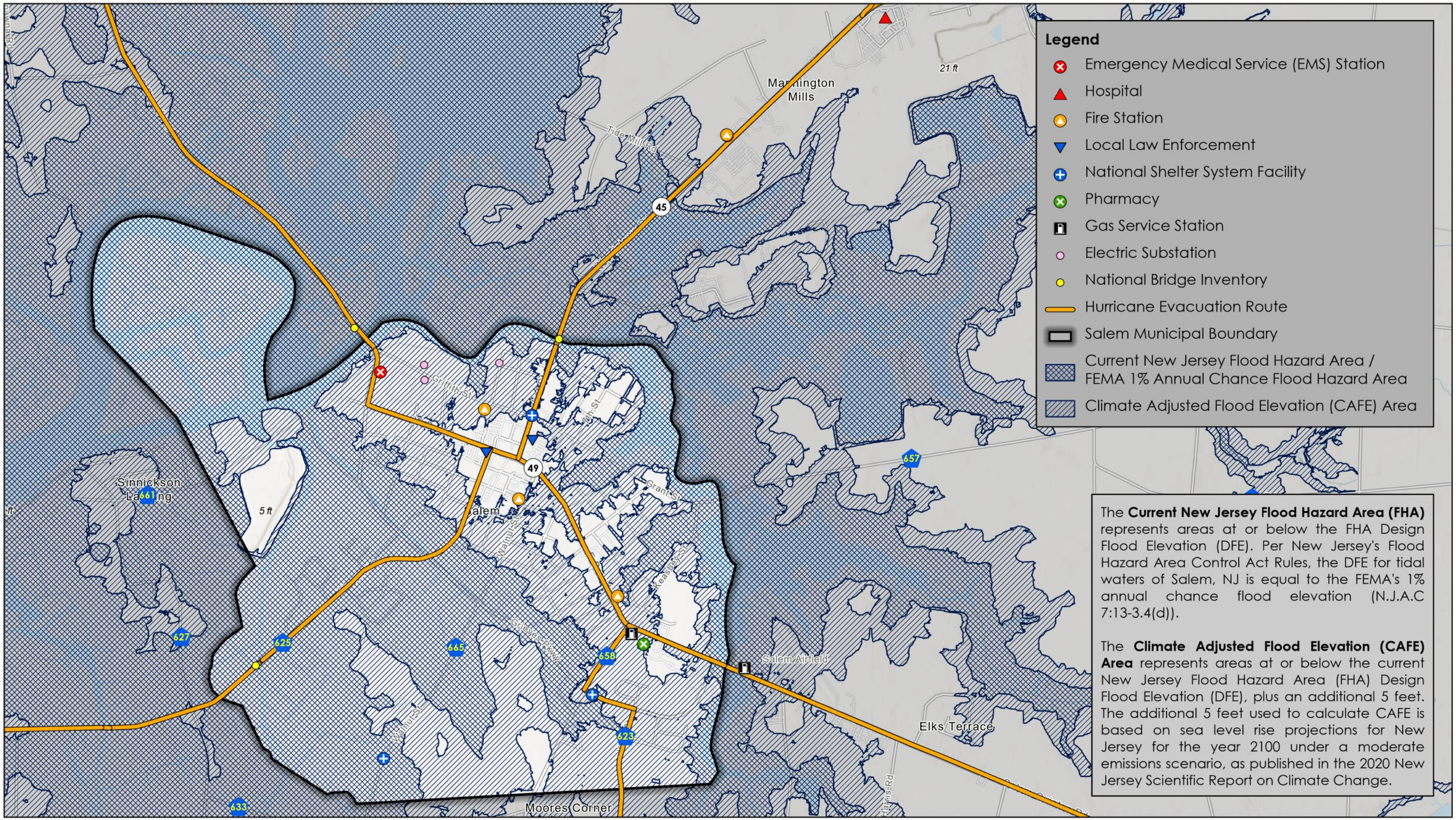
Spatial Reference: NAD 1983 2011 StatePlane New Jersey FIPS 2900 Ft US

0 700 1,400 Feet

CULTURAL RESOURCES IN EXISTING AND FUTURE 1% STORM FLOODPLAINS

RESILIENT NJ VULNERABILITY ASSESSMENT
BROWNFIELD REDEVELOPMENT SOLUTIONS, INC.
CITY OF SALEM, SALEM COUNTY, NEW JERSEY

File: P:\2070\Projects\2070001\GIS\APRX\Salem Vulnerability Assessment\Salem Vulnerability Assessment.aprx, Layout: 1% Storm Flooding + Critical Facilities, Exported: 2/15/2023, Drawn by thopper, Copyright Princeton Hydro, LLC.



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NOTES:
1. Gas service stations obtained from the NJDEP GIS website: www.state.nj.us/dep/gis/
2. Other critical facilities obtained from Homeland Infrastructure Foundation-Level Data (HIFLD) Geoplatform: https://hifld-geoplatform.opendata.arcgis.com/
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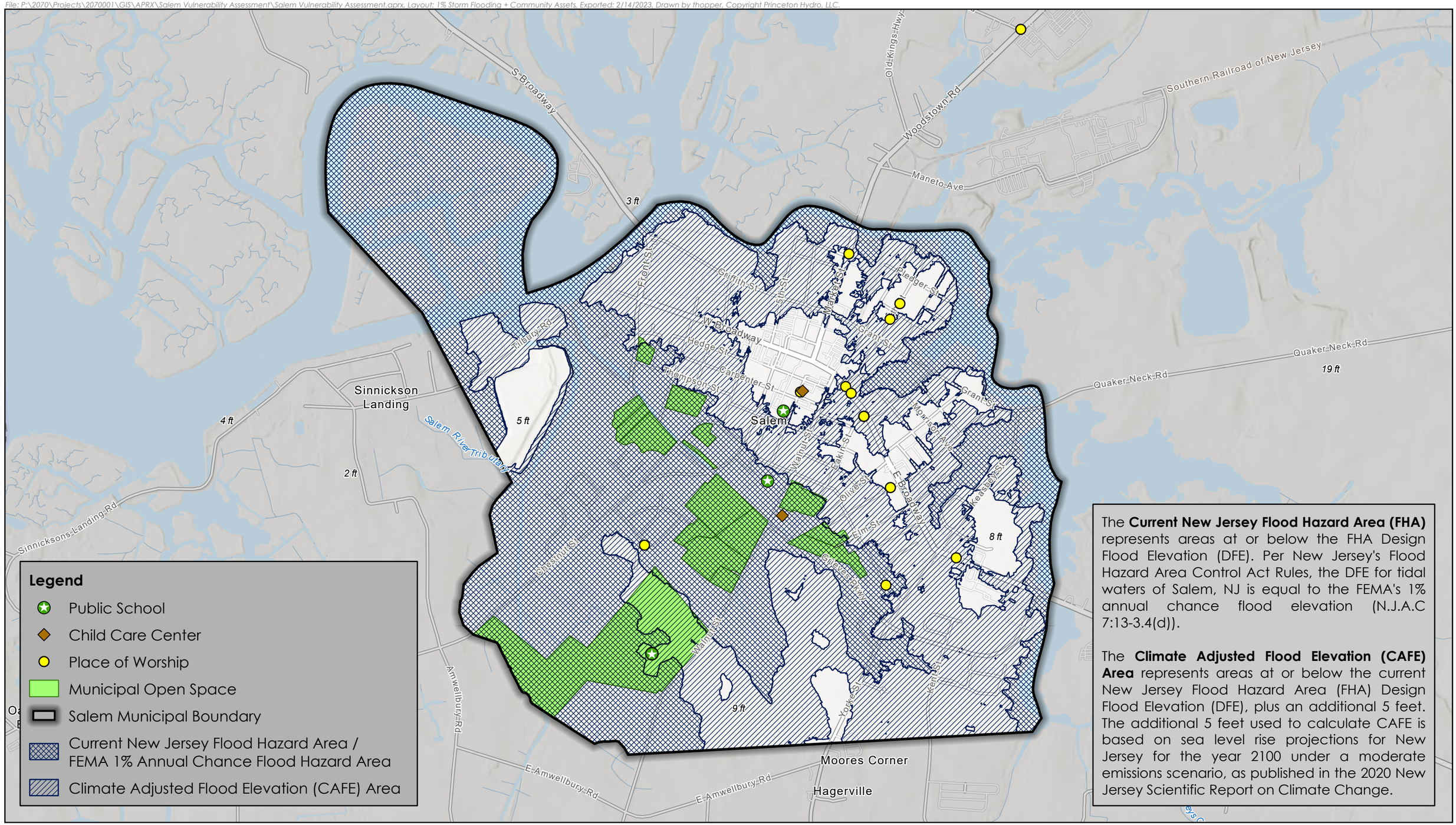
6. Basemap obtained from ESRI basemap services.

Spatial Reference: NAD 1983 2011 StatePlane New Jersey FIPS 2900 Ft US

0 800 1,600 Feet

CRITICAL FACILITIES IN EXISTING AND FUTURE 1% STORM FLOODPLAINS

RESILIENT NJ VULNERABILITY ASSESSMENT
BROWNFIELD REDEVELOPMENT SOLUTIONS, INC.
CITY OF SALEM, SALEM COUNTY, NEW JERSEY



Legend

- Public School
- Child Care Center
- Place of Worship
- Municipal Open Space
- Salem Municipal Boundary
- Current New Jersey Flood Hazard Area / FEMA 1% Annual Chance Flood Hazard Area
- Climate Adjusted Flood Elevation (CAFE) Area

The **Current New Jersey Flood Hazard Area (FHA)** represents areas at or below the FHA Design Flood Elevation (DFE). Per New Jersey's Flood Hazard Area Control Act Rules, the DFE for tidal waters of Salem, NJ is equal to the FEMA's 1% annual chance flood elevation (N.J.A.C 7:13-3.4(d)).

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NOTES:
1. Community assets obtained from Homeland Infrastructure Foundation-Level Data (HIFLD) Geoplatform: https://hifld-geoplatform.opendata.arcgis.com/
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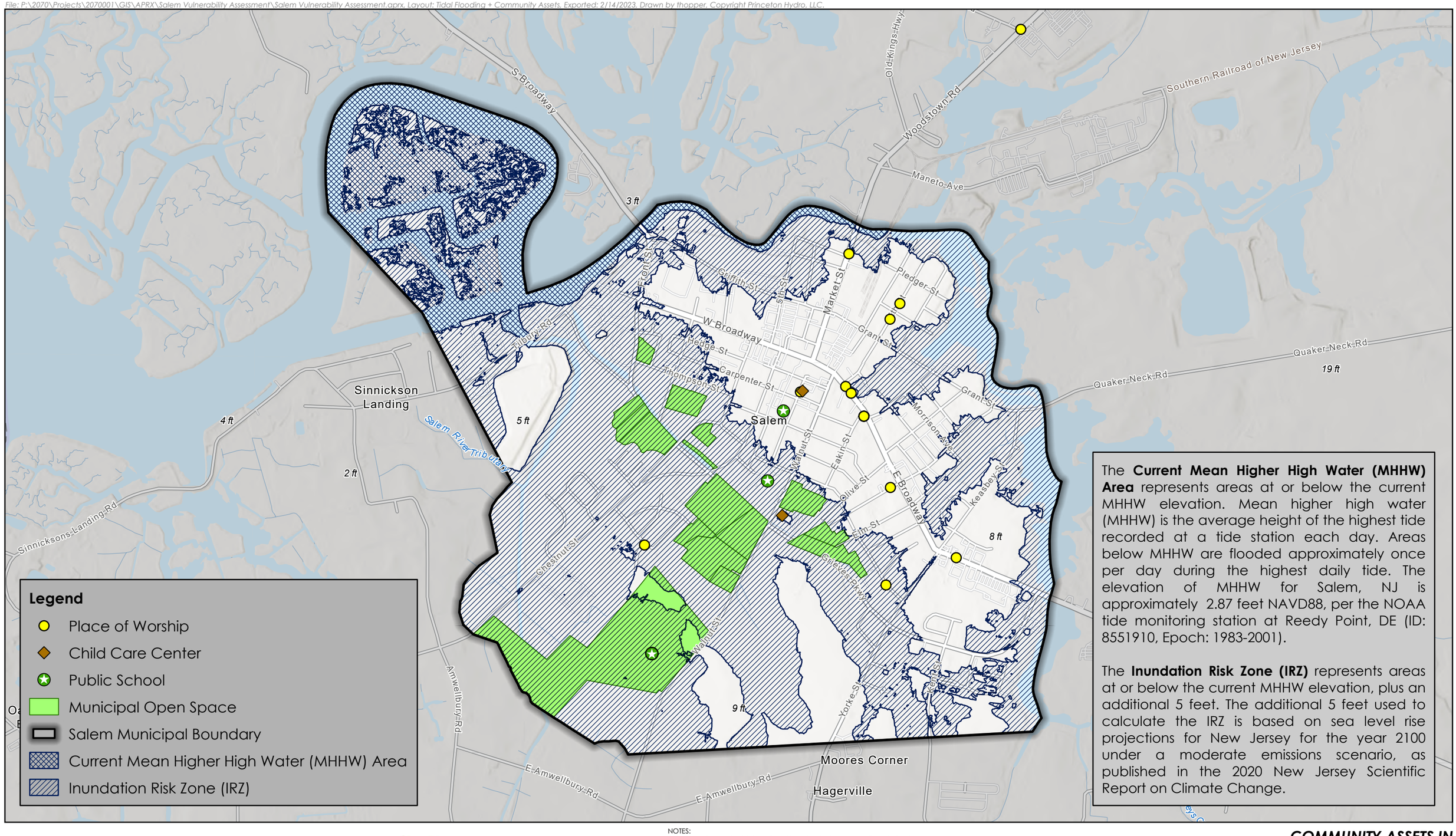
6. Basemap obtained from ESRI basemap services.

Spatial Reference: NAD 1983 2011 StatePlane New Jersey FIPS 2900 Ft US

0 700 1,400 Feet

COMMUNITY ASSETS IN EXISTING AND FUTURE 1% STORM FLOODPLAINS

RESILIENT NJ VULNERABILITY ASSESSMENT
BROWNFIELD REDEVELOPMENT SOLUTIONS, INC.
CITY OF SALEM, SALEM COUNTY, NEW JERSEY



Legend

- Place of Worship
- Child Care Center
- Public School
- Municipal Open Space
- Salem Municipal Boundary
- Current Mean Higher High Water (MHHW) Area
- Inundation Risk Zone (IRZ)

The **Current Mean Higher High Water (MHHW) Area** represents areas at or below the current MHHW elevation. Mean higher high water (MHHW) is the average height of the highest tide recorded at a tide station each day. Areas below MHHW are flooded approximately once per day during the highest daily tide. The elevation of MHHW for Salem, NJ is approximately 2.87 feet NAVD88, per the NOAA tide monitoring station at Reedy Point, DE (ID: 8551910, Epoch: 1983-2001).

The **Inundation Risk Zone (IRZ)** represents areas at or below the current MHHW elevation, plus an additional 5 feet. The additional 5 feet used to calculate the IRZ is based on sea level rise projections for New Jersey for the year 2100 under a moderate emissions scenario, as published in the 2020 New Jersey Scientific Report on Climate Change.

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5. Basemap obtained from ESRI basemap services.

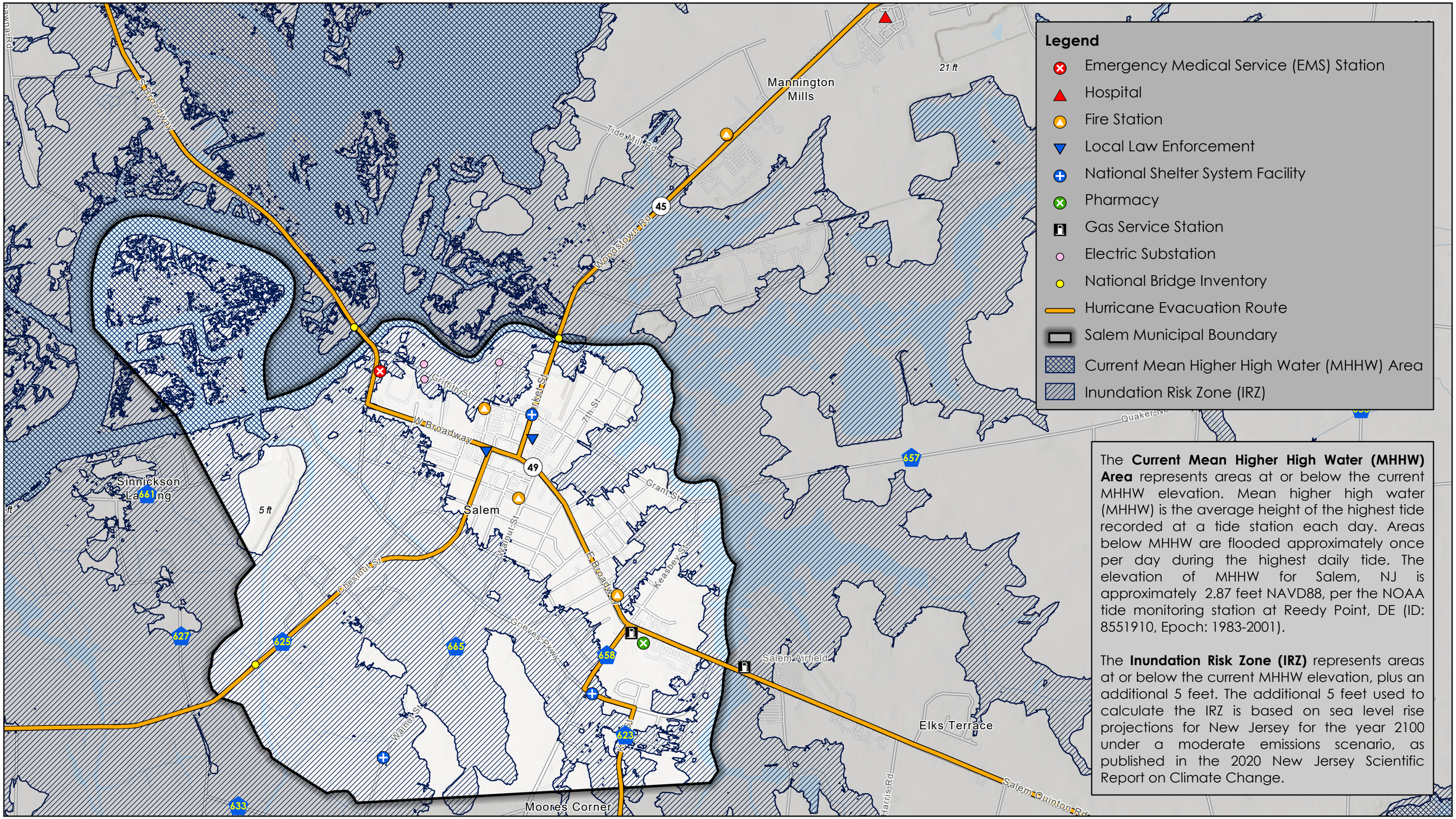
Spatial Reference: NAD 1983 2011 StatePlane New Jersey FIPS 2900 Ft US

0 700 1,400 Feet

COMMUNITY ASSETS IN EXISTING AND FUTURE TIDAL INUNDATION AREAS

RESILIENT NJ VULNERABILITY ASSESSMENT
BROWNFIELD REDEVELOPMENT SOLUTIONS, INC.
CITY OF SALEM, SALEM COUNTY, NEW JERSEY

File: P:\2070\Projects\2070001\GIS\APRX\Salem Vulnerability Assessment\Salem Vulnerability Assessment.aprx, Layout: Tidal Flooding + Critical Facilities, Exported: 2/14/2023, Drawn by thopper, Copyright Princeton Hydro, LLC.



The **Current Mean Higher High Water (MHHW) Area** represents areas at or below the current MHHW elevation. Mean higher high water (MHHW) is the average height of the highest tide recorded at a tide station each day. Areas below MHHW are flooded approximately once per day during the highest daily tide. The elevation of MHHW for Salem, NJ is approximately 2.87 feet NAVD88, per the NOAA tide monitoring station at Reedy Point, DE (ID: 8551910, Epoch: 1983-2001).

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NOTES:
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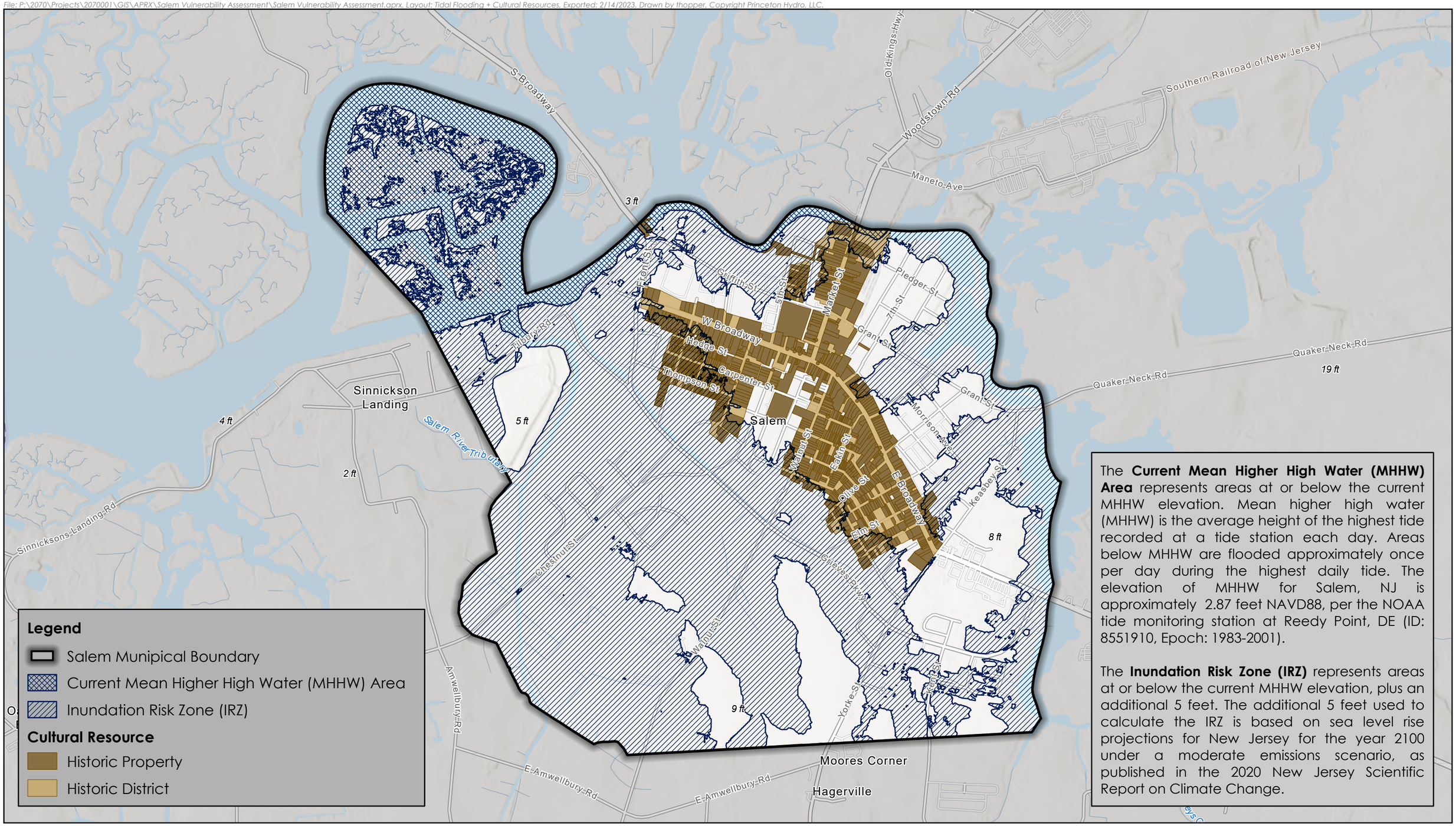
Spatial Reference: NAD 1983 2011 StatePlane New Jersey FIPS 2900 Ft US

0 800 1,600 Feet

CRITICAL FACILITIES IN EXISTING AND FUTURE TIDAL INUNDATION AREAS

RESILIENT NJ VULNERABILITY ASSESSMENT
BROWNFIELD REDEVELOPMENT SOLUTIONS, INC.
CITY OF SALEM, SALEM COUNTY, NEW JERSEY



Legend

- Salem Munipical Boundary
- Current Mean Higher High Water (MHHW) Area
- Inundation Risk Zone (IRZ)

Cultural Resource

- Historic Property
- Historic District

The **Current Mean Higher High Water (MHHW) Area** represents areas at or below the current MHHW elevation. Mean higher high water (MHHW) is the average height of the highest tide recorded at a tide station each day. Areas below MHHW are flooded approximately once per day during the highest daily tide. The elevation of MHHW for Salem, NJ is approximately 2.87 feet NAVD88, per the NOAA tide monitoring station at Reedy Point, DE (ID: 8551910, Epoch: 1983-2001).

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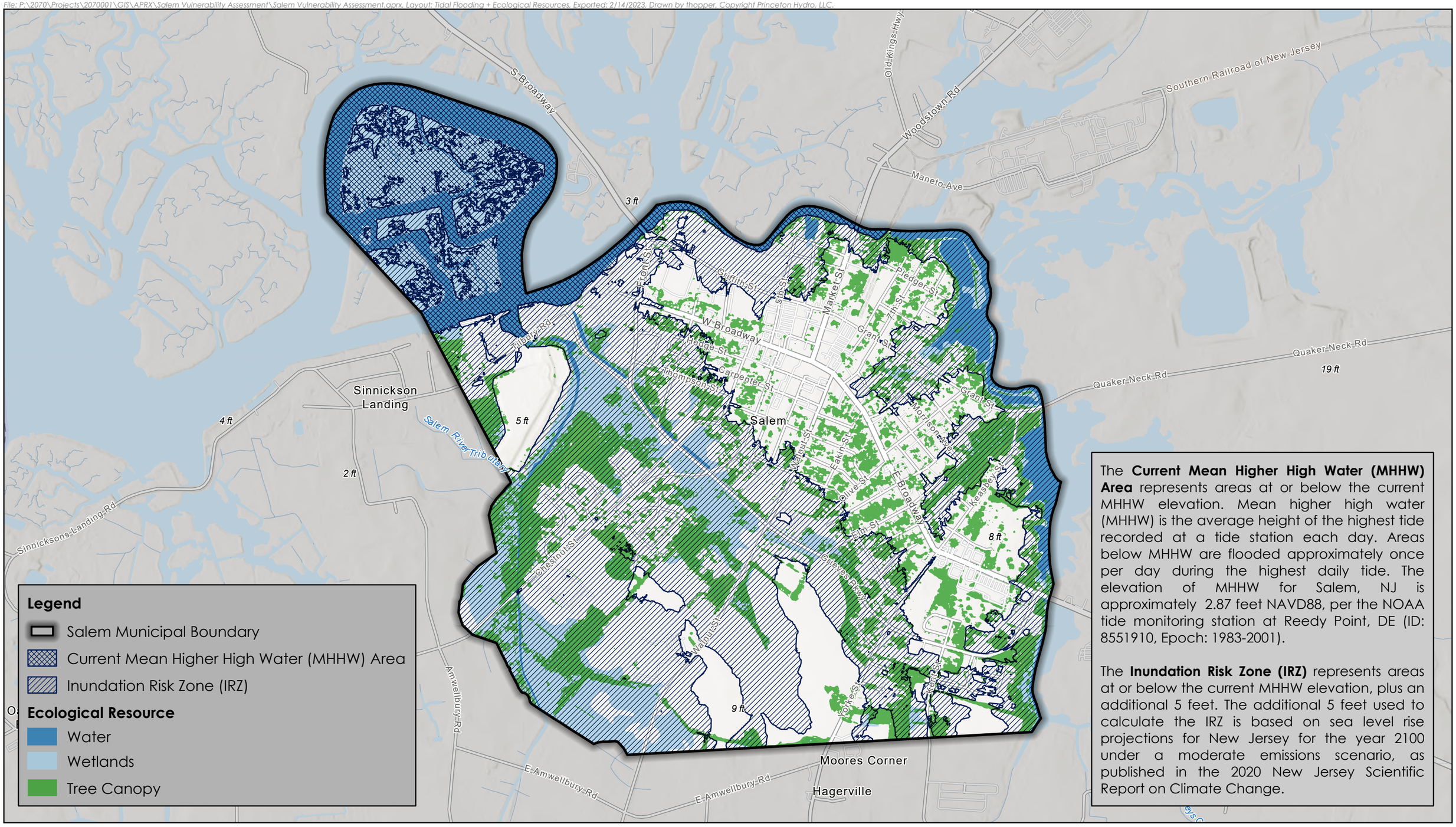
Spatial Reference: NAD 1983 2011 StatePlane New Jersey FIPS 2900 Ft US

0 700 1,400 Feet

CULTURAL RESOURCES IN EXISTING AND FUTURE TIDAL INUNDATION AREAS

RESILIENT NJ VULNERABILITY ASSESSMENT
BROWNFIELD REDEVELOPMENT SOLUTIONS, INC.
CITY OF SALEM, SALEM COUNTY, NEW JERSEY



Legend

- Salem Municipal Boundary
- Current Mean Higher High Water (MHHW) Area
- Inundation Risk Zone (IRZ)

Ecological Resource

- Water
- Wetlands
- Tree Canopy

The **Current Mean Higher High Water (MHHW) Area** represents areas at or below the current MHHW elevation. Mean higher high water (MHHW) is the average height of the highest tide recorded at a tide station each day. Areas below MHHW are flooded approximately once per day during the highest daily tide. The elevation of MHHW for Salem, NJ is approximately 2.87 feet NAVD88, per the NOAA tide monitoring station at Reedy Point, DE (ID: 8551910, Epoch: 1983-2001).

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NOTES:
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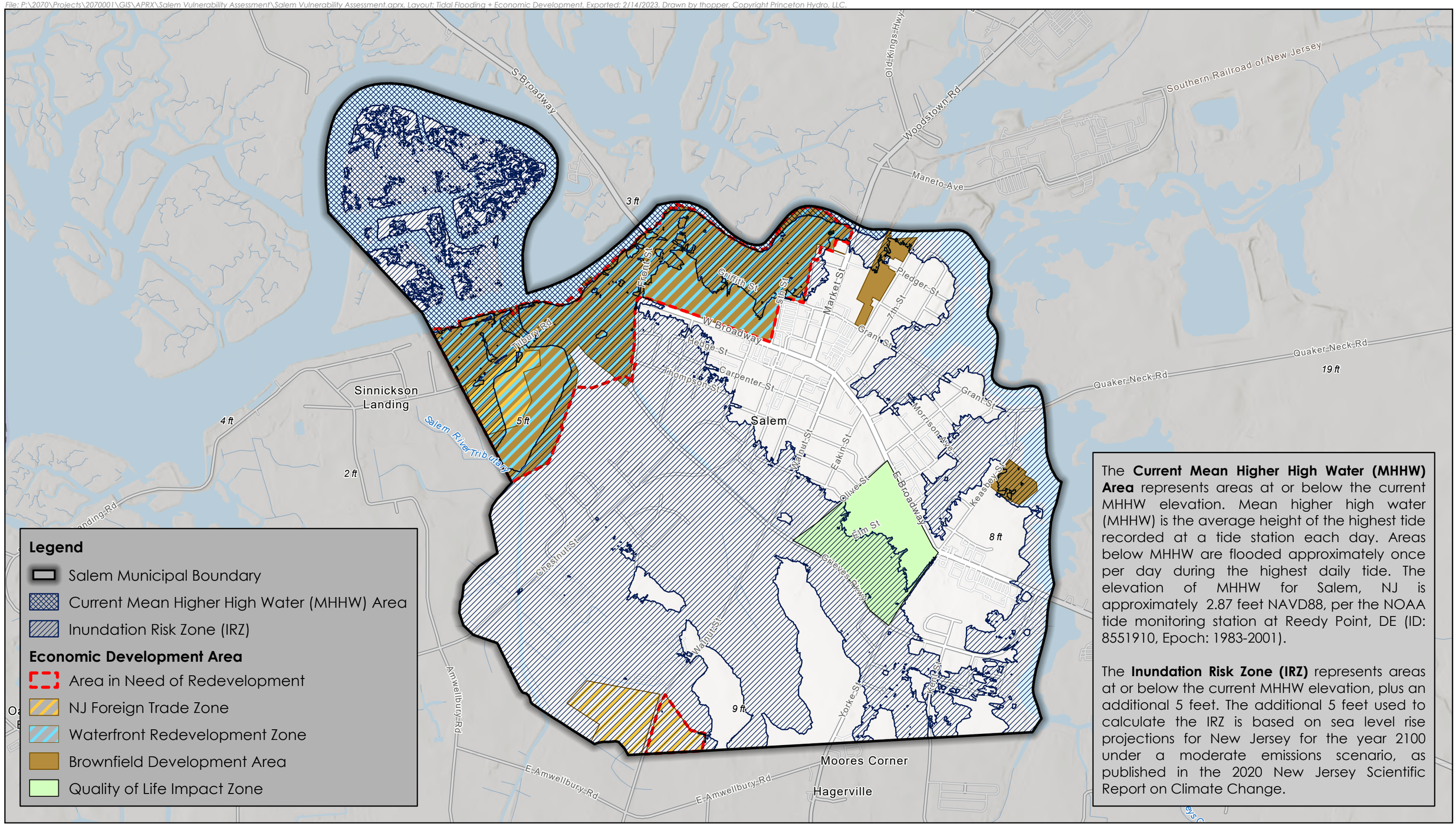
0 700 1,400 Feet

ECOLOGICAL RESOURCES IN EXISTING AND FUTURE TIDAL INUNDATION AREAS

RESILIENT NJ VULNERABILITY ASSESSMENT
BROWNFIELD REDEVELOPMENT SOLUTIONS, INC.
CITY OF SALEM, SALEM COUNTY, NEW JERSEY



Legend

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- Current Mean Higher High Water (MHHW) Area
- Inundation Risk Zone (IRZ)

Economic Development Area

- Area in Need of Redevelopment
- NJ Foreign Trade Zone
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- Brownfield Development Area
- Quality of Life Impact Zone

The **Current Mean Higher High Water (MHHW) Area** represents areas at or below the current MHHW elevation. Mean higher high water (MHHW) is the average height of the highest tide recorded at a tide station each day. Areas below MHHW are flooded approximately once per day during the highest daily tide. The elevation of MHHW for Salem, NJ is approximately 2.87 feet NAVD88, per the NOAA tide monitoring station at Reedy Point, DE (ID: 8551910, Epoch: 1983-2001).

The **Inundation Risk Zone (IRZ)** represents areas at or below the current MHHW elevation, plus an additional 5 feet. The additional 5 feet used to calculate the IRZ is based on sea level rise projections for New Jersey for the year 2100 under a moderate emissions scenario, as published in the 2020 New Jersey Scientific Report on Climate Change.

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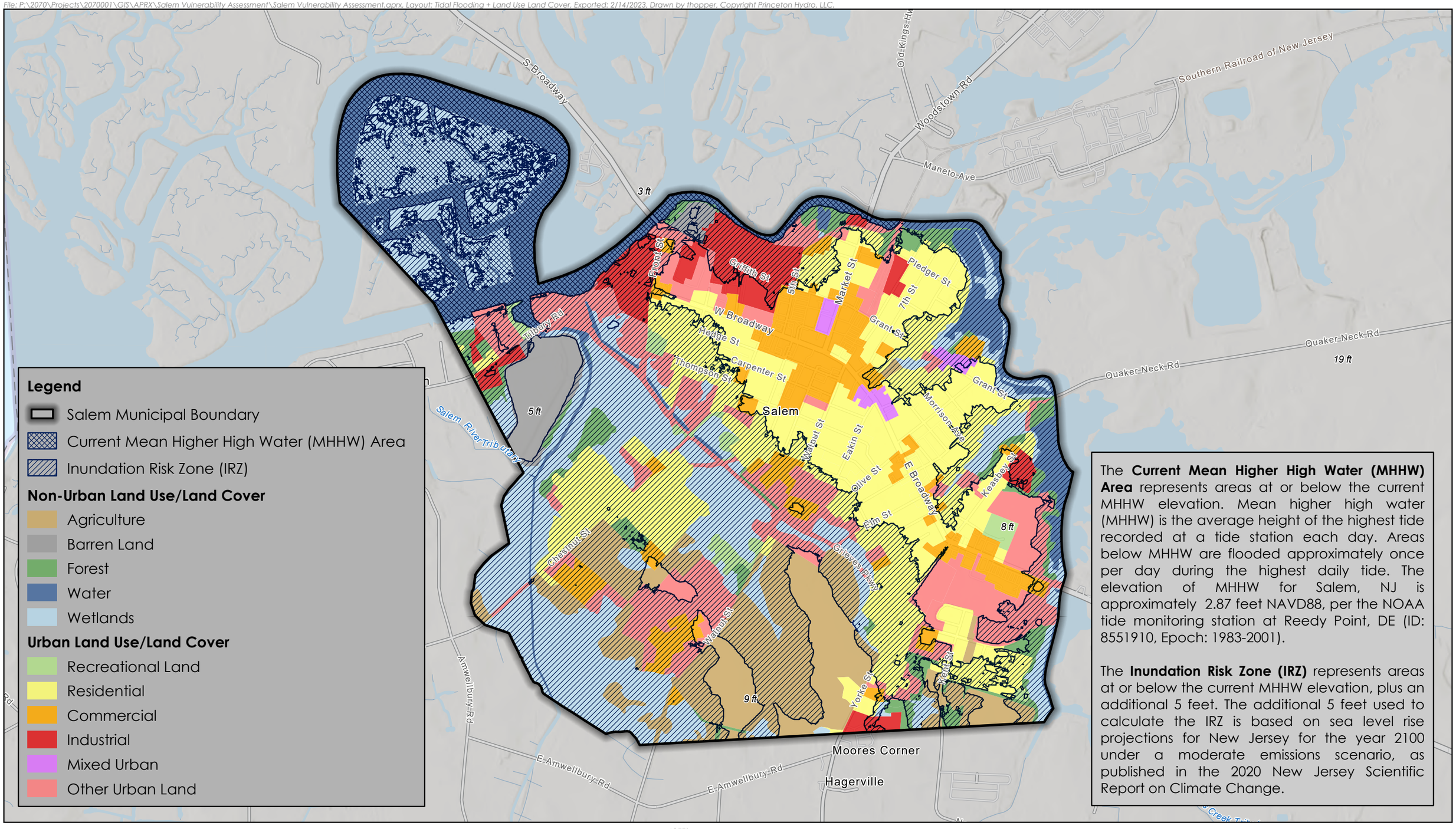
NOTES:
1. Waterfront redevelopment zone obtained from the City of Salem, NJ.
2. Other economic development features obtained from the NJ Geographic Information Network (NJGIN) Open Data portal: https://njgin.nj.gov/.
3. Current MHHW area and IRZ produced using NJ Adapt Flood Mapper: https://www.njfloodmapper.org/
4. Salem municipal boundary obtained from New Jersey Geographic Information Network (NJGIN) Open Data portal: https://njgin.nj.gov/
5. Basemap obtained from ESRI basemap services.

Spatial Reference: NAD 1983 2011 StatePlane New Jersey FIPS 2900 Ft US

0 700 1,400 Feet

ECONOMIC DEVELOPMENT FEATURES IN EXISTING AND FUTURE TIDAL INUNDATION AREAS

RESILIENT NJ VULNERABILITY ASSESSMENT
BROWNFIELD REDEVELOPMENT SOLUTIONS, INC.
CITY OF SALEM, SALEM COUNTY, NEW JERSEY



Legend

- Salem Municipal Boundary
- Current Mean Higher High Water (MHHW) Area
- Inundation Risk Zone (IRZ)

Non-Urban Land Use/Land Cover

- Agriculture
- Barren Land
- Forest
- Water
- Wetlands

Urban Land Use/Land Cover

- Recreational Land
- Residential
- Commercial
- Industrial
- Mixed Urban
- Other Urban Land

The **Current Mean Higher High Water (MHHW) Area** represents areas at or below the current MHHW elevation. Mean higher high water (MHHW) is the average height of the highest tide recorded at a tide station each day. Areas below MHHW are flooded approximately once per day during the highest daily tide. The elevation of MHHW for Salem, NJ is approximately 2.87 feet NAVD88, per the NOAA tide monitoring station at Reedy Point, DE (ID: 8551910, Epoch: 1983-2001).

The **Inundation Risk Zone (IRZ)** represents areas at or below the current MHHW elevation, plus an additional 5 feet. The additional 5 feet used to calculate the IRZ is based on sea level rise projections for New Jersey for the year 2100 under a moderate emissions scenario, as published in the 2020 New Jersey Scientific Report on Climate Change.

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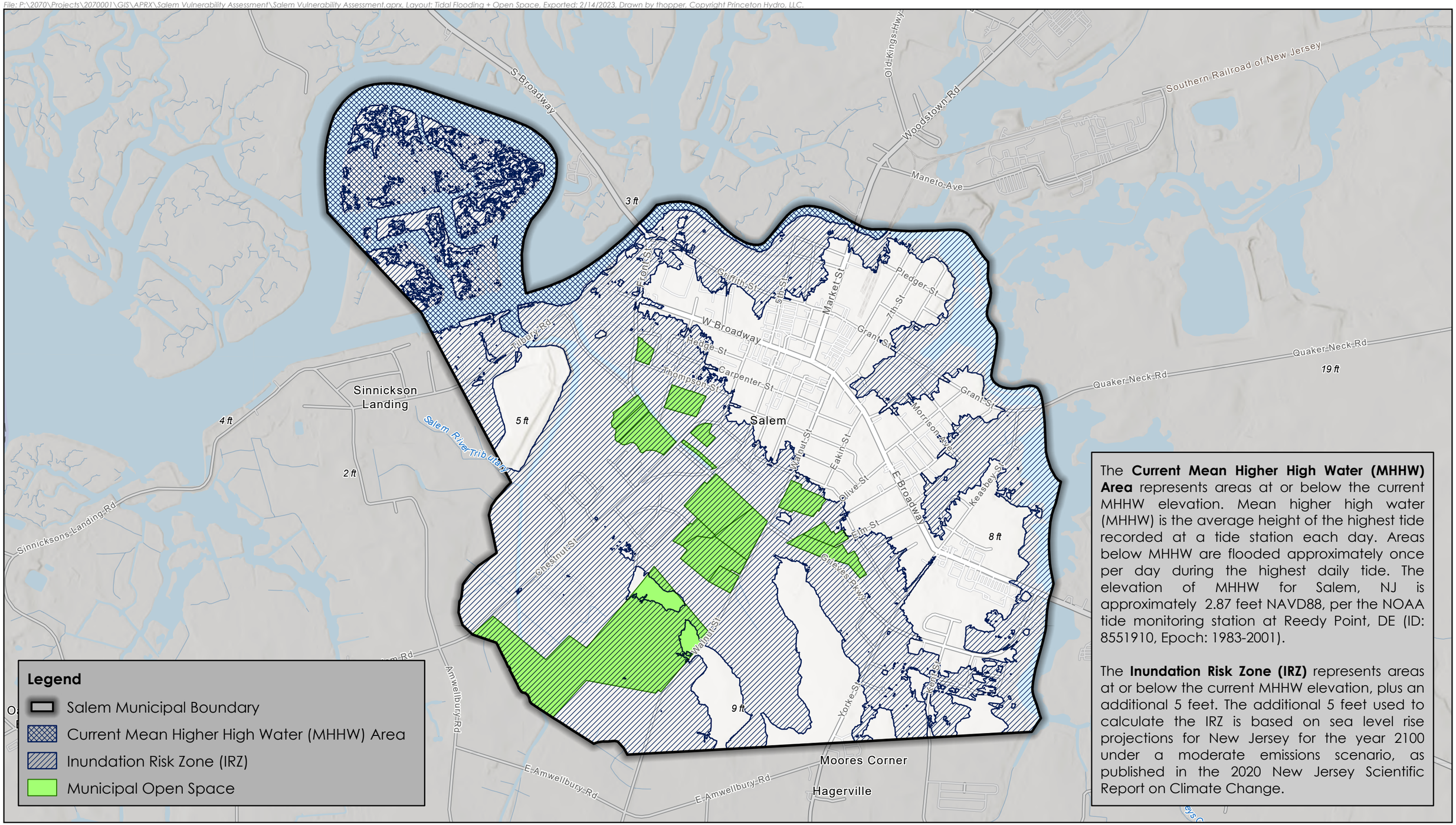
NOTES:
1. 2015 Land Use/Land Cover obtained from the NJDEP GIS website: www.state.nj.us/dep/gis/
2. Current MHHW area and IRZ produced using NJ Adapt Flood Mapper: https://www.njfloodmapper.org/
3. Salem municipal boundary obtained from New Jersey Geographic Information Network (NJGIN) Open Data portal: https://njgin.nj.gov/
4. Basemap obtained from ESRI basemap services.

Spatial Reference: NAD 1983 2011 StatePlane New Jersey FIPS 2900 Ft US

0 700 1,400 Feet

LAND USE/LAND COVER IN EXISTING AND FUTURE TIDAL INUNDATION AREAS

RESILIENT NJ VULNERABILITY ASSESSMENT
BROWNFIELD REDEVELOPMENT SOLUTIONS, INC.
CITY OF SALEM, SALEM COUNTY, NEW JERSEY



Legend

- Salem Municipal Boundary
- Current Mean Higher High Water (MHHW) Area
- Inundation Risk Zone (IRZ)
- Municipal Open Space

The **Current Mean Higher High Water (MHHW) Area** represents areas at or below the current MHHW elevation. Mean higher high water (MHHW) is the average height of the highest tide recorded at a tide station each day. Areas below MHHW are flooded approximately once per day during the highest daily tide. The elevation of MHHW for Salem, NJ is approximately 2.87 feet NAVD88, per the NOAA tide monitoring station at Reedy Point, DE (ID: 8551910, Epoch: 1983-2001).

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NOTES:
1. Open spaces obtained from the NJ Geographic Information Network (NJGIN) Open Data portal: https://njgin.nj.gov/
2. Current MHHW area and IRZ produced using NJ Adapt Flood Mapper: https://www.njfloodmapper.org/
3. Salem municipal boundary obtained from New Jersey Geographic Information Network (NJGIN) Open Data portal: https://njgin.nj.gov/
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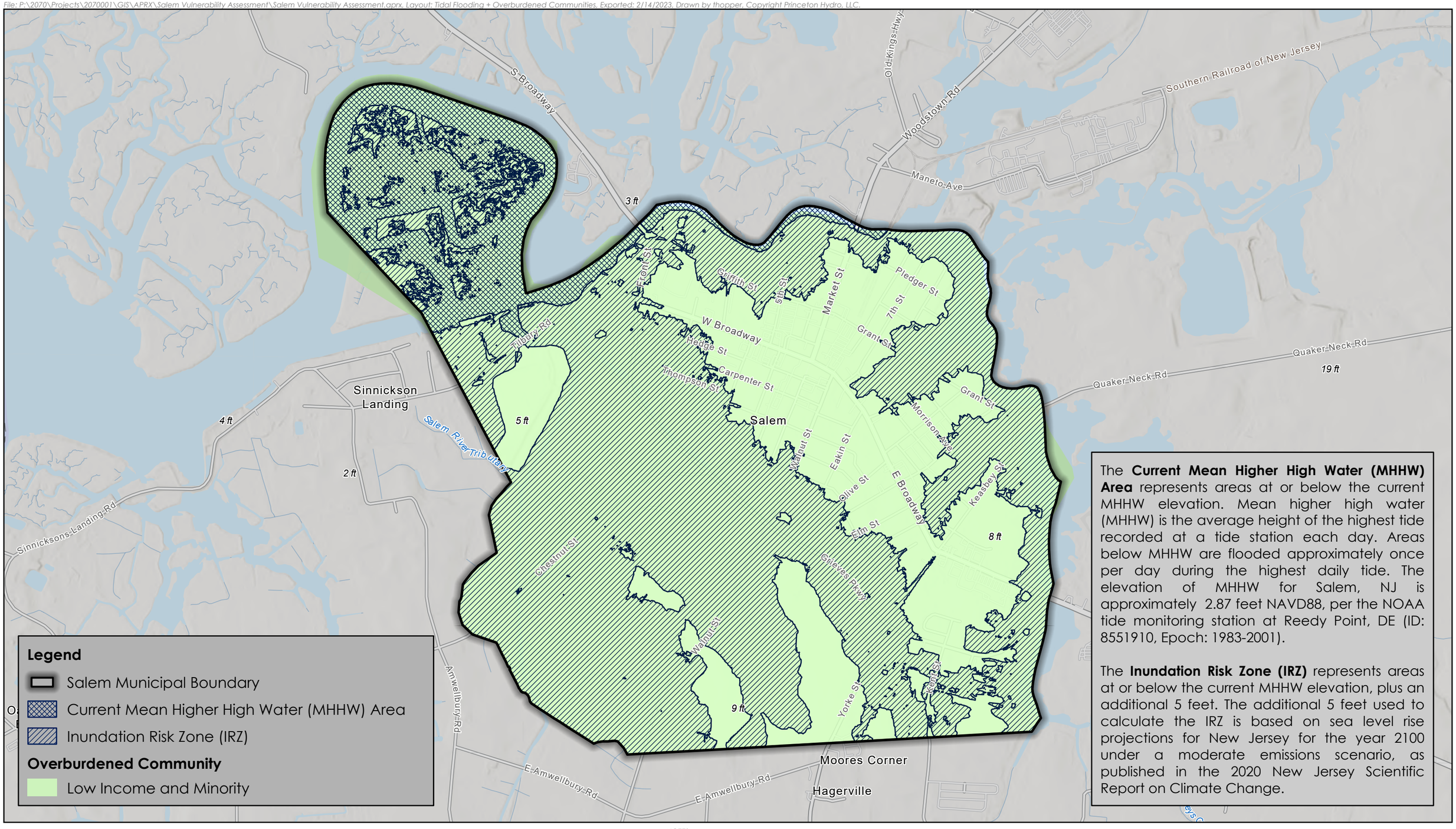
Spatial Reference: NAD 1983 2011 StatePlane New Jersey FIPS 2900 Ft US

0 700 1,400 Feet

OPEN SPACE IN EXISTING AND FUTURE TIDAL INUNDATION AREAS

RESILIENT NJ VULNERABILITY ASSESSMENT
BROWNFIELD REDEVELOPMENT SOLUTIONS, INC.
CITY OF SALEM, SALEM COUNTY, NEW JERSEY



Legend

- Salem Municipal Boundary
- Current Mean Higher High Water (MHHW) Area
- Inundation Risk Zone (IRZ)

Overburdened Community

- Low Income and Minority

The **Current Mean Higher High Water (MHHW) Area** represents areas at or below the current MHHW elevation. Mean higher high water (MHHW) is the average height of the highest tide recorded at a tide station each day. Areas below MHHW are flooded approximately once per day during the highest daily tide. The elevation of MHHW for Salem, NJ is approximately 2.87 feet NAVD88, per the NOAA tide monitoring station at Reedy Point, DE (ID: 8551910, Epoch: 1983-2001).

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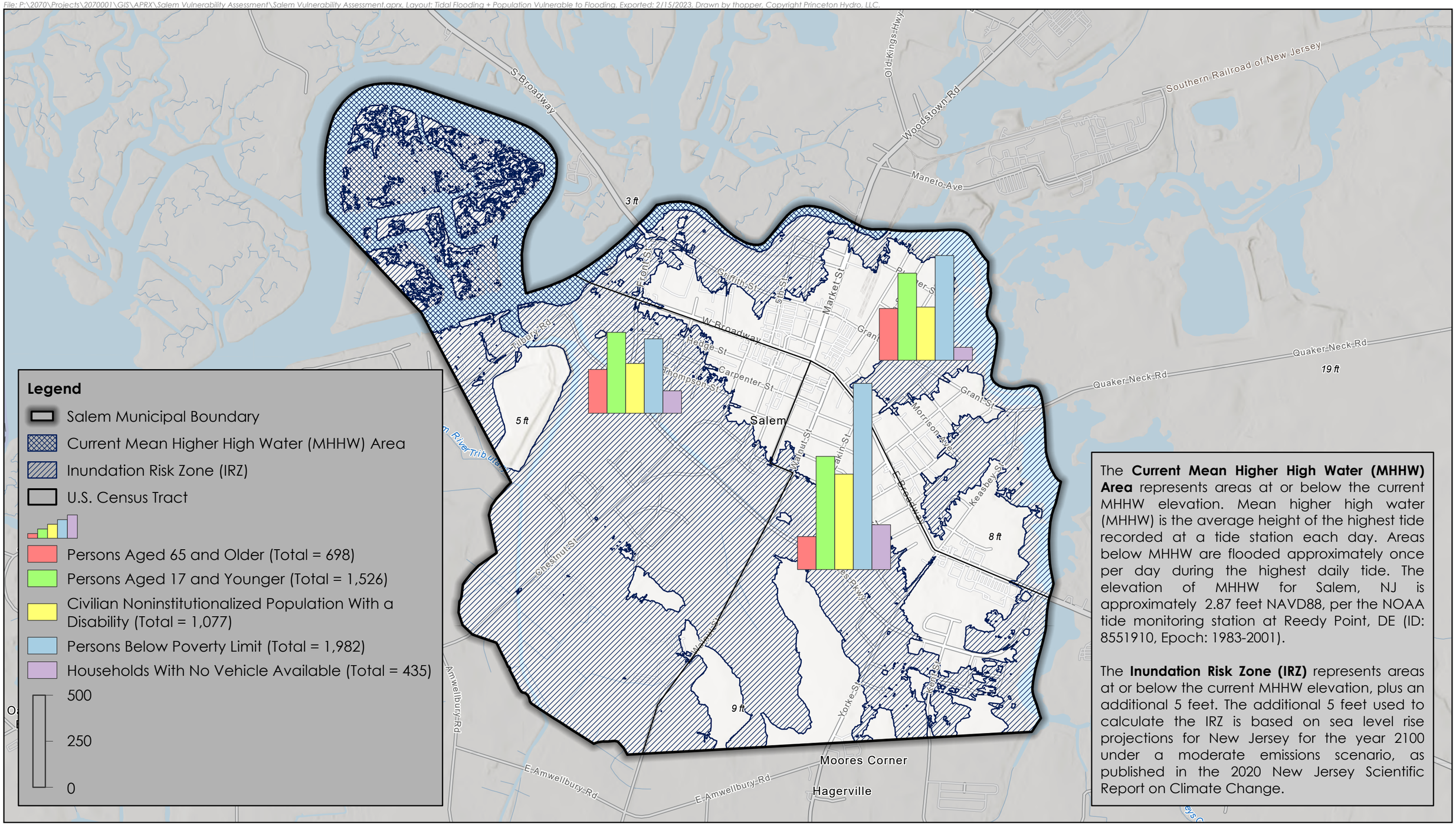
NOTES:
1. Overburdened communities under the NJ Environmental Justice Law obtained from the NJDEP GIS website: www.state.nj.us/dep/gis/
2. Current MHHW area and IRZ produced using NJ Adapt Flood Mapper: https://www.njfloodmapper.org/
3. Salem municipal boundary obtained from New Jersey Geographic Information Network (NJGIN) Open Data portal: https://njgin.nj.gov/
4. Basemap obtained from ESRI basemap services.

Spatial Reference: NAD 1983 2011 StatePlane New Jersey FIPS 2900 Ft US

0 700 1,400 Feet

OVERBURDENED COMMUNITIES IN EXISTING AND FUTURE TIDAL INUNDATION AREAS

RESILIENT NJ VULNERABILITY ASSESSMENT
BROWNFIELD REDEVELOPMENT SOLUTIONS, INC.
CITY OF SALEM, SALEM COUNTY, NEW JERSEY



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NOTES:
1. Overburdened communities under the NJ Environmental Justice Law obtained from the NJDEP GIS website: www.state.nj.us/dep/gis/
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4. Basemap obtained from ESRI basemap services.

Spatial Reference: NAD 1983 2011 StatePlane New Jersey FIPS 2900 Ft US

0 700 1,400 Feet

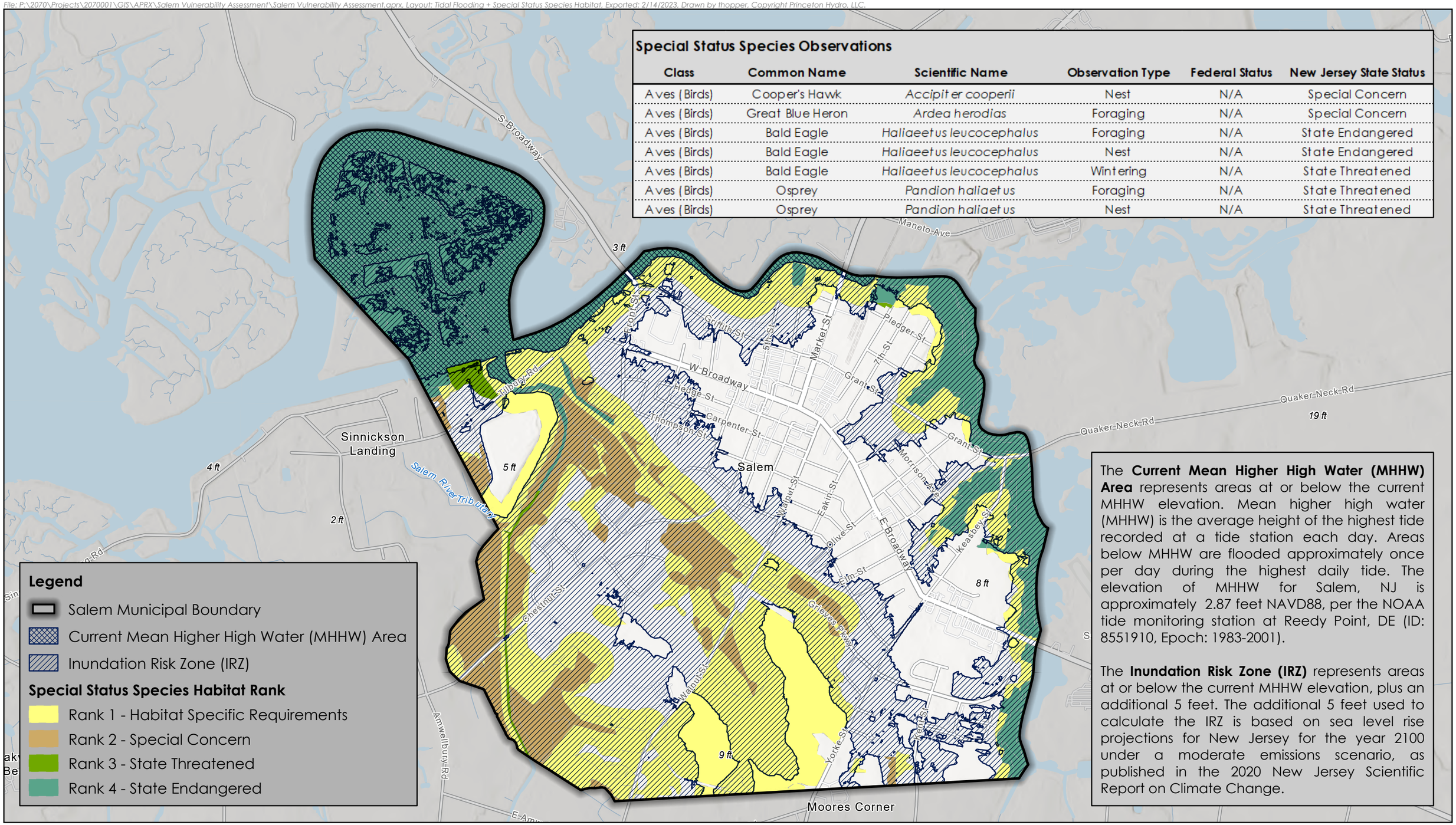
VULNERABLE POPULATIONS AND EXISTING AND FUTURE TIDAL INUNDATION AREAS

RESILIENT NJ VULNERABILITY ASSESSMENT
BROWNFIELD REDEVELOPMENT SOLUTIONS, INC.
CITY OF SALEM, SALEM COUNTY, NEW JERSEY

File: P:\2070\Projects\2070001\GIS\APRX\Salem Vulnerability Assessment\Salem Vulnerability Assessment.aprx, Layout: Tidal Flooding + Special Status Species Habitat, Exported: 2/14/2023, Drawn by thopper, Copyright Princeton Hydro, LLC.

Special Status Species Observations

Class	Common Name	Scientific Name	Observation Type	Federal Status	New Jersey State Status
Aves (Birds)	Cooper's Hawk	*Accipiter cooperii*	Nest	N/A	Special Concern
Aves (Birds)	Great Blue Heron	*Ardea herodias*	Foraging	N/A	Special Concern
Aves (Birds)	Bald Eagle	*Haliaeetus leucocephalus*	Foraging	N/A	State Endangered
Aves (Birds)	Bald Eagle	*Haliaeetus leucocephalus*	Nest	N/A	State Endangered
Aves (Birds)	Bald Eagle	*Haliaeetus leucocephalus*	Wintering	N/A	State Threatened
Aves (Birds)	Osprey	*Pandion haliaetus*	Foraging	N/A	State Threatened
Aves (Birds)	Osprey	*Pandion haliaetus*	Nest	N/A	State Threatened



Legend

- Salem Municipal Boundary
- Current Mean Higher High Water (MHHW) Area
- Inundation Risk Zone (IRZ)

Special Status Species Habitat Rank

- Rank 1 - Habitat Specific Requirements
- Rank 2 - Special Concern
- Rank 3 - State Threatened
- Rank 4 - State Endangered

The **Current Mean Higher High Water (MHHW) Area** represents areas at or below the current MHHW elevation. Mean higher high water (MHHW) is the average height of the highest tide recorded at a tide station each day. Areas below MHHW are flooded approximately once per day during the highest daily tide. The elevation of MHHW for Salem, NJ is approximately 2.87 feet NAVD88, per the NOAA tide monitoring station at Reedy Point, DE (ID: 8551910, Epoch: 1983-2001).

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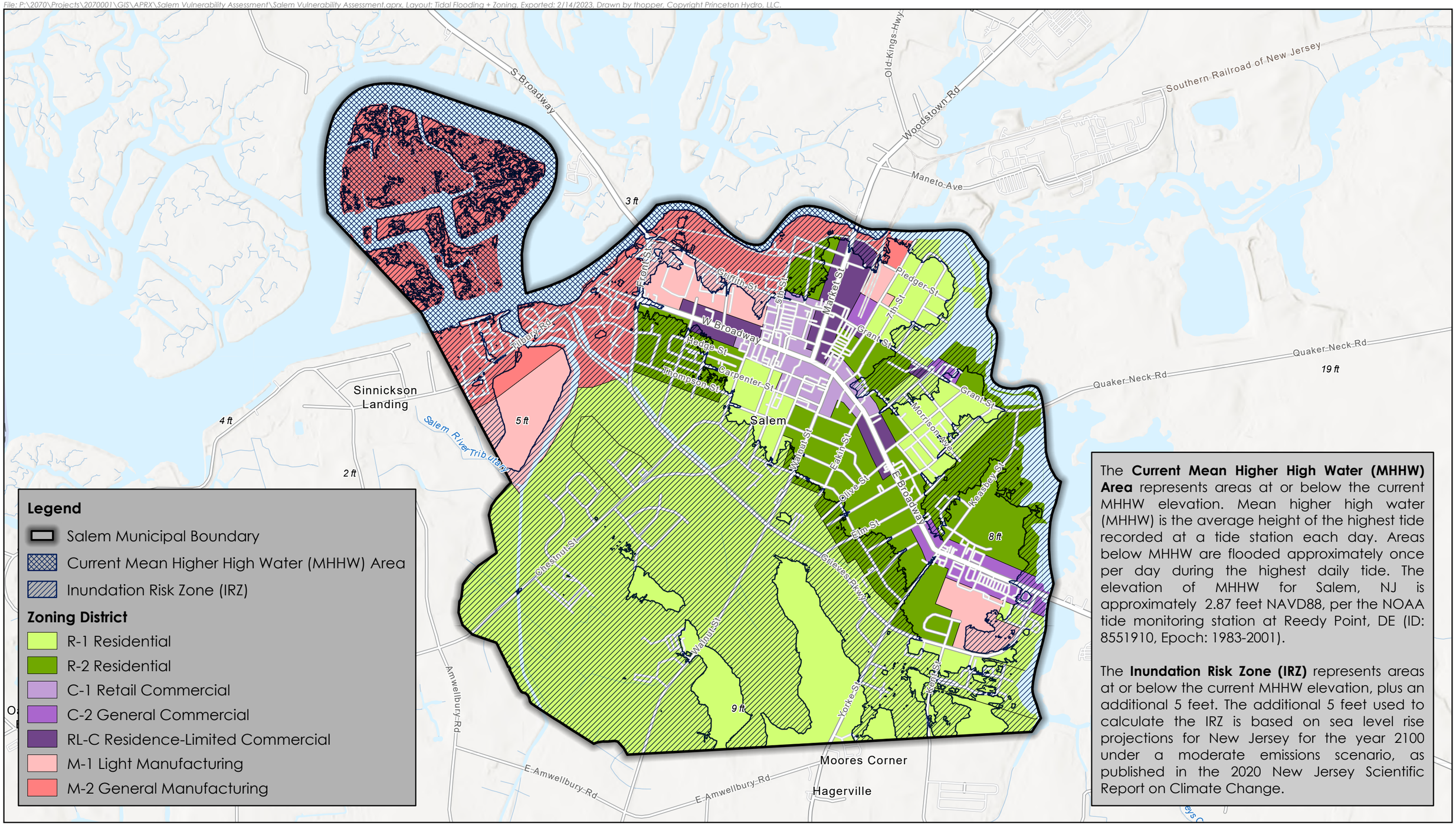
NOTES:
1. Special status species habitat from the Landscape Project, v3.3, obtained from the NJDEP GIS website: www.state.nj.us/dep/gis/
2. Current MHHW area and IRZ produced using NJ Adapt Flood Mapper: https://www.njfloodmapper.org/
3. Salem municipal boundary obtained from New Jersey Geographic Information Network (NJGIN) Open Data portal: https://njgin.nj.gov/
4. Basemap obtained from ESRI basemap services.

Spatial Reference: NAD 1983 2011 StatePlane New Jersey FIPS 2900 Ft US

0 700 1,400 Feet

SPECIAL STATUS SPECIES HABITAT IN EXISTING AND FUTURE TIDAL INUNDATION AREAS

RESILIENT NJ VULNERABILITY ASSESSMENT
BROWNFIELD REDEVELOPMENT SOLUTIONS, INC.
CITY OF SALEM, SALEM COUNTY, NEW JERSEY



Legend

- Salem Municipal Boundary
- Current Mean Higher High Water (MHHW) Area
- Inundation Risk Zone (IRZ)

Zoning District

- R-1 Residential
- R-2 Residential
- C-1 Retail Commercial
- C-2 General Commercial
- RL-C Residence-Limited Commercial
- M-1 Light Manufacturing
- M-2 General Manufacturing

The **Current Mean Higher High Water (MHHW) Area** represents areas at or below the current MHHW elevation. Mean higher high water (MHHW) is the average height of the highest tide recorded at a tide station each day. Areas below MHHW are flooded approximately once per day during the highest daily tide. The elevation of MHHW for Salem, NJ is approximately 2.87 feet NAVD88, per the NOAA tide monitoring station at Reedy Point, DE (ID: 8551910, Epoch: 1983-2001).

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NOTES:
1. Zoning districts provided by the City of Salem.
2. Current MHHW area and IRZ produced using NJ Adapt Flood Mapper: https://www.njfloodmapper.org/
3. Salem municipal boundary obtained from New Jersey Geographic Information Network (NJGIN) Open Data portal: https://njgin.nj.gov/
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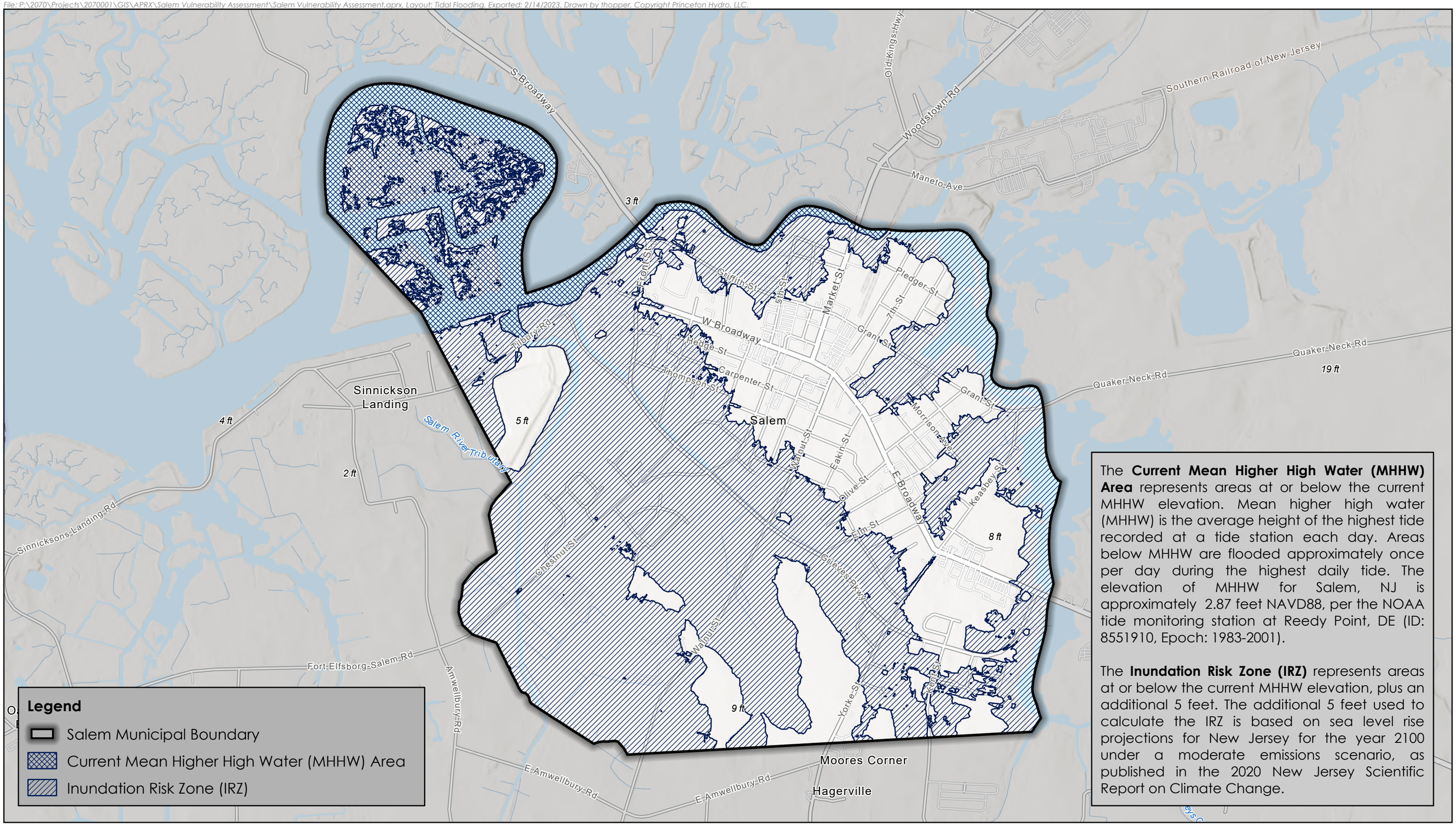
Spatial Reference: NAD 1983 2011 StatePlane New Jersey FIPS 2900 Ft US

0 700 1,400 Feet

ZONING IN EXISTING AND FUTURE TIDAL INUNDATION AREAS

RESILIENT NJ VULNERABILITY ASSESSMENT
BROWNFIELD REDEVELOPMENT SOLUTIONS, INC.
CITY OF SALEM, SALEM COUNTY, NEW JERSEY



Legend

- Salem Municipal Boundary
- Current Mean Higher High Water (MHHW) Area
- Inundation Risk Zone (IRZ)

The **Current Mean Higher High Water (MHHW) Area** represents areas at or below the current MHHW elevation. Mean higher high water (MHHW) is the average height of the highest tide recorded at a tide station each day. Areas below MHHW are flooded approximately once per day during the highest daily tide. The elevation of MHHW for Salem, NJ is approximately 2.87 feet NAVD88, per the NOAA tide monitoring station at Reedy Point, DE (ID: 8551910, Epoch: 1983-2001).

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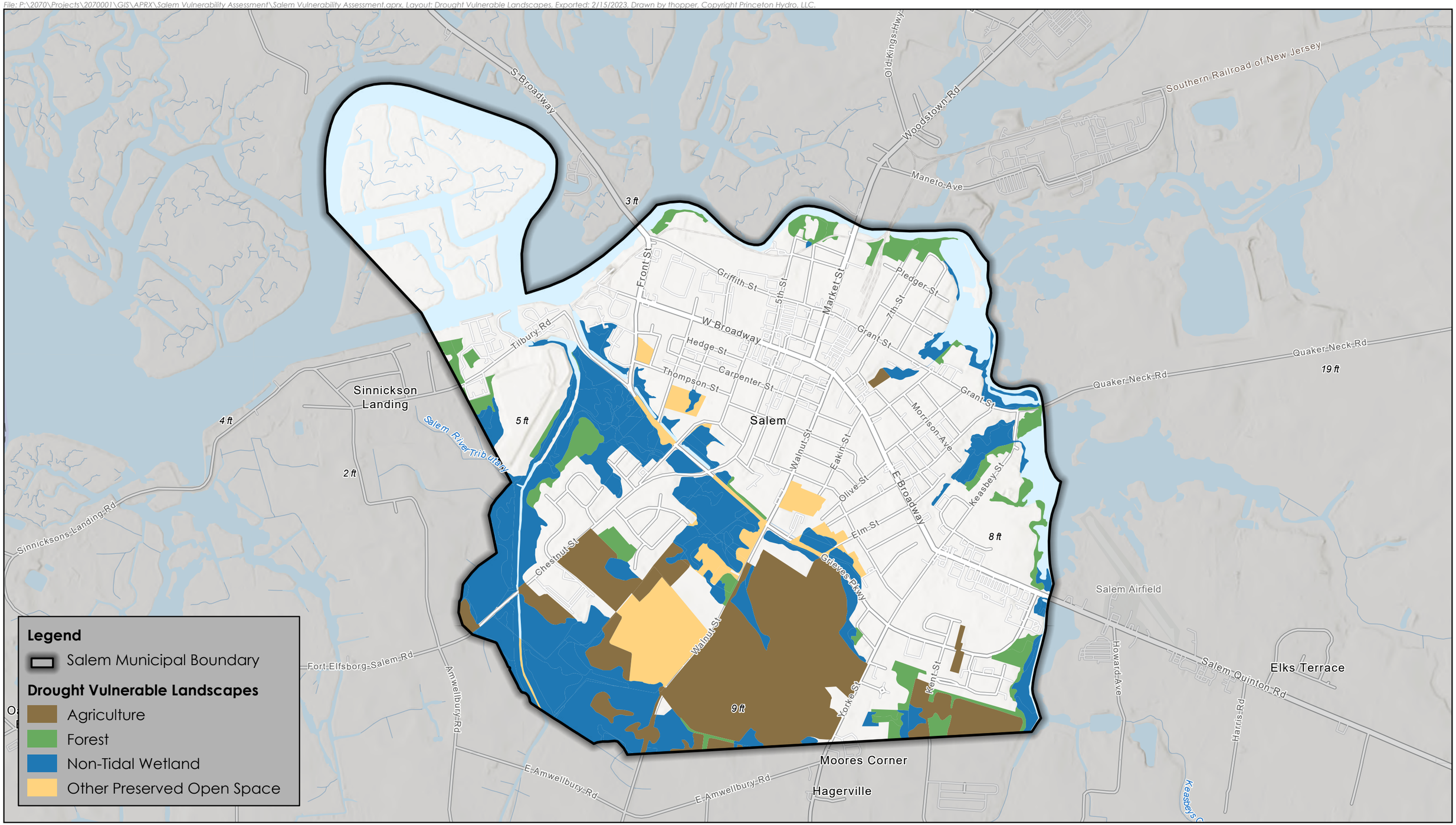
0 700 1,400 Feet

EXISTING AND FUTURE TIDAL INUNDATION AREAS

RESILIENT NJ VULNERABILITY ASSESSMENT
BROWNFIELD REDEVELOPMENT SOLUTIONS, INC.
CITY OF SALEM, SALEM COUNTY, NEW JERSEY



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NOTES:
1. Agriculture, forest and non-tidal wetlands (2015 Land Use/Land Cover) obtained from the NJDEP GIS website: www.state.nj.us/dep/gis/
2. Open spaces obtained from the NJ Geographic Information Network (NJGIN) Open Data portal: https://njgin.nj.gov/
3. Salem municipal boundary obtained from New Jersey Geographic Information Network (NJGIN) Open Data portal: https://njgin.nj.gov/
4. Basemap obtained from ESRI basemap services.

Spatial Reference: NAD 1983 2011 StatePlane New Jersey FIPS 2900 Ft US

0 700 1,400 Feet

DROUGHT VULNERABLE LANDSCAPES

RESILIENT NJ VULNERABILITY ASSESSMENT
BROWNFIELD REDEVELOPMENT SOLUTIONS, INC.
CITY OF SALEM, SALEM COUNTY, NEW JERSEY

Urban Heat Island Severity Areas are those areas that are hotter than the average temperature of the city as a whole, based on satellite-based thermal readings during the summer of 2021. Severity is measured on a scale of 1 to 5, with 1 being a relatively mild heat area (slightly above the mean for the city), and 5 being a severe heat area (significantly above the mean for the city). The absolute heat above mean values were classified into 4 classes using the Jenks Natural Breaks classification method.

Legend

- Salem Municipal Boundary

Non-Urban Land Use/Land Cover

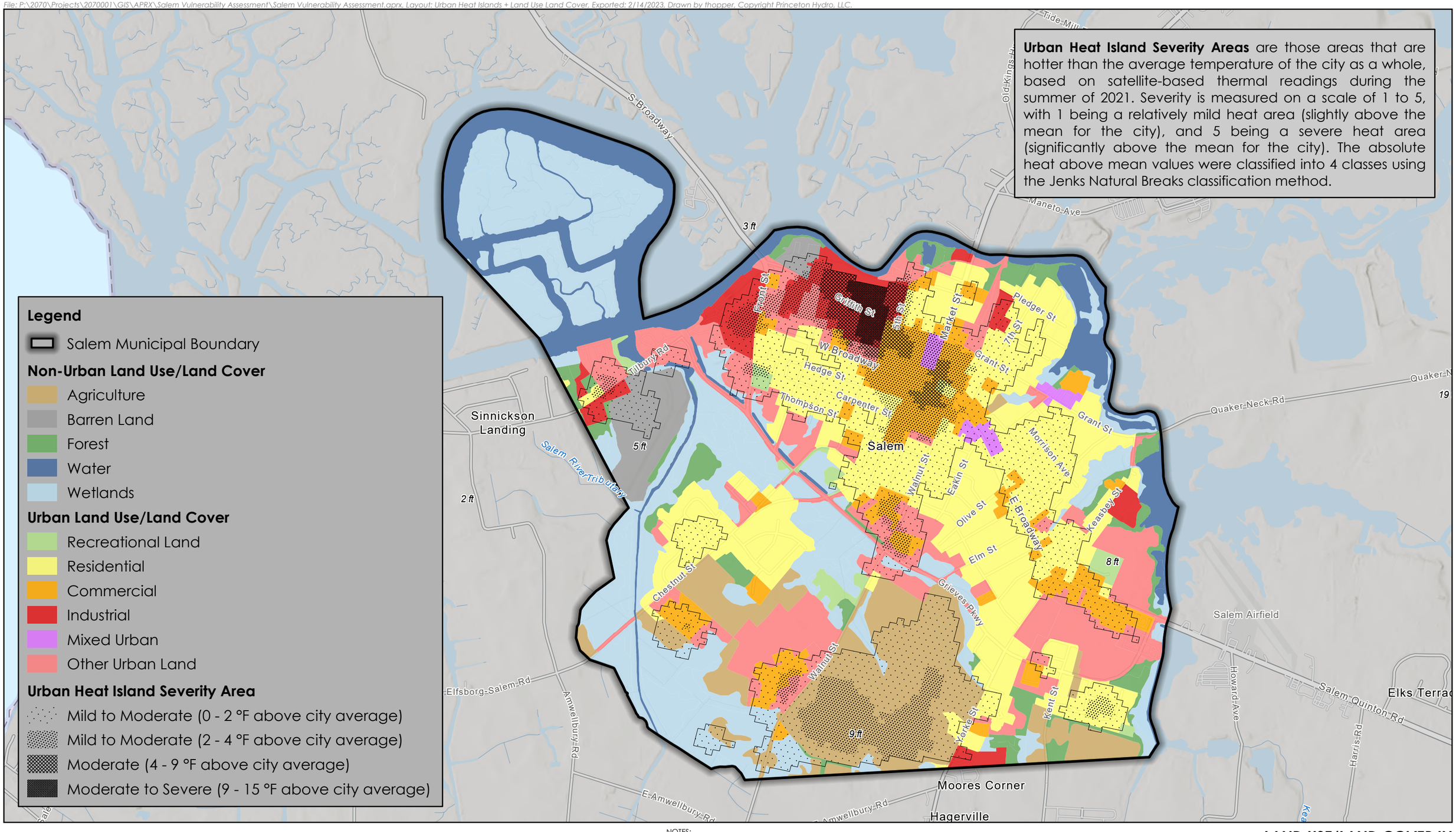
- Agriculture
- Barren Land
- Forest
- Water
- Wetlands

Urban Land Use/Land Cover

- Recreational Land
- Residential
- Commercial
- Industrial
- Mixed Urban
- Other Urban Land

Urban Heat Island Severity Area

- Mild to Moderate (0 - 2 °F above city average)
- Mild to Moderate (2 - 4 °F above city average)
- Moderate (4 - 9 °F above city average)
- Moderate to Severe (9 - 15 °F above city average)



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NOTES:
1. 2015 Land Use/Land Cover obtained from the NJDEP GIS website: www.state.nj.us/dep/gis/
2. Urban heat island severity areas obtained from The Trust for Public Land.
3. Salem municipal boundary obtained from New Jersey Geographic Information Network (NJGIN) Open Data portal: https://njgin.nj.gov/
4. Basemap obtained from ESRI basemap services.

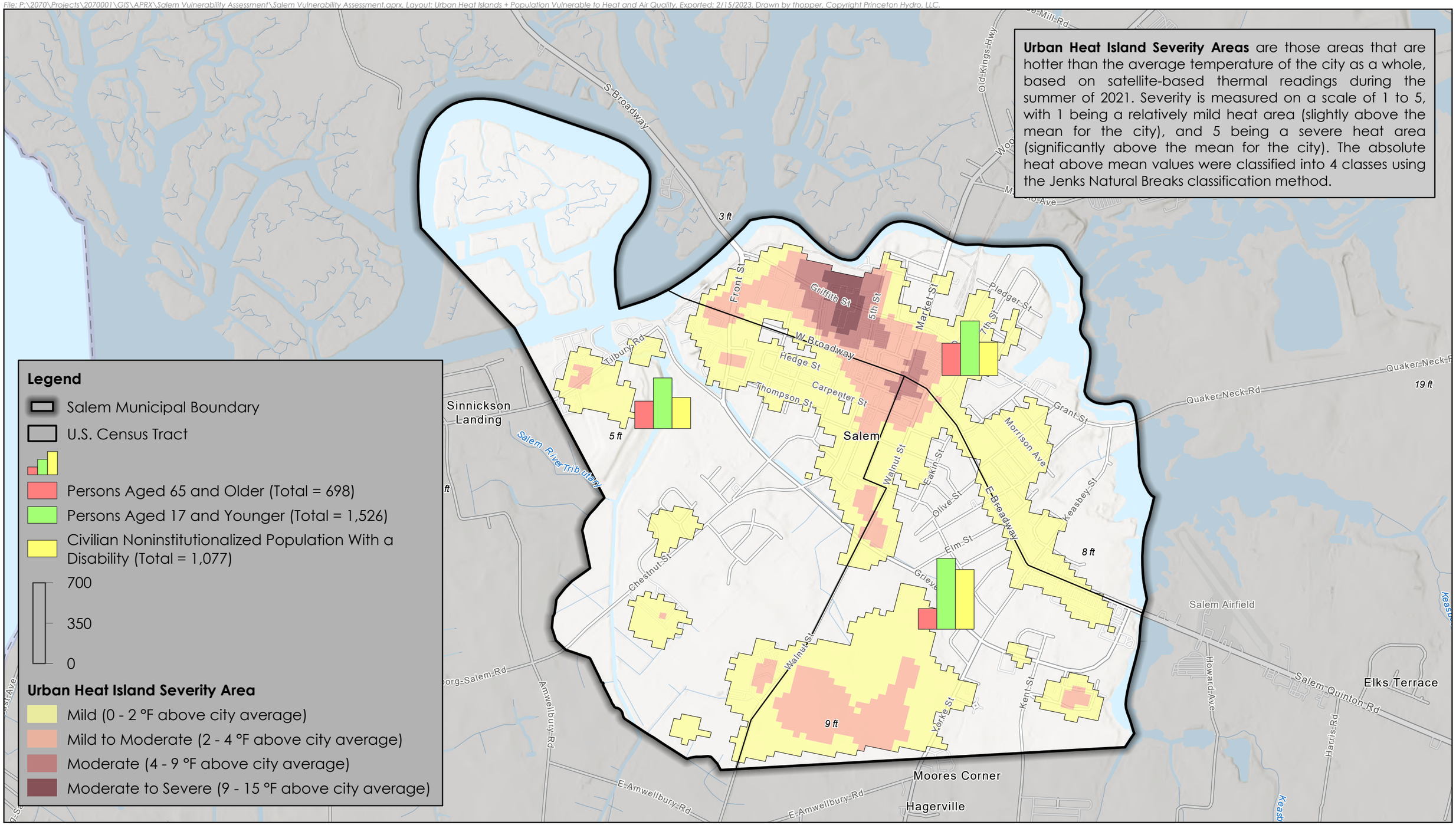
Spatial Reference: NAD 1983 2011 StatePlane New Jersey FIPS 2900 Ft US

0 700 1,400 Feet

LAND USE/LAND COVER IN URBAN HEAT ISLAND SEVERITY AREAS

RESILIENT NJ VULNERABILITY ASSESSMENT
BROWNFIELD REDEVELOPMENT SOLUTIONS, INC.
CITY OF SALEM, SALEM COUNTY, NEW JERSEY

Urban Heat Island Severity Areas are those areas that are hotter than the average temperature of the city as a whole, based on satellite-based thermal readings during the summer of 2021. Severity is measured on a scale of 1 to 5, with 1 being a relatively mild heat area (slightly above the mean for the city), and 5 being a severe heat area (significantly above the mean for the city). The absolute heat above mean values were classified into 4 classes using the Jenks Natural Breaks classification method.



Legend

- Salem Municipal Boundary
- U.S. Census Tract
- Persons Aged 65 and Older (Total = 698)
- Persons Aged 17 and Younger (Total = 1,526)
- Civilian Noninstitutionalized Population With a Disability (Total = 1,077)
- 700
- 350
- 0

Urban Heat Island Severity Area

- Mild (0 - 2 °F above city average)
- Mild to Moderate (2 - 4 °F above city average)
- Moderate (4 - 9 °F above city average)
- Moderate to Severe (9 - 15 °F above city average)

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NOTES:
1. Populations vulnerable to extreme heat and/or poor air quality obtained from the Center for Disease Control (CDS), Social Vulnerability Index (SVI) for 2018. Population estimates are based on the U.S. Census, American Community Survey (ACS), 2014-2018. Census tracts are labeled with the total estimate of vulnerable population (Age ≥ 65, Age ≤ 17, Disability).
2. Urban heat island severity areas obtained from The Trust for Public Land.
3. Salem municipal boundary obtained from New Jersey Geographic Information Network (NJGIN) Open Data portal: https://njgin.nj.gov/
4. Basemap obtained from ESRI basemap services.

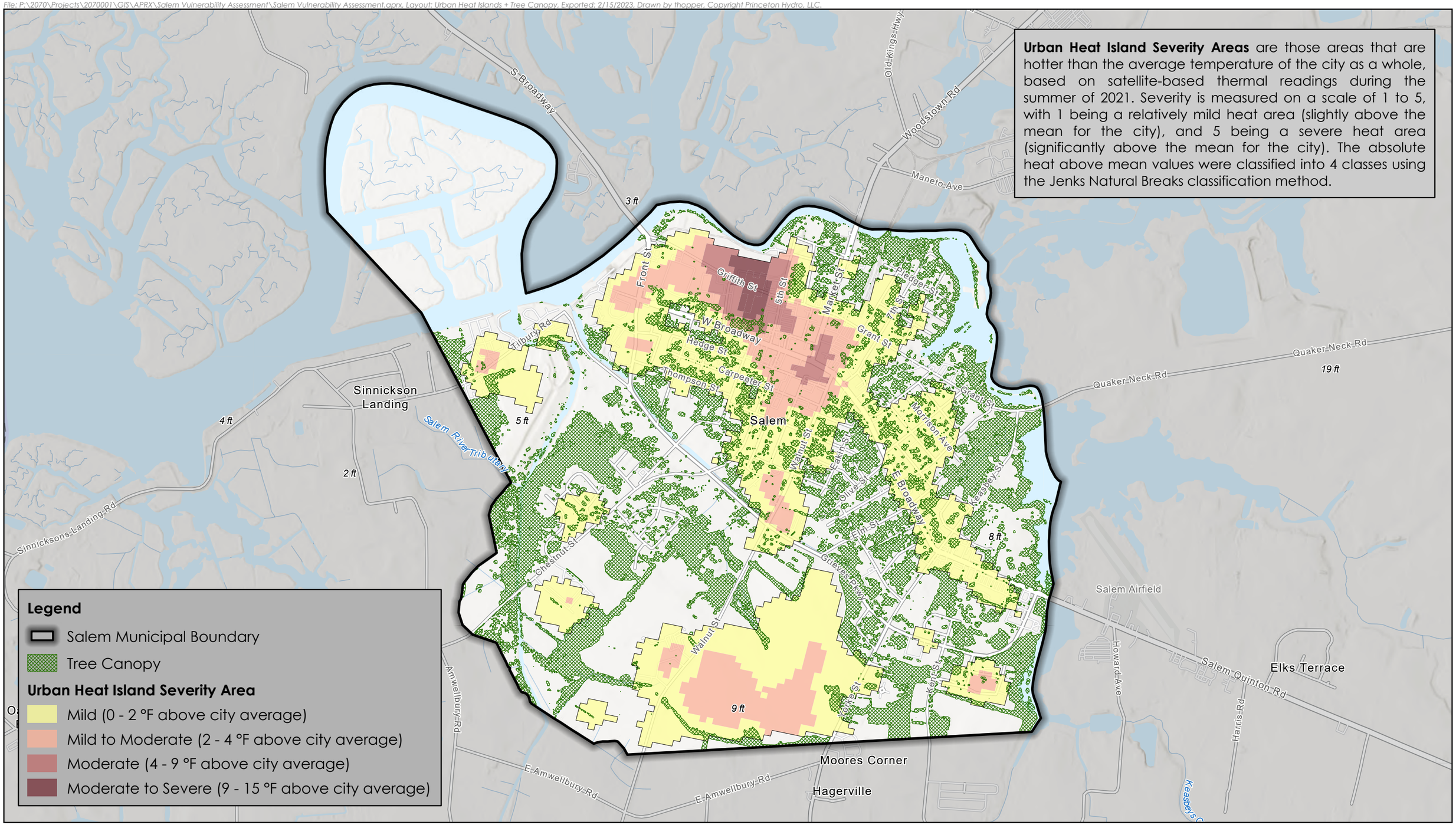
Spatial Reference: NAD 1983 2011 StatePlane New Jersey FIPS 2900 Ft US

0 700 1,400 Feet

URBAN HEAT ISLAND SEVERITY AND POPULATION VULNERABLE TO EXTREME HEAT AND/OR POOR AIR QUALITY

RESILIENT NJ VULNERABILITY ASSESSMENT
BROWNFIELD REDEVELOPMENT SOLUTIONS, INC.
CITY OF SALEM, SALEM COUNTY, NEW JERSEY

Urban Heat Island Severity Areas are those areas that are hotter than the average temperature of the city as a whole, based on satellite-based thermal readings during the summer of 2021. Severity is measured on a scale of 1 to 5, with 1 being a relatively mild heat area (slightly above the mean for the city), and 5 being a severe heat area (significantly above the mean for the city). The absolute heat above mean values were classified into 4 classes using the Jenks Natural Breaks classification method.



Legend

- Salem Municipal Boundary
- Tree Canopy

Urban Heat Island Severity Area

- Mild (0 - 2 °F above city average)
- Mild to Moderate (2 - 4 °F above city average)
- Moderate (4 - 9 °F above city average)
- Moderate to Severe (9 - 15 °F above city average)

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NOTES:
1. Tree canopy is approximate. Canopy areas delineated through a Normalized Difference Vegetation Index (NDVI) using 2019 near-infrared imagery obtained from the National Agriculture Imagery Program (NAIP).
2. Urban heat island severity areas obtained from The Trust for Public Land.
3. Salem municipal boundary obtained from New Jersey Geographic Information Network (NJGIN) Open Data portal: https://njgin.nj.gov/
4. Basemap obtained from ESRI basemap services.

Spatial Reference: NAD 1983 2011 StatePlane New Jersey FIPS 2900 Ft US

0 700 1,400 Feet

URBAN HEAT ISLAND SEVERITY AND TREE CANOPY

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CITY OF SALEM, SALEM COUNTY, NEW JERSEY

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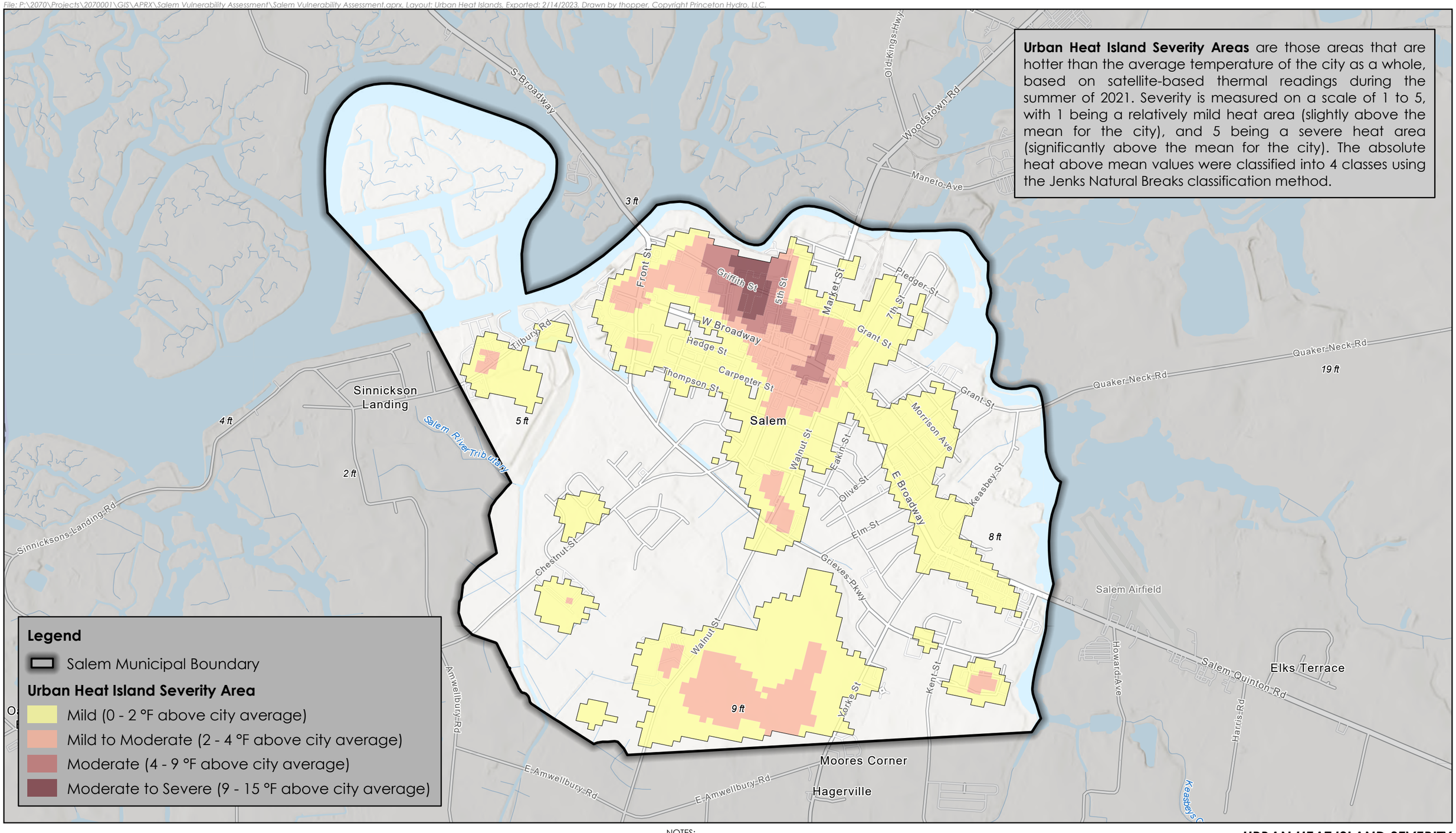

Legend

- Salem Municipal Boundary

Urban Heat Island Severity Area

- Mild (0 - 2 °F above city average)
- Mild to Moderate (2 - 4 °F above city average)
- Moderate (4 - 9 °F above city average)
- Moderate to Severe (9 - 15 °F above city average)

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NOTES:
1. Urban heat island severity areas obtained from The Trust for Public Land.
2. Salem municipal boundary obtained from New Jersey Geographic Information Network (NJGIN) Open Data portal: https://njgin.nj.gov/
3. Basemap obtained from ESRI basemap services.

Spatial Reference: NAD 1983 2011 StatePlane New Jersey FIPS 2900 Ft US

0 700 1,400 Feet

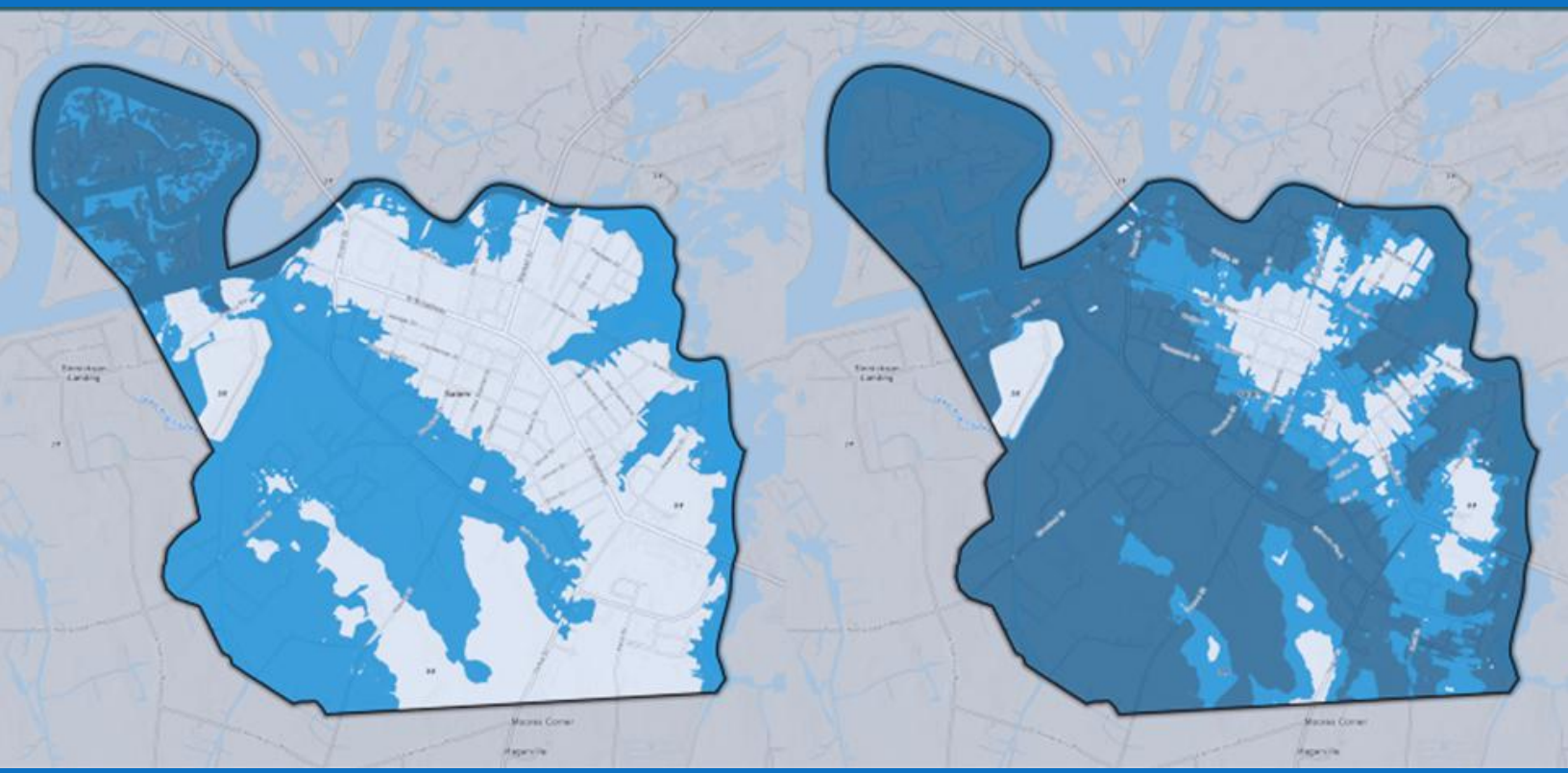
URBAN HEAT ISLAND SEVERITY

RESILIENT NJ VULNERABILITY ASSESSMENT
BROWNFIELD REDEVELOPMENT SOLUTIONS, INC.
CITY OF SALEM, SALEM COUNTY, NEW JERSEY

CLIMATE CHANGE-RELATED HAZARD VULNERABILITY ASSESSMENT

ATTACHMENT 3: MAPPING PACKAGE DOT DATA SOURCE

RESILIENTSALEM



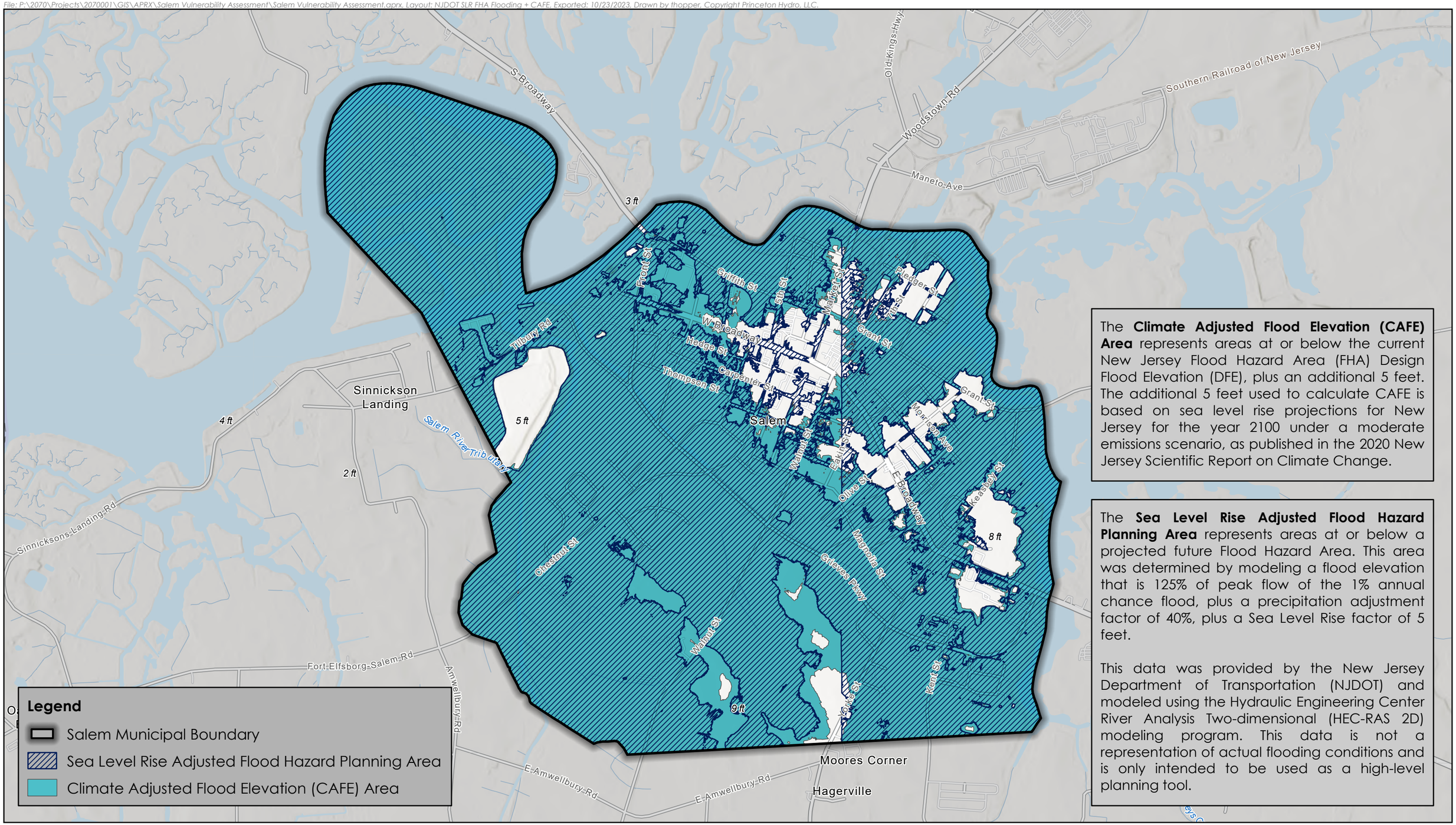
NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION

BRS inc | PRINCETON HYDRO | NEW JERSEY FUTURE

Terms and Conditions for the use of the data from which the following maps were derived:

1. The data is not a representation of actual flooding conditions and is only intended to be used as a high-level planning tool.
2. The locations of the streams shown on the maps are not an indication that they encompass all regulated waters under the Flood Hazard Area Control Act rules.
3. NJDOT is not responsible for the quality, content, accuracy, or completeness of any of the data sets, applications, or application programming interfaces (API)s linked.
4. The creator of the data sets, applications, and APIs retain any copyright or intellectual property restrictions they have placed on the data sets, applications, or APIs in their original format.
5. When creating new applications, visualizations, or other projects based on the data from NJDOT, the use may not use any trademark, emblem, logo, or statement implying the endorsement of the original creator of the data set, application, or API unless the creator has agreed to that endorsement.
6. The user assumes sole responsibility for any applications, visualization, or other projects created using data found on the NJDOT model and data set, The NJDOT team and the creator of the original data source have no legal responsibility or indemnity for projects created using this data.
7. The NJDOT does not recommend the use of the results on the Delaware River and recommends the sue of alternate or more detailed methodology.

File: P:\2070\Projects\2070001\GIS\APRX\Salem Vulnerability Assessment\Salem Vulnerability Assessment.aprx, Layout: NJDOT SLR FHA Flooding + CAFE, Exported: 10/23/2023, Drawn by thopper, Copyright Princeton Hydro, LLC.



Legend

- Salem Municipal Boundary
- Sea Level Rise Adjusted Flood Hazard Planning Area
- Climate Adjusted Flood Elevation (CAFE) Area

The **Climate Adjusted Flood Elevation (CAFE) Area** represents areas at or below the current New Jersey Flood Hazard Area (FHA) Design Flood Elevation (DFE), plus an additional 5 feet. The additional 5 feet used to calculate CAFE is based on sea level rise projections for New Jersey for the year 2100 under a moderate emissions scenario, as published in the 2020 New Jersey Scientific Report on Climate Change.

The **Sea Level Rise Adjusted Flood Hazard Planning Area** represents areas at or below a projected future Flood Hazard Area. This area was determined by modeling a flood elevation that is 125% of peak flow of the 1% annual chance flood, plus a precipitation adjustment factor of 40%, plus a Sea Level Rise factor of 5 feet.

This data was provided by the New Jersey Department of Transportation (NJDOT) and modeled using the Hydraulic Engineering Center River Analysis Two-dimensional (HEC-RAS 2D) modeling program. This data is not a representation of actual flooding conditions and is only intended to be used as a high-level planning tool.

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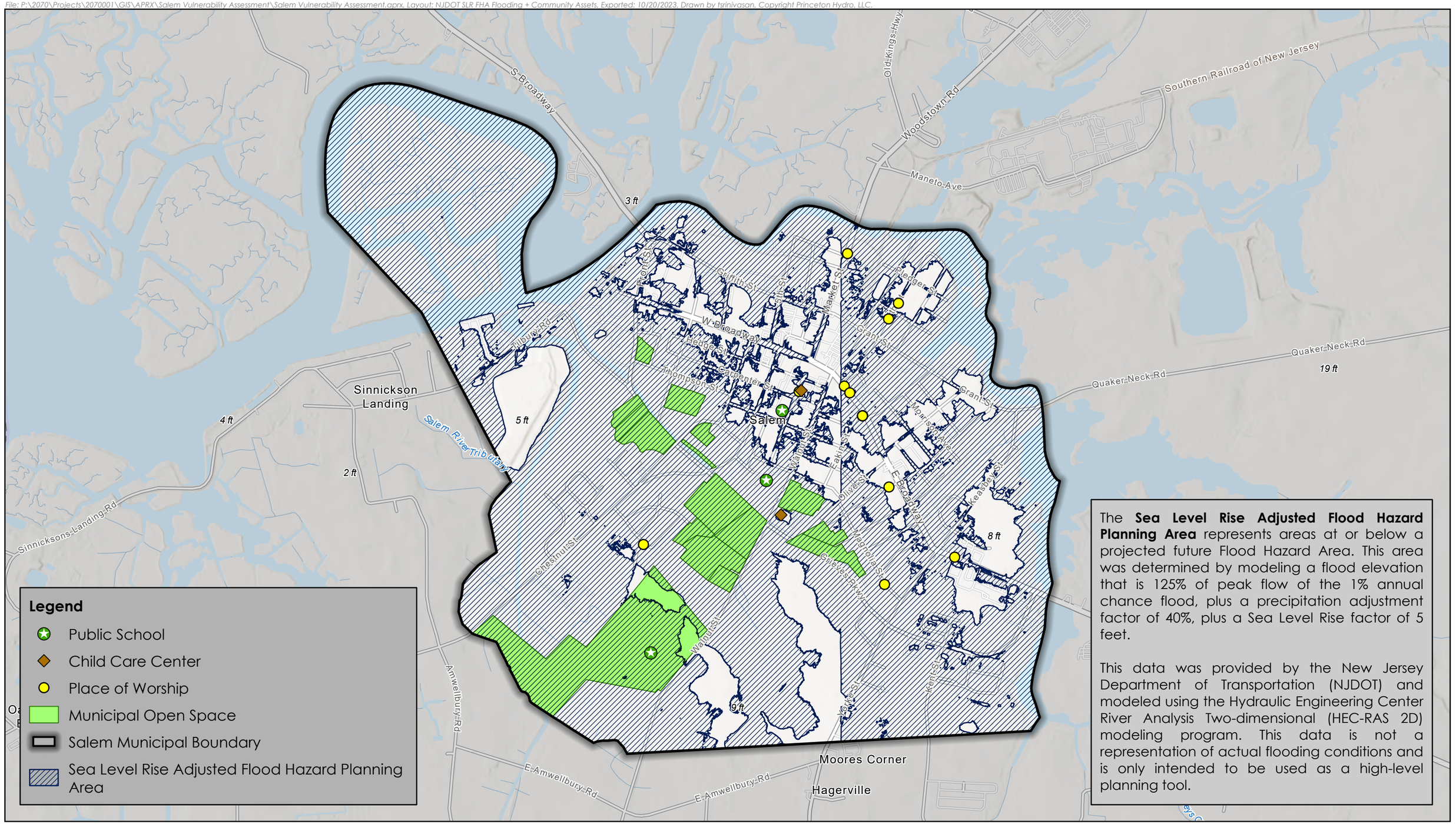
NOTES:
1. Sea Level Rise Adjusted Flood Hazard Planning Area obtained from the New Jersey Department of Transportation (NJDOT).
2. CAFE area produced using NJ Adapt Flood Mapper: https://www.njfloodmapper.org/
3. Salem municipal boundary obtained from New Jersey Geographic Information Network (NJGIN) Open Data portal: https://njgin.nj.gov/
4. Basemap obtained from ESRI basemap services.

Spatial Reference: NAD 1983 2011 StatePlane New Jersey FIPS 2900 Ft US

0 700 1,400 Feet

SEA LEVEL RISE ADJUSTED FLOOD HAZARD PLANNING AREA VS. CLIMATE ADJUSTED FLOOD ELEVATION AREA

RESILIENT NJ VULNERABILITY ASSESSMENT
BROWNFIELD REDEVELOPMENT SOLUTIONS, INC.
CITY OF SALEM, SALEM COUNTY, NEW JERSEY



Legend

- Public School
- Child Care Center
- Place of Worship
- Municipal Open Space
- Salem Municipal Boundary
- Sea Level Rise Adjusted Flood Hazard Planning Area

The **Sea Level Rise Adjusted Flood Hazard Planning Area** represents areas at or below a projected future Flood Hazard Area. This area was determined by modeling a flood elevation that is 125% of peak flow of the 1% annual chance flood, plus a precipitation adjustment factor of 40%, plus a Sea Level Rise factor of 5 feet.

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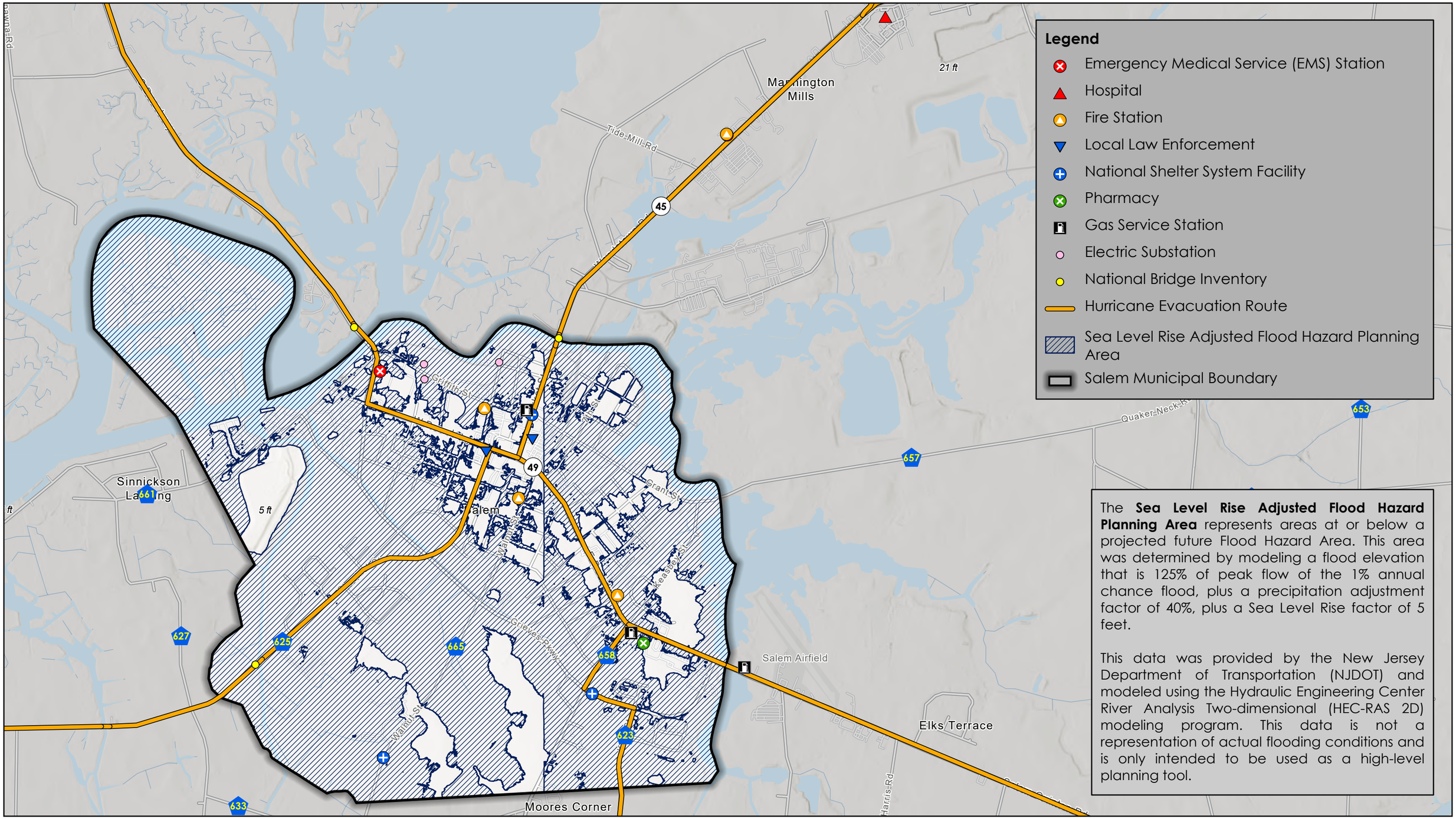
NOTES:
1. Community assets obtained from Homeland Infrastructure Foundation-Level Data (HIFLD) Geoplatform: https://hifld-geoplatform.opendata.arcgis.com/
2. Open spaces obtained from the NJ Geographic Information Network (NJGIN) Open Data portal: https://njgin.nj.gov/.
3. Sea Level Rise Adjusted Flood Hazard Planning Area obtained from the New Jersey Department of Transportation (NJDOT).
4. Salem municipal boundary obtained from New Jersey Geographic Information Network (NJGIN) Open Data portal: https://njgin.nj.gov/
5. Basemap obtained from ESRI basemap services.

Spatial Reference: NAD 1983 2011 StatePlane New Jersey FIPS 2900 Ft US

0 700 1,400 Feet

COMMUNITY ASSETS IN SEA LEVEL RISE ADJUSTED FLOOD HAZARD PLANNING AREAS

RESILIENT NJ VULNERABILITY ASSESSMENT
BROWNFIELD REDEVELOPMENT SOLUTIONS, INC.
CITY OF SALEM, SALEM COUNTY, NEW JERSEY



The **Sea Level Rise Adjusted Flood Hazard Planning Area** represents areas at or below a projected future Flood Hazard Area. This area was determined by modeling a flood elevation that is 125% of peak flow of the 1% annual chance flood, plus a precipitation adjustment factor of 40%, plus a Sea Level Rise factor of 5 feet.

This data was provided by the New Jersey Department of Transportation (NJDOT) and modeled using the Hydraulic Engineering Center River Analysis Two-dimensional (HEC-RAS 2D) modeling program. This data is not a representation of actual flooding conditions and is only intended to be used as a high-level planning tool.

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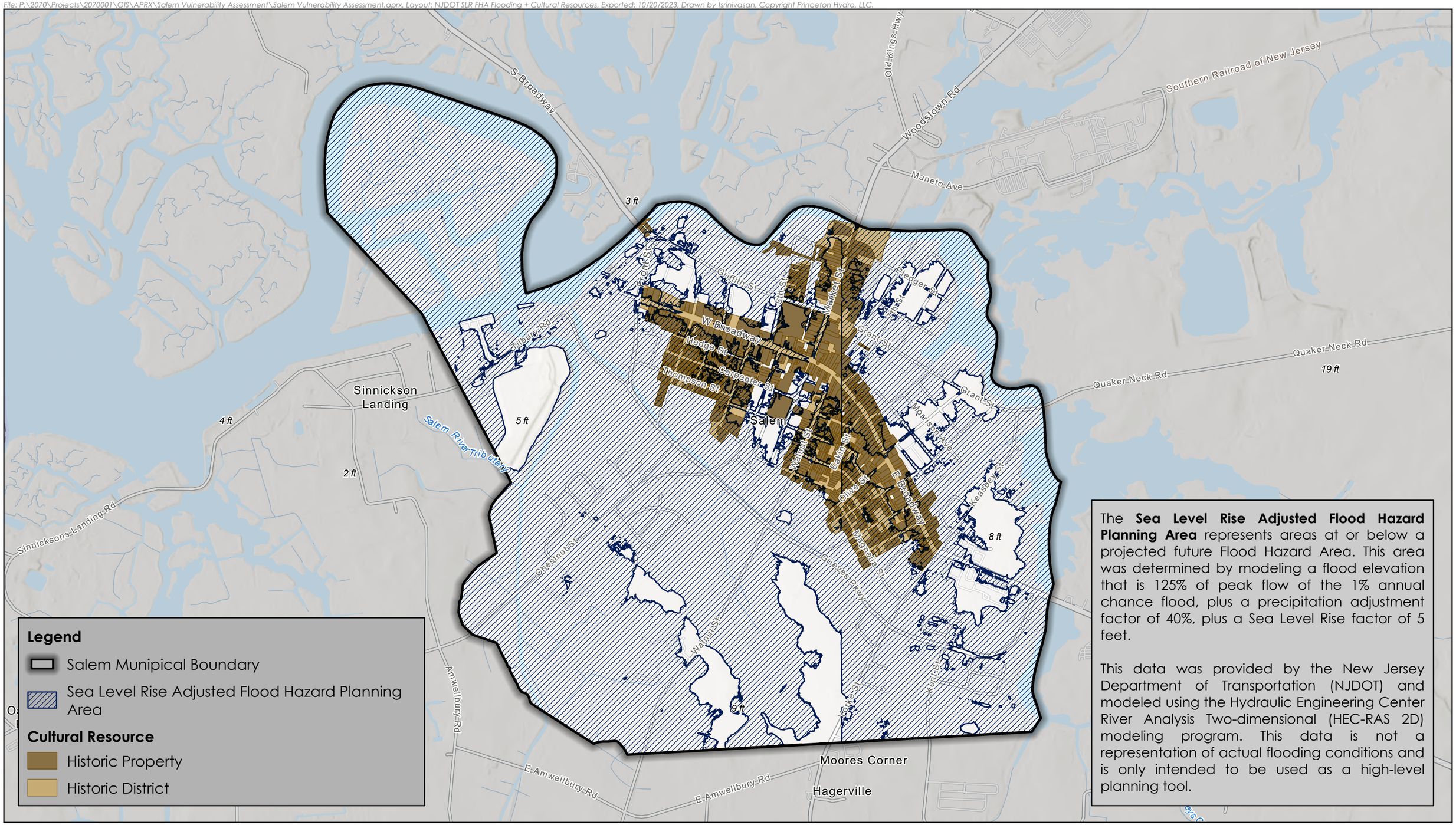
NOTES:
1. Gas service stations obtained from the NJDEP GIS website: www.state.nj.us/dep/gis/
2. Other critical facilities obtained from Homeland Infrastructure Foundation-Level Data (HIFLD) Geoplatform: https://hifld-geoplatform.opendata.arcgis.com/
3. Sea Level Rise Adjusted Flood Hazard Planning Area obtained from the New Jersey Department of Transportation (NJDOT).
4. Salem municipal boundary obtained from New Jersey Geographic Information Network (NJGIN) Open Data portal: https://njgin.nj.gov/
5. Basemap obtained from ESRI basemap services.

Spatial Reference: NAD 1983 2011 StatePlane New Jersey FIPS 2900 Ft US

0 800 1,600 Feet

CRITICAL FACILITIES IN SEA LEVEL RISE ADJUSTED FLOOD HAZARD PLANNING AREAS

RESILIENT NJ VULNERABILITY ASSESSMENT
BROWNFIELD REDEVELOPMENT SOLUTIONS, INC.
CITY OF SALEM, SALEM COUNTY, NEW JERSEY



Legend

- Salem Munipical Boundary
- Sea Level Rise Adjusted Flood Hazard Planning Area

Cultural Resource

- Historic Property
- Historic District

The **Sea Level Rise Adjusted Flood Hazard Planning Area** represents areas at or below a projected future Flood Hazard Area. This area was determined by modeling a flood elevation that is 125% of peak flow of the 1% annual chance flood, plus a precipitation adjustment factor of 40%, plus a Sea Level Rise factor of 5 feet.

This data was provided by the New Jersey Department of Transportation (NJDOT) and modeled using the Hydraulic Engineering Center River Analysis Two-dimensional (HEC-RAS 2D) modeling program. This data is not a representation of actual flooding conditions and is only intended to be used as a high-level planning tool.

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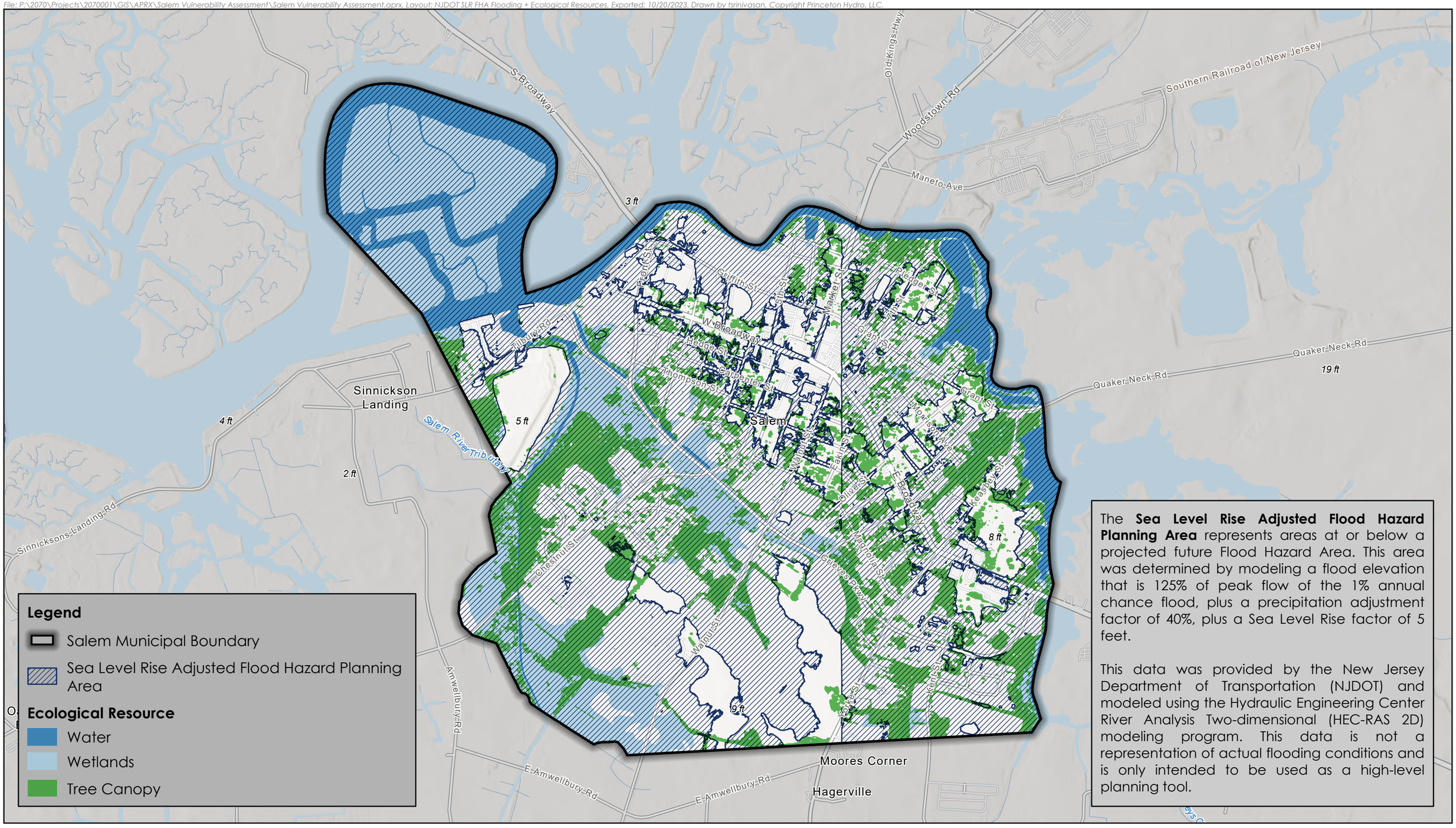
NOTES:
1. Historic properties and districts obtained from NJDEP GIS website: www.state.nj.us/dep/gis/.
2. Sea Level Rise Adjusted Flood Hazard Planning Area obtained from the New Jersey Department of Transportation (NJDOT).
3. Salem municipal boundary obtained from New Jersey Geographic Information Network (NJGIN) Open Data portal: https://njgin.nj.gov/
4. Basemap obtained from ESRI basemap services.

Spatial Reference: NAD 1983 2011 StatePlane New Jersey FIPS 2900 Ft US

0 700 1,400 Feet

CULTURAL RESOURCES IN SEA LEVEL RISE ADJUSTED FLOOD HAZARD PLANNING AREAS

RESILIENT NJ VULNERABILITY ASSESSMENT
BROWNFIELD REDEVELOPMENT SOLUTIONS, INC.
CITY OF SALEM, SALEM COUNTY, NEW JERSEY



Legend

- Salem Municipal Boundary
- Sea Level Rise Adjusted Flood Hazard Planning Area

Ecological Resource

- Water
- Wetlands
- Tree Canopy

The **Sea Level Rise Adjusted Flood Hazard Planning Area** represents areas at or below a projected future Flood Hazard Area. This area was determined by modeling a flood elevation that is 125% of peak flow of the 1% annual chance flood, plus a precipitation adjustment factor of 40%, plus a Sea Level Rise factor of 5 feet.

This data was provided by the New Jersey Department of Transportation (NJDOT) and modeled using the Hydraulic Engineering Center River Analysis Two-dimensional (HEC-RAS 2D) modeling program. This data is not a representation of actual flooding conditions and is only intended to be used as a high-level planning tool.

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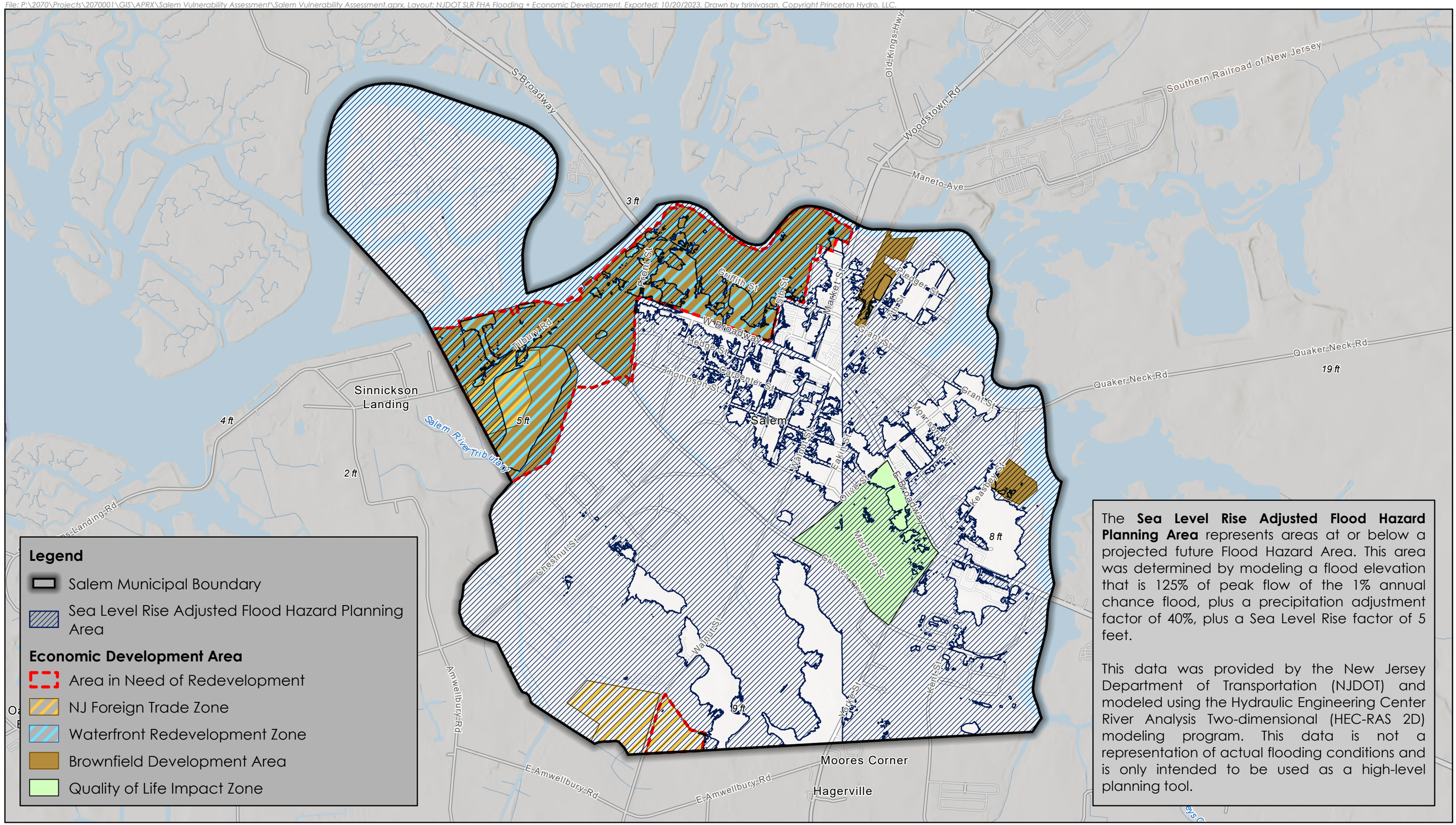
NOTES:
1. Water and wetlands (2015 Land Use/Land Cover) obtained from the NJDEP GIS website: www.state.nj.us/dep/gis/
2. Tree canopy is approximate. Canopy areas delineated through a Normalized Difference Vegetation Index (NDVI) using 2019 near-infrared imagery obtained from the National Agriculture Imagery Program (NAIP).
3. Sea Level Rise Adjusted Flood Hazard Planning Area obtained from the New Jersey Department of Transportation (NJDOT).
4. Salem municipal boundary obtained from New Jersey Geographic Information Network (NJGIN) Open Data portal: https://njgin.nj.gov/
5. Basemap obtained from ESRI basemap services.

Spatial Reference: NAD 1983 2011 StatePlane New Jersey FIPS 2900 Ft US

0 700 1,400 Feet

ECOLOGICAL RESOURCES IN SEA LEVEL RISE ADJUSTED FLOOD HAZARD PLANNING AREAS

RESILIENT NJ VULNERABILITY ASSESSMENT
BROWNFIELD REDEVELOPMENT SOLUTIONS, INC.
CITY OF SALEM, SALEM COUNTY, NEW JERSEY



Legend

- Salem Municipal Boundary
- Sea Level Rise Adjusted Flood Hazard Planning Area

Economic Development Area

- Area in Need of Redevelopment
- NJ Foreign Trade Zone
- Waterfront Redevelopment Zone
- Brownfield Development Area
- Quality of Life Impact Zone

The **Sea Level Rise Adjusted Flood Hazard Planning Area** represents areas at or below a projected future Flood Hazard Area. This area was determined by modeling a flood elevation that is 125% of peak flow of the 1% annual chance flood, plus a precipitation adjustment factor of 40%, plus a Sea Level Rise factor of 5 feet.

This data was provided by the New Jersey Department of Transportation (NJDOT) and modeled using the Hydraulic Engineering Center River Analysis Two-dimensional (HEC-RAS 2D) modeling program. This data is not a representation of actual flooding conditions and is only intended to be used as a high-level planning tool.

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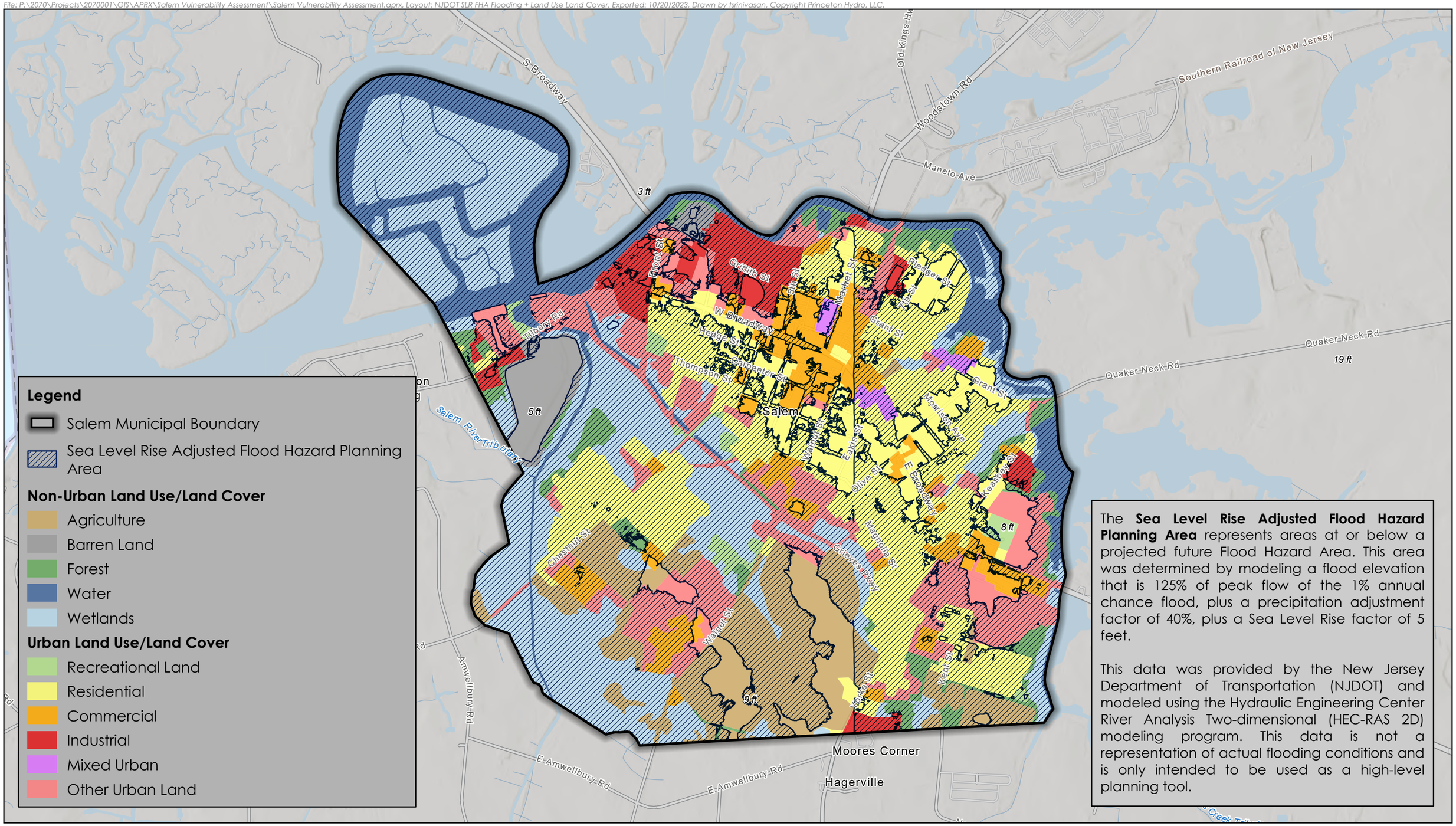
NOTES:
1. Waterfront redevelopment zone obtained from the City of Salem, NJ.
2. Other economic development features obtained from the NJ Geographic Information Network (NJGIN) Open Data portal: https://njgin.nj.gov/.
3. Sea Level Rise Adjusted Flood Hazard Planning Area obtained from the New Jersey Department of Transportation (NJDOT).
4. Trenton municipal boundary obtained from New Jersey Geographic Information Network (NJGIN) Open Data portal: https://njgin.nj.gov/
5. Basemap obtained from ESRI basemap services.

Spatial Reference: NAD 1983 2011 StatePlane New Jersey FIPS 2900 Ft US

0 700 1,400 Feet

ECONOMIC DEVELOPMENT FEATURES IN SEA LEVEL RISE ADJUSTED FLOOD HAZARD PLANNING AREAS

RESILIENT NJ VULNERABILITY ASSESSMENT
BROWNFIELD REDEVELOPMENT SOLUTIONS, INC.
CITY OF SALEM, SALEM COUNTY, NEW JERSEY



Legend

- Salem Municipal Boundary
- Sea Level Rise Adjusted Flood Hazard Planning Area

Non-Urban Land Use/Land Cover

- Agriculture
- Barren Land
- Forest
- Water
- Wetlands

Urban Land Use/Land Cover

- Recreational Land
- Residential
- Commercial
- Industrial
- Mixed Urban
- Other Urban Land

The **Sea Level Rise Adjusted Flood Hazard Planning Area** represents areas at or below a projected future Flood Hazard Area. This area was determined by modeling a flood elevation that is 125% of peak flow of the 1% annual chance flood, plus a precipitation adjustment factor of 40%, plus a Sea Level Rise factor of 5 feet.

This data was provided by the New Jersey Department of Transportation (NJDOT) and modeled using the Hydraulic Engineering Center River Analysis Two-dimensional (HEC-RAS 2D) modeling program. This data is not a representation of actual flooding conditions and is only intended to be used as a high-level planning tool.

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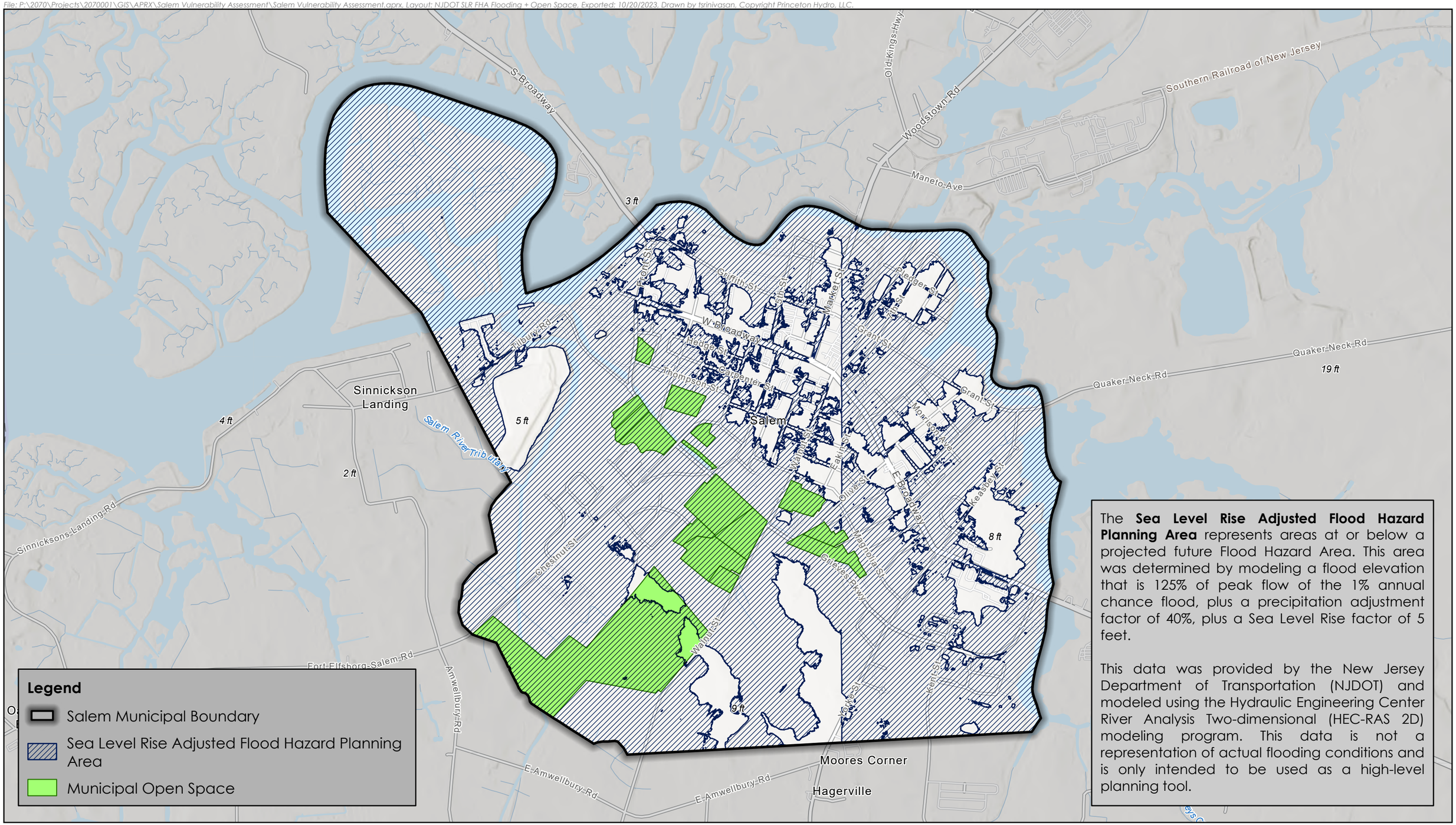
NOTES:
1. 2015 Land Use/Land Cover obtained from the NJDEP GIS website: www.state.nj.us/dep/gis/
2. Sea Level Rise Adjusted Flood Hazard Planning Area obtained from the New Jersey Department of Transportation (NJDOT).
3. Salem municipal boundary obtained from New Jersey Geographic Information Network (NJGIN) Open Data portal: https://njgin.nj.gov/
4. Basemap obtained from ESRI basemap services.

Spatial Reference: NAD 1983 2011 StatePlane New Jersey FIPS 2900 Ft US

0 700 1,400 Feet

LAND USE/LAND COVER IN SEA LEVEL RISE ADJUSTED FLOOD HAZARD PLANNING AREAS

RESILIENT NJ VULNERABILITY ASSESSMENT
BROWNFIELD REDEVELOPMENT SOLUTIONS, INC.
CITY OF SALEM, SALEM COUNTY, NEW JERSEY



Legend

- Salem Municipal Boundary
- Sea Level Rise Adjusted Flood Hazard Planning Area
- Municipal Open Space

The **Sea Level Rise Adjusted Flood Hazard Planning Area** represents areas at or below a projected future Flood Hazard Area. This area was determined by modeling a flood elevation that is 125% of peak flow of the 1% annual chance flood, plus a precipitation adjustment factor of 40%, plus a Sea Level Rise factor of 5 feet.

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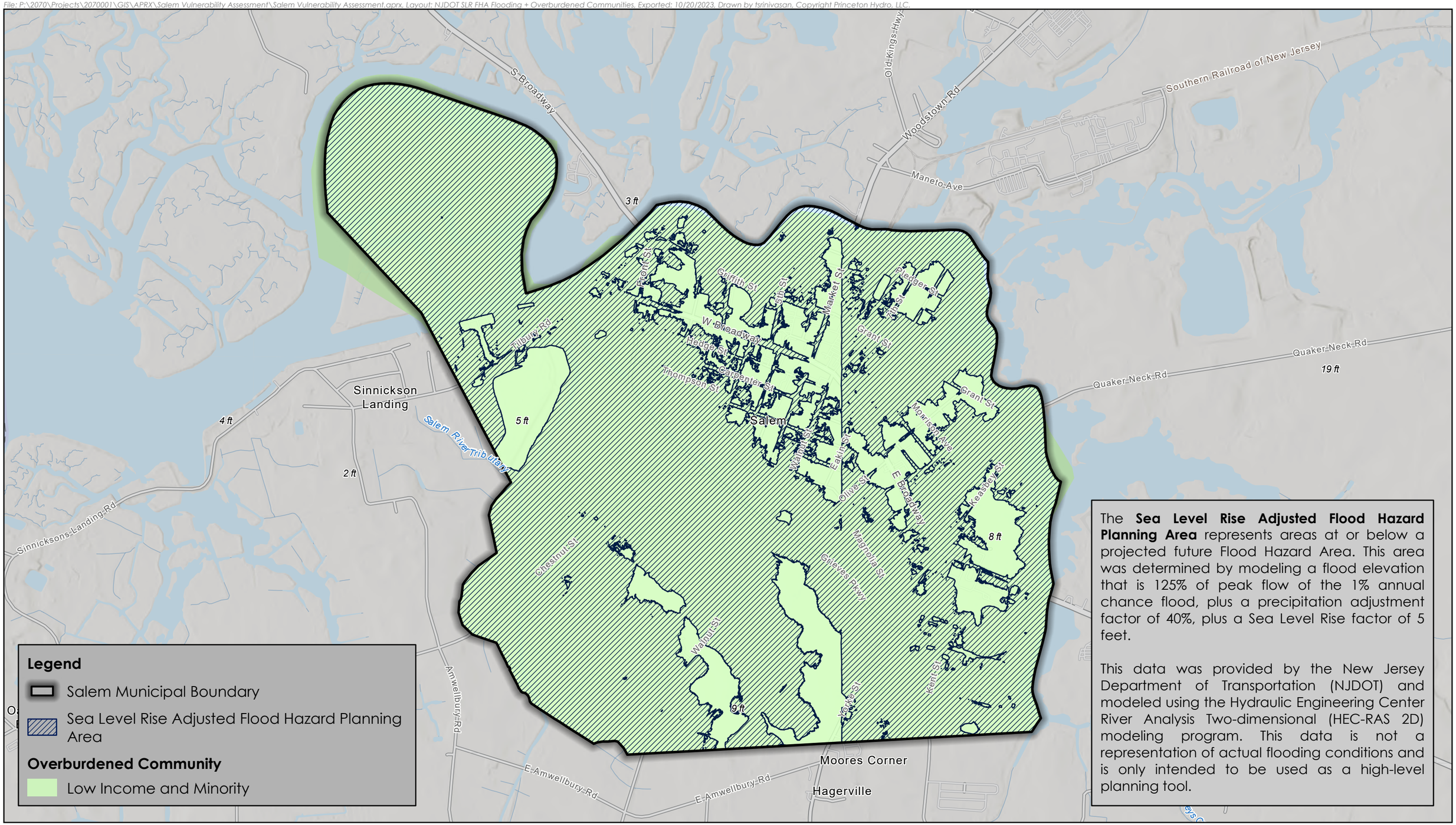
NOTES:
1. Open spaces obtained from the NJ Geographic Information Network (NJGIN) Open Data portal: https://njgin.nj.gov/
2. Sea Level Rise Adjusted Flood Hazard Planning Area obtained from the New Jersey Department of Transportation (NJDOT).
3. Salem municipal boundary obtained from New Jersey Geographic Information Network (NJGIN) Open Data portal: https://njgin.nj.gov/
4. Basemap obtained from ESRI basemap services.

Spatial Reference: NAD 1983 2011 StatePlane New Jersey FIPS 2900 Ft US

0 700 1,400 Feet

OPEN SPACE IN SEA LEVEL RISE ADJUSTED FLOOD HAZARD PLANNING AREAS

RESILIENT NJ VULNERABILITY ASSESSMENT
BROWNFIELD REDEVELOPMENT SOLUTIONS, INC.
CITY OF SALEM, SALEM COUNTY, NEW JERSEY



Legend

- Salem Municipal Boundary
- Sea Level Rise Adjusted Flood Hazard Planning Area

Overburdened Community

- Low Income and Minority

The **Sea Level Rise Adjusted Flood Hazard Planning Area** represents areas at or below a projected future Flood Hazard Area. This area was determined by modeling a flood elevation that is 125% of peak flow of the 1% annual chance flood, plus a precipitation adjustment factor of 40%, plus a Sea Level Rise factor of 5 feet.

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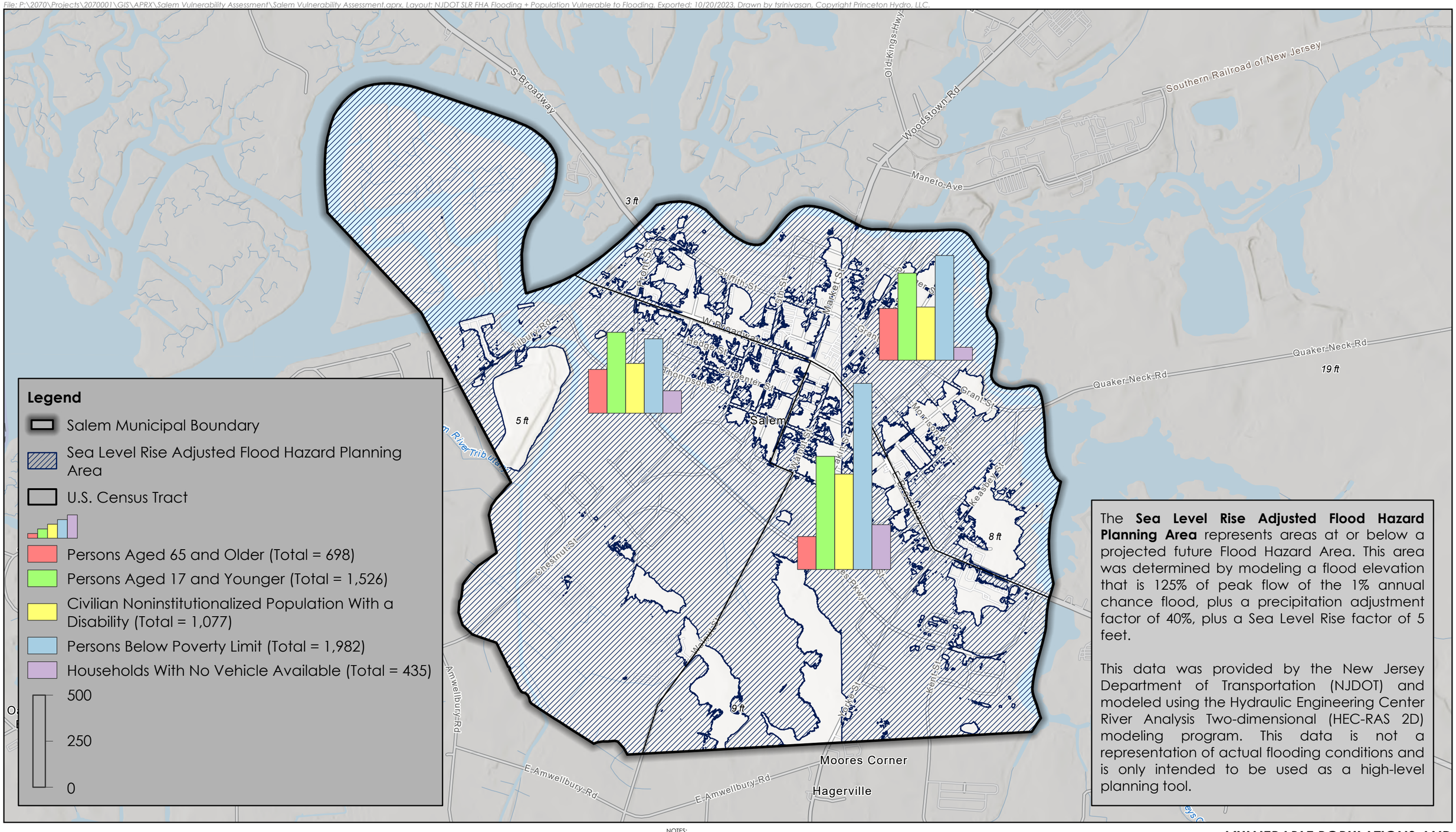
NOTES:
1. Overburdened communities under the NJ Environmental Justice Law obtained from the NJDEP GIS website: www.state.nj.us/dep/gis/
2. Sea Level Rise Adjusted Flood Hazard Planning Area obtained from the New Jersey Department of Transportation (NJDOT).
3. Salem municipal boundary obtained from New Jersey Geographic Information Network (NJGIN) Open Data portal: https://njgin.nj.gov/
4. Basemap obtained from ESRI basemap services.

Spatial Reference: NAD 1983 2011 StatePlane New Jersey FIPS 2900 Ft US

0 700 1,400 Feet

OVERBURDENED COMMUNITIES IN SEA LEVEL RISE ADJUSTED FLOOD HAZARD PLANNING AREAS

RESILIENT NJ VULNERABILITY ASSESSMENT
BROWNFIELD REDEVELOPMENT SOLUTIONS, INC.
CITY OF SALEM, SALEM COUNTY, NEW JERSEY



The **Sea Level Rise Adjusted Flood Hazard Planning Area** represents areas at or below a projected future Flood Hazard Area. This area was determined by modeling a flood elevation that is 125% of peak flow of the 1% annual chance flood, plus a precipitation adjustment factor of 40%, plus a Sea Level Rise factor of 5 feet.

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NOTES:
1. Vulnerable populations obtained from the Center for Disease Control (CDS), Social Vulnerability Index (SVI) for 2018. Population estimates are based on the U.S. Census, American Community Survey (ACS), 2014-2018.
2. Sea Level Rise Adjusted Flood Hazard Planning Area obtained from the New Jersey Department of Transportation (NJDOT).
3. Salem municipal boundary obtained from New Jersey Geographic Information Network (NJGIN) Open Data portal: https://njgin.nj.gov/
4. Basemap obtained from ESRI basemap services.

Spatial Reference: NAD 1983 2011 StatePlane New Jersey FIPS 2900 Ft US

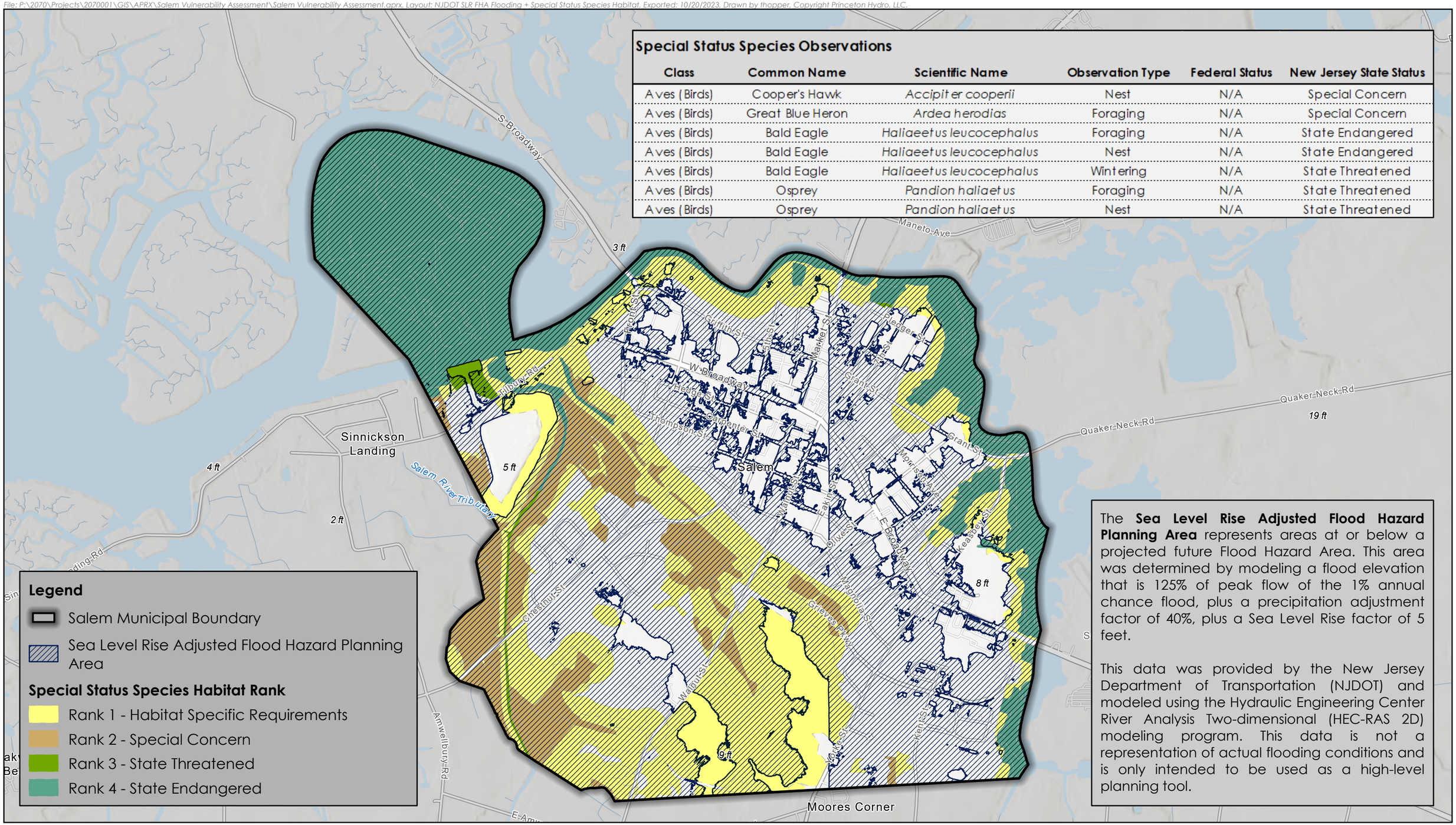
0 700 1,400 Feet

VULNERABLE POPULATIONS AND SEA LEVEL RISE ADJUSTED FLOOD HAZARD PLANNING AREAS

RESILIENT NJ VULNERABILITY ASSESSMENT
BROWNFIELD REDEVELOPMENT SOLUTIONS, INC.
CITY OF SALEM, SALEM COUNTY, NEW JERSEY

Special Status Species Observations

Class	Common Name	Scientific Name	Observation Type	Federal Status	New Jersey State Status
Aves (Birds)	Cooper's Hawk	*Accipiter cooperii*	Nest	N/A	Special Concern
Aves (Birds)	Great Blue Heron	*Ardea herodias*	Foraging	N/A	Special Concern
Aves (Birds)	Bald Eagle	*Haliaeetus leucocephalus*	Foraging	N/A	State Endangered
Aves (Birds)	Bald Eagle	*Haliaeetus leucocephalus*	Nest	N/A	State Endangered
Aves (Birds)	Bald Eagle	*Haliaeetus leucocephalus*	Wintering	N/A	State Threatened
Aves (Birds)	Osprey	*Pandion haliaetus*	Foraging	N/A	State Threatened
Aves (Birds)	Osprey	*Pandion haliaetus*	Nest	N/A	State Threatened



Legend

- Salem Municipal Boundary
- Sea Level Rise Adjusted Flood Hazard Planning Area

Special Status Species Habitat Rank

- Rank 1 - Habitat Specific Requirements
- Rank 2 - Special Concern
- Rank 3 - State Threatened
- Rank 4 - State Endangered

The **Sea Level Rise Adjusted Flood Hazard Planning Area** represents areas at or below a projected future Flood Hazard Area. This area was determined by modeling a flood elevation that is 125% of peak flow of the 1% annual chance flood, plus a precipitation adjustment factor of 40%, plus a Sea Level Rise factor of 5 feet.

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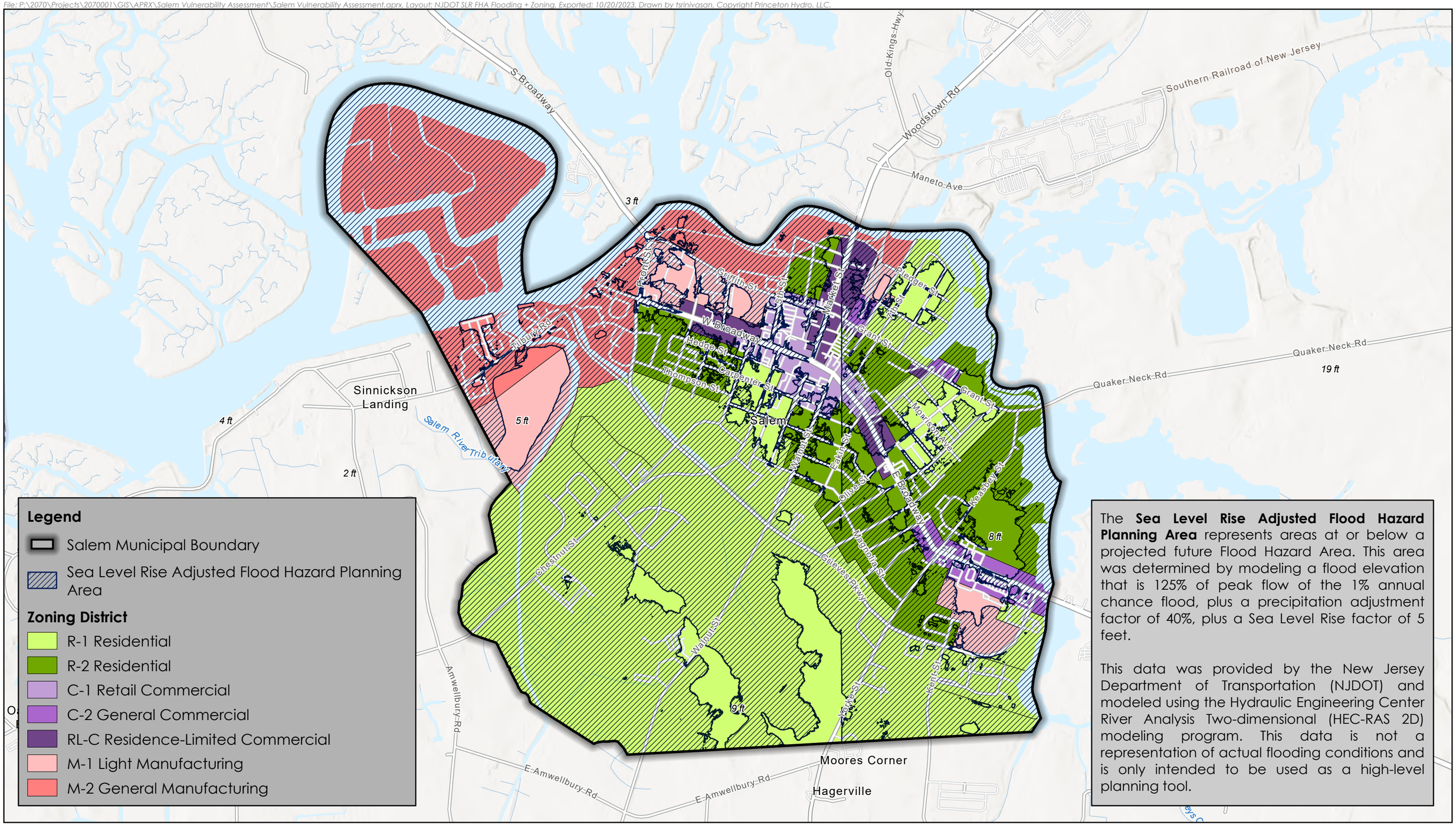
NOTES:
1. Special status species habitat from the Landscape Project, v3.3, obtained from the NJDEP GIS website: www.state.nj.us/dep/gis/
2. Sea Level Rise Adjusted Flood Hazard Planning Area obtained from the New Jersey Department of Transportation (NJDOT).
3. Salem municipal boundary obtained from New Jersey Geographic Information Network (NJGIN) Open Data portal: https://njgin.nj.gov/
4. Basemap obtained from ESRI basemap services.

Spatial Reference: NAD 1983 2011 StatePlane New Jersey FIPS 2900 Ft US

0 700 1,400 Feet

SPECIAL STATUS SPECIES HABITAT IN SEA LEVEL RISE ADJUSTED FLOOD HAZARD PLANNING AREAS

RESILIENT NJ VULNERABILITY ASSESSMENT
BROWNFIELD REDEVELOPMENT SOLUTIONS, INC.
CITY OF SALEM, SALEM COUNTY, NEW JERSEY



Legend

- Salem Municipal Boundary
- Sea Level Rise Adjusted Flood Hazard Planning Area

Zoning District

- R-1 Residential
- R-2 Residential
- C-1 Retail Commercial
- C-2 General Commercial
- RL-C Residence-Limited Commercial
- M-1 Light Manufacturing
- M-2 General Manufacturing

The **Sea Level Rise Adjusted Flood Hazard Planning Area** represents areas at or below a projected future Flood Hazard Area. This area was determined by modeling a flood elevation that is 125% of peak flow of the 1% annual chance flood, plus a precipitation adjustment factor of 40%, plus a Sea Level Rise factor of 5 feet.

This data was provided by the New Jersey Department of Transportation (NJDOT) and modeled using the Hydraulic Engineering Center River Analysis Two-dimensional (HEC-RAS 2D) modeling program. This data is not a representation of actual flooding conditions and is only intended to be used as a high-level planning tool.

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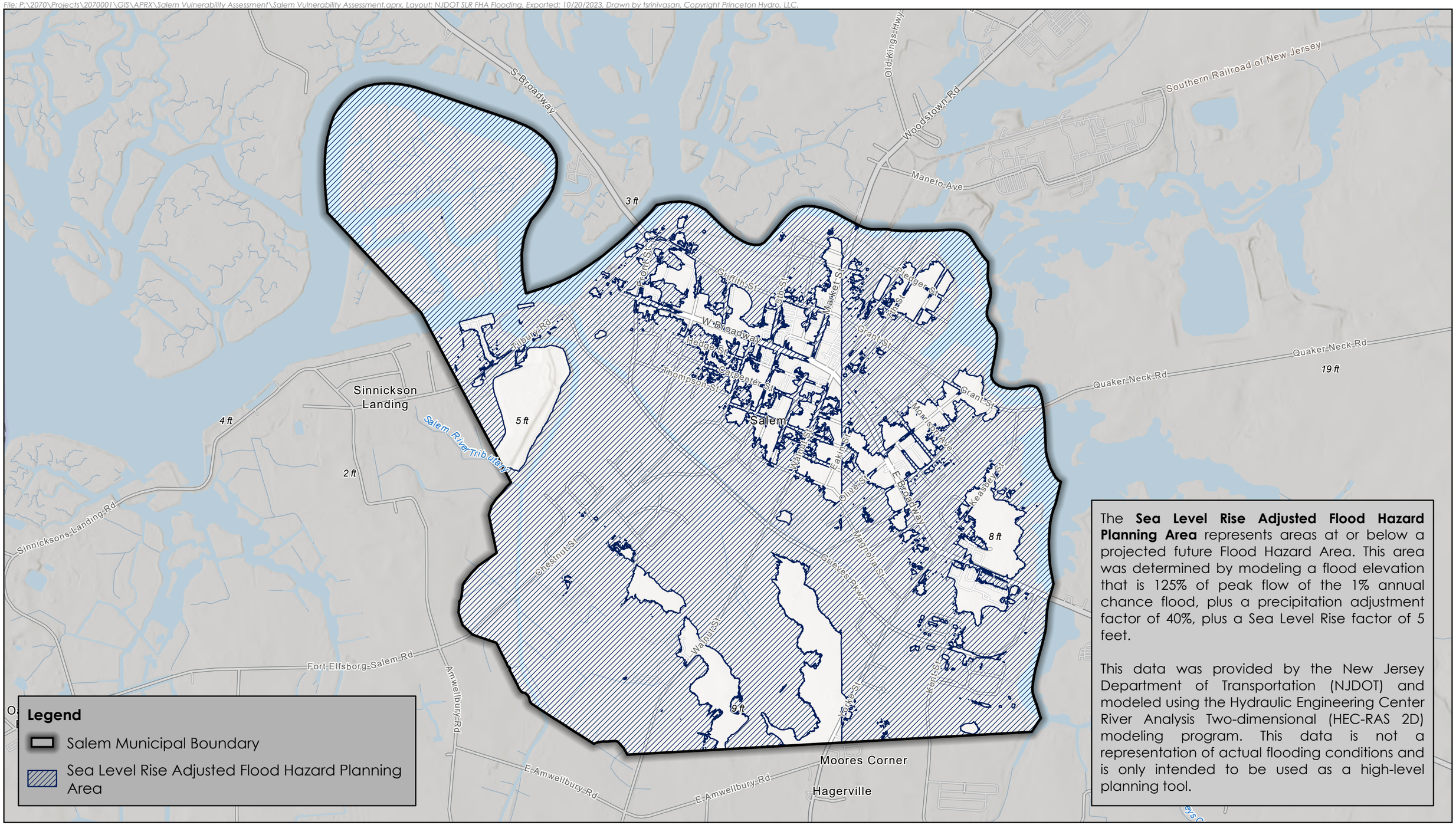
NOTES:
1. Zoning districts provided by the City of Salem.
2. Sea Level Rise Adjusted Flood Hazard Planning Area obtained from the New Jersey Department of Transportation (NJDOT).
3. Salem municipal boundary obtained from New Jersey Geographic Information Network (NJGIN) Open Data portal: https://njgin.nj.gov/
4. Basemap obtained from ESRI basemap services.

Spatial Reference: NAD 1983 2011 StatePlane New Jersey FIPS 2900 Ft US

0 700 1,400 Feet

ZONING IN SEA LEVEL RISE ADJUSTED FLOOD HAZARD PLANNING AREAS

RESILIENT NJ VULNERABILITY ASSESSMENT
BROWNFIELD REDEVELOPMENT SOLUTIONS, INC.
CITY OF SALEM, SALEM COUNTY, NEW JERSEY



Legend

- Salem Municipal Boundary
- Sea Level Rise Adjusted Flood Hazard Planning Area

The **Sea Level Rise Adjusted Flood Hazard Planning Area** represents areas at or below a projected future Flood Hazard Area. This area was determined by modeling a flood elevation that is 125% of peak flow of the 1% annual chance flood, plus a precipitation adjustment factor of 40%, plus a Sea Level Rise factor of 5 feet.

This data was provided by the New Jersey Department of Transportation (NJDOT) and modeled using the Hydraulic Engineering Center River Analysis Two-dimensional (HEC-RAS 2D) modeling program. This data is not a representation of actual flooding conditions and is only intended to be used as a high-level planning tool.

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NOTES:
1. Sea Level Rise Adjusted Flood Hazard Planning Area obtained from the New Jersey Department of Transportation (NJDOT).
2. Salem municipal boundary obtained from New Jersey Geographic Information Network (NJGIN) Open Data portal: https://njgin.nj.gov/
3. Basemap obtained from ESRI basemap services.

Spatial Reference: NAD 1983 2011 StatePlane New Jersey FIPS 2900 Ft US

0 700 1,400 Feet

SEA LEVEL RISE ADJUSTED FLOOD HAZARD PLANNING AREA

RESILIENT NJ VULNERABILITY ASSESSMENT
BROWNFIELD REDEVELOPMENT SOLUTIONS, INC.
CITY OF SALEM, SALEM COUNTY, NEW JERSEY

Appendix E:

RESILIENCE ACTIONS

2023

RESILIENT SALEM

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION

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System Area	Action Area	Hazard Vulnerability	Identified Problem	Recommended Action	Geography	Prioritization: Low Med High	Estimated Cost: $, $$, $$$ $$$$ **	Lead Organization/Department/Division	Supporting Organizations	Potential Funding Sources	Critical Next Steps
Natural System	Green Infrastructure	Flooding, Hurricanes and Other Extreme Weather Events, Sea Level Rise	Stomwater and drainage capacity is limited. Climate change will cause more precipitation events, making effective management of stormwater more important.	Determine where green infrastructure can be utilized in development projects .Construct rain gardens, bioswales, and subsurface stormwater retention/detention in roadway right-of-ways and within public parks, schools, housing, or other properties.	City wide	High Priority	$$$	City Engineer, Streets Department and County Department of Public Works	Salem Green Team, Planning Board	NJ DCA Resilient Communities; FEMA BRIC; NJ Infrastructure Bank; NJDEP Water Quality Management Grant	Develop a comprehensive plan for the construction and integration of green infrastructure practices across the city.
Natural System	Open Space Stormwater Management	Flooding, Hurricanes and Other Extreme Weather Events, Sea Level Rise	Current stormwater management is inadequate as more frequent and intense storms will increase flooding.	Develop a comprehensive stormwater management plan that incorporates existing open space for stormwater storage, utilizes green infrastructure features and promotes resilience in parks and open spaces. Develop design guidelines for flood-prone areas that incorporate green infrastructure features and promote resilience.	City wide, but with a focus on flood prone areas	High	$	City Engineer, Streets Department	City Planning Board, City Council; County Department of Public Works	NJDCA Local Planning Services, NJDEP Water Quality Management Grant	Conduct a feasibility study to identify specific existing open spaces that could benefit from stormwater management projects.Identify and prioritize areas most vulnerable to flooding for immediate drainage system improvements.Survey flood prone areas, and work with city engineers to identify opportunities to install green infrastructure.
Natural System	Tree Planting Programs	Extreme Temperatures	Lack of urban tree canopy contributes to heat island effect, leading to higher temperatures	Reactivate the shade tree commission to expand tree planting initiatives in parks and recreational areas. Identify suitable locations and plan tree planting events.	Citywide, Parks and Recreational Areas	High	$	City Engineer, Streets Department	Environmental Commission; Shade Tree Commission	US Forestry grants, NJ DEP Natural Climate Solutions grant; NJDEP Urban Forestry grants; TD Bank	Conduct an inventory of available planting locations; Plan tree planting events, engage the community, and establish maintenance practices for planted trees.

System Area	Action Area	Hazard Vulnerability	Identified Problem	Recommended Action	Geography	Prioritization: Low Med High	Estimated Cost: $, $$, $$$ $$$$ **	Lead Organization/Department/Division	Supporting Organizations	Potential Funding Sources	Critical Next Steps
Natural System	Heat-Resilient Landscaping	Extreme Temperatures	Urban areas lacking green spaces and shade have higher temperatures	Implement heat-resilient landscaping in parks and recreational areas. Plant native, heat-tolerant trees, install shade structures, and provide comfortable seating in parks	Parks and Recreational Areas	Medium	$	City Engineer, Streets Department, City Council, City Planning Board	County Department of Public Works, NJDEP Environmental Groups, Rutgers Cooperative Extension	US Forestry grants, NJ DEP Natural Climate Solutions grant; NJDEP Urban Forestry grants; TD Bank	Using the heat island map develop priority areas for tree planting and shade areas.
Natural System	Gardening and Local Food Growing	Flooding, Hurricanes and Other Extreme Weather Events, Sea Level Rise	Climate change can impact food supply chains; as a food desert, Salem is particularly vulnerable to disruptions in the supply chain.	Identify locations that can become community gardens; establish community gardens in recreation areas. Create a demonstration garden. Provide garden plots, gardening education, and support for community-led initiatives.	Citywide, Parks and Recreational Areas	Medium	$	Streets Department	Local Gardening Clubs, Schools, Community Organizations	NJDEP Green Acres; TD Bank	Prepare garden areas, allocate plots, and provide educational resources for gardeners.
Natural System	Stormwater Capture	Hurricanes and Other Extreme Weather Events	Increased frequency and severity of heavy rainfall events leads to flooding	Install rain barrels and stormwater capture systems in recreation facilities.	Citywide, Parks and Recreational Areas	Low	$	Environmental Commission	Local Watershed Organizations	ANJEC grant, component of NJDEP Water Quality Management Grant	Identify priority sites for installation, procure equipment, and initiate community awareness campaigns.
Economic System	Infrastructure Improvements	Flooding, Hurricanes and Other Extreme Weather Events, Sea Level Rise	City-owned infrastructure has not been evaluated in light of climate change resilience.	Infrastructure quality index	Citywide	High	$$	Salem Infrastructure and Public Safety	County and State DOT, Engineering	Municipal Budget	Identify city-owned infrastructure and develop a system to evaluate.
Econmic System	Services	Hurricanes and Other Extreme Weather Events	The city does not currently have a plan to ensure business can be up and running quickly after a storm event.	Continuity of essential services	Citywide, Downtown	Medium	$$	Salem Economic Development Department	Office of Emergency Management	Municipal Budget	Develop a plan to ensure businesses are able to reopen in a timely fashionk following a storm event.

System Area	Action Area	Hazard Vulnerability	Identified Problem	Recommended Action	Geography	Prioritization: Low Med High	Estimated Cost: $, $$, $$$ $$$$ **	Lead Organization/Department/Division	Supporting Organizations	Potential Funding Sources	Critical Next Steps
Social System	Community Education and Workshops	Flooding, Droughts, Extreme Temperatures, Hurricanes and Other Extreme Weather Events, Sea Level Rise	Lack of awareness about climate change and resilience strategies leads to unprepared residents. Community members have expressed a need to know more about what they can do to reduce climate-related risk on their own properties and also contribute to reduced climate risk more broadly.	Organize educational workshops and community events focused on climate change and resilience. Promote awareness about climate change and resilience strategies in schools and through City policies.	Citywide, Recreational Facilities	High	$	City Board of Education, City Council	Local Schools, Environmental Groups, Community Associations	Municipal Budget, School budget	Develop and deliver educational programs, outreach to community organizations, and ensure accessibility.
Built System	Infrastructure Improvements	Flooding, Hurricanes and Other Extreme Weather Events, Sea Level Rise	Existing emergency shelters are vulnerable to flooding	Identify and evaluate viable locations in the city for emergency shelters. Determine the feasibility and timeline to establish these locations as alternate shelters.	Citywide	High	$$	City Engineer, County Department of Facilities	Board of Education	HUD Emergency Solutions grant; FEMA Individuals and Households program; HUD HOME; FEMA Housing Assistance; NJ DCA Resilient Communities	Plan and execute the establishment of emergency shelters in locations outside flood hazard areas.
Built System	Infrastructure Improvements	Flooding	Critical assets and facilities in flood areas (Utilities, Fire Houses, pumps, nursing homes/ day care centers)are at greater risk	Site- or building-level adaptation may include: •Elevating critical mechanical systems, •Dry floodproofing •Retrofitting pump stations •Relocating critical facilities	Citywide	High	$$$	City Engineer, Streets Department, Economic Development, Fire Department, Water & Sewer	County Department of Public Works, Office of Emergency Management	NJ DCA Resilient Communities; FEMA BRIC; NJ Infrastructure Bank	Conduct asset-specific studies to determine the best risk reduction strategies for each priority asset.Design and develop a detailed database of all utilities including age, capacity, location and annual maintenance requirements.

System Area	Action Area	Hazard Vulnerability	Identified Problem	Recommended Action	Geography	Prioritization: Low Med High	Estimated Cost: $, $$, $$$ $$$$ **	Lead Organization/Department/Division	Supporting Organizations	Potential Funding Sources	Critical Next Steps
Built System	Infrastructure Improvements	Flooding, Hurricanes and Other Extreme Weather Events, Sea Level Rise	Ineffective and ageing stormwater management system are inadequate to handle the increased demands due to climate change.	Update and maintain the stormwater infrastructure, including pumps, and selective dredging.	Flooding areas such as along Grieves Parkway, York Street, Salem Manor Complex, and Keasbey Creek	Medium	$$$	Public Works	NJDEP	FEMA BRIC; Sewer Authority budget; Consider forming a Stormwater Utility; NJ DCA Resilient Communities; NJ Infrastructure Bank	Develop a stormwater mapping and needs assessment

APPENDIX F:
RESILIENCE ACTION RESOURCES

DECEMBER 2023

RESILIENT SALEM

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION

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About this Document

The following document is a guide provided to the City of Salem to assist in the implementation of its Resilience Action Plan. The guide comprises a series of resources and example ordinances drawn from the New Jersey Future Green Infrastructure Municipal Toolkit. It serves as an invaluable tool for municipal planners and policymakers in Salem, aimed at enhancing the city's strategies for integrating sustainable and low-impact development practices.

The City of Salem was a recipient of a grant from the NJDEP Resilient NJ Municipal Assistance Program, administered by the New Jersey Department of Environmental Protection (NJDEP) and is part of a broader state-wide effort to build more resilient communities and reduce the risks of natural disasters and other climate-related hazards. This grant program aims to assist municipalities in New Jersey to become more resilient in the face of natural disasters and other climate-related challenges. The program offers technical assistance and funding to help local governments develop and implement plans to mitigate the risks associated with climate change.

This work was made possible with financial assistance from the Coastal Zone Management Act of 1972, as amended, administered by the Office for Coastal Management, National Oceanic and Atmospheric Administration (NOAA) through the New Jersey Department of Environmental Protection, Coastal Management Program.

Project Team:

The environmental assessments, data, and actions in this plan do not represent guidance or policy of the New Jersey Department of Environmental Protection or the National Oceanic and Atmospheric Administration and does not replace the need for regulatory review by the appropriate local, state, and federal agencies.

CONTENTS

INTRODUCTION

The following document is a guide provided to the City of Salem to assist in the implementation of its Resilience Action Plan. The guide comprises a series of resources and example ordinances drawn from the New Jersey Future Green Infrastructure Municipal Toolkit. It serves as an invaluable tool for municipal planners and policymakers in Salem, aimed at enhancing the city's strategies for integrating sustainable and low-impact development practices.

The document details essential updates to municipal plans that underscore the significance of green infrastructure. It prescribes practical steps to incorporate green infrastructure into the city's Master Plan, Land Use Element, and Stormwater Management Plan, among others. Additionally, it provides direction for updating and improving ordinances, offering incentives, and improving municipal processes. The guide also emphasizes the importance of planning public projects with green infrastructure in mind, thereby leading by example and educating the community on the benefits of such an approach.

These essential revisions will offer a foundational rationale and structure to promote or mandate the adoption green infrastructure. The following resources are adapted from the New Jersey Future Green Infrastructure Municipal tool kit that can be access here: https://gitoolkit.njfuture.org/

DEVELOP AND UPDATE PLANS

Update the Master Plan Goals and Objectives

These model statements can be incorporated into the section of your Master Plan that articulates your community's overarching goals and objectives. This will provide the basis for Master Plan elements and regulations that encourage or require the implementation of green infrastructure.

Update the Land Use Element

The Land Use Element is a required element of the Master Plan in accordance with New Jersey Municipal Land Use Law. It is the part of the Master Plan that focuses on the future vision of land uses within the community. Incorporating the topic of resiliency and green infrastructure in this part of the Master Plan will emphasize the role green infrastructure should play in the community. Oceanport Borough's Master Plan includes resiliency as a central theme in its future land use decisions. The section of Oceanport's Master Plan provided here emphasizes the importance of green infrastructure.

Update the Stormwater Management Plan

All municipalities must adopt a Municipal Stormwater Management Plan (MSWMP). This plan is an important vehicle by which to stress the importance and promote the adoption, adaptation, and integration of Green Infrastructure into the municipality's land development (zoning) and stormwater management ordinances. Municipalities may modify NJDEP's sample MSWMP to promote GI and to integrate such practices as prominent elements of a municipality's Land Development and Stormwater Management Ordinances. This MSWMP guidance document is intended to assist municipalities in the preparation of their own individual MSWMP to include GI.

Update Redevelopment Plans

Most redevelopment plans address overarching goals as well as the design of streets and other elements. Goals and relevant components of these plans should include specific encouragement for the integration of green infrastructure, in such a way that there is flexibility within the frameworks of the

overall vision to accommodate it without triggering variances or waivers. Consider this suggested language.

Create a Green Building and Environmental Sustainability Element, a.k.a. Sustainability Element

The Sustainability Element is an element of the Master Plan that seeks to encourage and promote the efficient use of natural resources and the installation and usage of renewable energy systems; consider the impact of buildings on the local, regional and global environment; allow ecosystems to function naturally; conserve and reuse water; treat stormwater on-site; and optimize climatic conditions through site orientation and design. Lawrence Township created a Sustainability Element to guide land use decisions and provide the basis for ordinances addressing sustainability and land use issues.

This section of the Sustainability Element addresses sustainable water resources practices in general and green infrastructure in particular. The Sustainability Element is a good repository for a wide variety of sustainability topics, including green infrastructure. A completed Sustainability Element can earn your municipality points toward Sustainable Jersey Certification.

Create a Stormwater Mitigation Plan

A municipal Stormwater Mitigation Plan is an optional element of a Municipal Stormwater Management Plan, but is required in order for a municipality to grant a variance or exemption to the design and performance standards for stormwater runoff quality and quantity, and groundwater recharge, established under the Stormwater Management rules at N.J.A.C. 7:8-5. Municipalities may offer a number of possible mitigation projects that an applicant may build or contribute funding toward in order to offset the effect of a requested waiver or exemption. At the municipal level, MS4 permits require cities and towns to inventory existing stormwater infrastructure. The inventory process offers a good opportunity to document problem areas, identify mitigation opportunities and implement green infrastructure. NJDEP has Stormwater Mapping and Inventory Assistance Tools to aid a municipality in this exercise. Some towns, like Jackson Township and Chatham Township, have included a mitigation plan within their Municipal Stormwater Management Plan. Other towns, such as Moorestown Township, have separate Mitigation Plans. The Moorestown Stormwater Mitigation Plan provides mitigation projects by watershed but these projects are very general. NJDEP provides a mitigation plan guidance document for the creation of a stormwater mitigation plan.

Community Forestry Plan and Tree Cover Goal

A Community Forestry Plan is an important first step in creating a comprehensive tree planting program, which could inform the location and type of trees for green infrastructure projects. NJDEP provides financial assistance for the development of these plans. Sustainable Jersey points are awarded for the certification of a community forestry plan.

Green Infrastructure Plan

A municipality may want to implement a comprehensive Green Infrastructure Plan as a sub-element to the Master Plan to provide actions and policy direction to institutionalize green infrastructure. The Green Infrastructure Plan guidance document provides several elements for consideration by a municipality that wants to plan comprehensively for the implementation of green infrastructure. The City of Hoboken developed a Green Infrastructure Strategic Plan, which creates a framework for green infrastructure on both a city-wide and district by district basis; identifies the most cost-effective place-based best

management practices (BMP) the city can employ to address stormwater management and the anticipated increase in frequency of flooding events; and develops a set of strategies the city can employ to implement the plan. The City of Lancaster, Pennsylvania, adopted a Green Infrastructure Plan to reduce combined sewer system overflows and identify economically viable, long-term strategies for mitigating the negative impact on its water quality of wet-weather overflows. Sustainable Jersey awards points for completing impervious coverage assessments and, separately, for creating short-term and long-term goals for reducing runoff and disconnecting drainage systems. It also requires conceptual project designs.

Resources:

- Model Language for Master Plan Goals and Objectives
- Stormwater Management Plan Guidance
- Oceanport Borough Master Plan
- Sustainability Element of Lawrence Twp Master Plan
- Jackson Township Stormwater Management Plan
- Chatham Township Stormwater Management Plan
- The Moorestown Stormwater Mitigation Plan
- Guidance for the Development of Municipal Mitigation Plans
- Conservation Element of Byram Master Plan
- Green Infrastructure Plan Guidance Document
- Hoboken Green Infrastructure Strategic Plan
- Milwaukee Green Infrastructure Plan

UPDATE AND IMPROVE ORDINANCES

There are a number of ways to improve both your municipal stormwater ordinance and your **land use / zoning ordinances** to encourage and incentivize the use of green infrastructure. All municipalities are free to adopt ordinance provisions that go above and beyond the State's minimum requirements. Here are ways to raise the bar:

Stormwater Ordinance Improvements

Every NJ municipality must update its stormwater ordinance to comply with new amendments to the Stormwater Management Rules (NJAC 7:8). NJDEP provides a sample stormwater ordinance. New Jersey Future's Enhanced Model Stormwater Ordinance, also available as an editable Word document, provides several options for municipalities to strengthen their ordinances to increase green infrastructure and reduce flood risk.

Local stormwater ordinances may go above and beyond the minimum requirements of NJDEP's new stormwater rules for certain kinds of projects. For example, municipalities may choose to define "major development" with a smaller area of disturbance; apply stormwater requirements to both major and minor development; add green infrastructure requirements in urban redevelopment areas; require onsite stormwater retention; and more. For more guidance on these and other ways to bring increased green infrastructure benefits to your community, explore the menu of options provided in New Jersey Future's Enhanced Model Stormwater Ordinance (links above).

Note: these kinds of higher standards can be applied only to nonresidential projects that go before the local planning board or zoning board of adjustment. Residential projects are governed by the Residential Site Improvement Standards (RSIS), which reference the current stormwater rule. Thus, residential projects subject to planning board or zoning board review must meet the state's minimum standards, no more and no less.

Resources:

- Sustainable Jersey Enhanced Stormwater Management Control Model Ordinance
- GI Guidance in NJ's Highlands Region
- Pinelands Model Stormwater Control Ordinance
- Language for Tree Protection Provisions in Land Use Ordinance

Land Use / Zoning Ordinance Improvements:

Reduce Impervious Cover Be Specific About Landscape Requirements, Including Tree Protection Establish Riparian Buffers and Protect Stream Corridors Promote Compact Development

Maximum Parking Requirements. Establish maximum parking space requirements for non-residential development and require a process by which the developer must include measures to mitigate the increase such as additional open space, pervious pavement and non-structural stormwater management elements if the parking maximum is exceed by 10% or more. Minimum Parking Requirements. Consider revising parking regulations below ITE (Institute of Transportation Engineers) standards based on empirical data from local development and actual demand counts, especially in mixed-use and transit village districts.

Curbing. Make sure your ordinance accommodates curb requirements related to green infrastructure. Sample language: Development that incorporates non-structural stormwater management mechanisms/elements , such as bio-swales, recharge areas, etc, adjacent to streets may be constructed without curbing or with modified curb design, provided that the elimination/modification of curbing is related to the functioning of the non-structural stormwater management mechanisms/elements, subject to the approval of the Municipal Engineer.

Pervious Pavement. Pervious pavements should be permitted and encouraged. Sample ordinance language: Use of alternative pervious pavements are permitted provided that the function, safety and durability of the pavement is acceptable to the Municipal Engineer. Consider adopting a minimum percentage of parking lots, drives and roads to utilize pervious pavement elements. Parking Layout. Minimize impervious cover through parking layout. Encourage one-way directional, angled parking and/or require the developer to provide several parking layouts demonstrating the parking layout proposed minimizes to the maximum extent possible the amount of impervious coverage. Shared Driveways. Shared driveways are permitted or required for single-family residential developments. On-Street Parking Credit. Parking calculations may include public parking that is within 500 feet of the property. Shared Parking. Shared parking may allow for a reduction of up to 40 percent based upon the compatibility of uses that have different parking demands and are able to share parking lots/ spaces throughout the day. The Applicant shall provide a parking study to justify the number of spaces for shared parking. The Applicant shall provide a shared parking easement that must be approved by the

Board to allow the shared parking arrangement between property owners/ tenants. Parking Reduction. If an Applicant would like to reduce the number of parking spaces beyond 20 percent or increase the number of parking spaces beyond the maximum in the table below, the Applicant shall provide a parking study for review.

Be Specific About Landscape Requirements, Including Tree Protection Landscape design should facilitate water conservation through the use of drought-tolerant plants, capture, management and recharge of stormwater, and integration of potable water re-use strategies. The thoughtful integration of non-structural stormwater management elements within landscape design is encouraged. Integration of non-structural stormwater management elements within vegetated buffers is encouraged. Integration of non-structural stormwater management elements, such as bio-swales and recharge mechanisms, within parking lot planting beds, is encouraged. Consider adopting a minimum area of the interior portion of the parking lot to be landscaped. The landscape design should be designed to also serve as green infrastructure, such that it incorporates non-structural stormwater management elements to channel, treat, retain and recharge stormwater. Deep-rooted native vegetation is encouraged to increase the infiltration capacity of soils. Linear parking islands should be provided to increase opportunities for non-structural stormwater management elements and additional tree canopy. Municipalities are encouraged to examine and limit the excessive removal and destruction of trees, which can contribute to stormwater runoff. Here is specific language for tree protection provisions to be incorporated in your municipal Land Use Ordinance.

Establish Riparian Buffers and Protect Stream Corridors

Definition: STREAM CORRIDOR: A stream corridor shall include: A. The stream channel. B. The area within the one-hundred-year flood line, if delineated. C. The area extending outward from the stream channel in any direction as measured from either: a) the one-hundred-year floodline; or b) from the top of the stream bank (if the one-hundred-year floodline is not delineated), according to the following classifications: (1) One hundred feet for non-trout waters. (2) One hundred fifty feet for trout maintenance waters. (3) Three hundred feet for Category One waters. D. Areas abutting the outer boundary of the composite area of the stream corridor delineated pursuant to A through C above that have slopes of 15% or greater.

Regulation: Stream corridors. (1) The purpose of this section is to protect property from flooding; to reduce land development impacts on stream water quality and flows; to maintain quality of streams and improve the currently impaired streams; to protect significant ecological components of stream corridors such as wetlands, floodplains, woodlands, steep slopes, wildlife, plant and riparian habitats within the stream corridors: to complement existing state, regional, county and municipal stream corridor protection and management regulations and initiatives; to protect existing natural drainage features; to protect other's rights within the same watershed from adverse effects of improper stream corridor development; and to provide recreation and wildlife migration corridors. (2) Stream corridors shall remain in their natural state, with no clearing or cutting of trees and brush (except for removal of dead vegetation and pruning for reasons of public safety), altering of watercourses, regrading or construction. Only the following uses shall be permitted within stream corridors, subject to the aforementioned parameters:

- (a) Agriculture according to the best management practices of the Natural Resource Conservation Service or the Soil Conservation District, but excluding enclosed structures. (b)

Pasture and controlled grazing of animals as part of an agricultural operation in accordance with conservation practices approved by the Natural Resource Conservation Service or the Soil Conservation District. (c) Wildlife sanctuary, woodland preserve, and arboretum, except if subject to damage by flooding. (d) Hunting and fishing reserves, operated for the protection and propagation of wildlife, but excluding enclosed structures. (e) Passive recreational uses. (f) Stream corridor restoration that utilizes plantings of native and indigenous species. (g) Dams, culverts and bridges that have received approval from the appropriate municipal, county and state agencies having such authority. (h) Roads that cross the stream corridor as directly as feasible and have received approval from the appropriate municipal, county and state agencies having such authority.(a) Agriculture according to the best management practices of the Natural Resource Conservation Service or the Soil Conservation District, but excluding enclosed structures.

(3) Any use not specifically permitted in the stream corridor is prohibited. (4) An approved application for development or use on a lot which contains a stream corridor or portion of a stream corridor shall provide a conservation easement for the continued protection of the stream corridor. Conservation easements shall be established by deed or by plat filed with the County Recording Officer in compliance with the Map Filing Law. (5) Appropriate monuments shall be set by the licensed land surveyor. Such markers shall be set at each conservation easement corner not previously marked by a monument. All boundary markers shall be described on the survey provided to show their relation to the property or corner or, if appropriate, to the boundary lines.

Promote Compact Development

Definition- Residential cluster: A contiguous or non-contiguous area to be developed as a single entity according to a plan containing residential housing units which have a common or public open space area as an appurtenance. Residential Cluster Optional Development. Residential cluster optional development, when permitted by the applicable zoning district, shall conform to the following provisions: A. Permitted Uses. Single-family detached, semi-detached, or townhouse dwellings shall be permitted. B. Open Space. Open space, recreation, land or land for conservation purposes shall be a minimum of one acre in area and shall front on a publicly dedicated street or publicly accessible private street. Land intended for agricultural use shall be a minimum of 5 acres. C. Minimum Required Open Space. No residential cluster development shall include less than 40% of the total tract area for common open space. Common open space shall be set aside for conservation, passive recreation and active recreation. Such land shall be optimally related to the overall plan and design of the development and improved to best suit the purpose(s) for which it is intended. For the purposes of this section, land utilized for street rights-of-way shall not be considered common open space. D. Use of Open Space Land. Land to be devoted to public purposes may be offered to and may be accepted by the municipality, a non-profit land trust, or may be owned and maintained by an open space organization. Any lands intended to be offered to the municipality or non-profit land trust for public purposes shall be so declared prior to preliminary approval. All lands not offered to and/or not accepted by the municipality or non-profit land trust shall be owned and maintained by an open space organization pursuant to N.J.S.A. 40:55D-43. E. Public or Community Utility Systems Required. Residential cluster developments shall be required to be connected to public sewer and water or community well and septic. Individual lot septic system and well shall not be permitted.

OFFER INCENTIVES

Incentives for developers to use green infrastructure can be included in the development application and review process as well as in the zoning for the site. Development application and review incentives include:

- Discounted application fees
- Discounted or waiver of maintenance bonding for green infrastructure
- Redevelopment area bonuses: Municipalities may offer a one-time tax credit for development projects that incorporate green infrastructure in a way that benefits the local community.
- Zoning incentives
    - Allow increased height, density or intensity
    - Exempt green roofs and pervious pavement from impervious-cover regulation

Zoning incentives allow for increased height, density or intensity of the development in exchange for the use of green infrastructure, reduction in impervious surfaces and the increase of green spaces. Many communities include floor area ratio (FAR) regulations, which limit the amount of floor area or density for a building for a specific lot size. There may be opportunities to provide more flexible FAR standards for infill and retrofit developments that incorporate green infrastructure in the site design, thereby reducing the site's impact on the surrounding community. In addition, a municipality may allow green roofs and pervious pavement to be exempted from impervious-cover regulation. Hoboken provided potential development scenarios using incentive-based zoning techniques on p. 47 of its Green Infrastructure Strategic Plan.

IMPROVE MUNICIPAL PROCESSES

Update the municipal development application process to promote the use of green infrastructure early in the design phase. Green infrastructure should be considered early in the design phase of a development project and ideally should be distributed around a site. Local officials and their professionals may take the opportunity to work with developers and their teams before a site is engineered, to discuss the developer's plan for the site, have an informal Q&A that can ease the review process, and to ensure that green infrastructure is understood and used. This checklist can be helpful before or during a pre-application meeting between an applicant and pertinent review personnel to discuss the municipality's green infrastructure and low-impact development goals and requirements in order to optimize the development's nonstructural stormwater management design.

PLAN PUBLIC PROJECTS

Plan for green infrastructure in public projects Communities should lead by example. Green infrastructure should be incorporated into public projects including the construction of new roads, roadway upgrades, stormwater management facilities, parks, parking areas, streetscape improvements, etc. — all of which may appear in a Municipal Capital Improvement Plan. Not only do these projects provide opportunities for reducing community-wide stormwater impacts, but they also create educational opportunities for the community, provide examples for developers, and help ensure that

municipal professionals and staff are knowledgeable about green infrastructure design, installation and maintenance.

Tree Planting Programs Trees are excellent green infrastructure resources. They absorb a large volume of stormwater, beautify neighborhoods, cool and clean the air, and increase property values. Sustainable Jersey awards points for a Tree Planting Project Report that includes a description of the tree planting program, including a tree species and size list; planting locations or map; and a budget showing the project funding sources and in-kind contributions of materials and volunteer labor, if utilized.

Efficient Landscape Design With this Sustainable Jersey Certification action, municipalities can earn points for implementing a landscaping project that meets the guidelines outlined in the action for xeriscaping and rainscaping. While a rain garden would fall under the green infrastructure implementation action, other landscaping projects for this action could qualify as green infrastructure.

TRAINING AND EDUCATION

Like any infrastructure, green infrastructure requires periodic maintenance to function properly. Appropriate ongoing training for staff and contractors is imperative.

Training Programs

- Stormwater Training
- Asking the Right Questions in Stormwater Review eLearning Tool
- Green Infrastructure Overview: Examples and Properties of a Variety of Stormwater Management Solutions eLearning Tool
- Green Infrastructure Webcast Series
- Green Stormwater Infrastructure Operation and Maintenance Course
- Inventory and Assessment of your Stormwater Infrastructure eLearning Tool
- Paraprofessionals Watershed Restoration Training Program
- Rainwater Harvesting with Rain Barrels Trainer Manual
- Stormwater Management in Your Backyard

RESOURCES

Trees

- iTree online tools
- Arbor Day Foundation tree facts
- EPA: “Stormwater to Street Trees”
- Urban Forest Systems and Green Stormwater Infrastructure

NJ Stormwater Rules

- NJAC 7:8 Stormwater Management
- NJDEP Sample Stormwater Ordinance
- Stormwater Management Rules Applicability and Amendments
- NJDEP Stormwater Rule FAQs
- Checklist for Conducting Stormwater Management Reviews

- It's Official: NJDEP Amends State Stormwater Rules to Require Green Infrastructure
- Developers Green Infrastructure Guide 2.0
- Understanding the New MS4 Permit: A Primer for NJ Municipalities

Resources for Residents

- The Interactive Yard Tool: Design Your Jersey-Friendly Yard
- Green Infrastructure (GI) Wiz
- Rain Barrel Train-the-Trainer Program
- Rain Garden App
- Rain Garden Manual of New Jersey
- Stormwater Management in Your Backyard Program
- River-Friendly Programs

Resources for Schools

- Next Generation Science Standards (NGSS)
- Stormwater Camp
- Project WET (Water Education for Teachers) Foundation
- 4-H Stormwater Worksheet: Rain to Drain – Slow the Flow
- Understanding the Urban Watershed
- Stormwater Management in Your Schoolyard
- The Watershed Institute Teacher Programs
- Be Water Wise (National Environmental Education Foundation)
- Hands on Models: EnviroScape®
- Sewer in a Suitcase Workshop

Appendix G:

Resilient NJ

CLIMATE CHANGE CURRICULUM

City of Salem, NJ

2023

RESILIENT SALEM

MEMO

To: Salem Department of Education From: Resilient Salem Project Team Subject: Salem Climate Change Curriculum

December 2023

Dear Colleagues,

Attached is the draft of the Salem Climate Change Curriculum, developed to educate our city's students about local and global climate challenges. This curriculum is structured to progress from basic concepts in elementary grades to more complex topics in high school.

Elementary students will learn about the local environment and weather patterns. Middle school students will examine the impact of human activities on Salem's climate, with a focus on project-based learning. High school students will explore the broader effects of climate change, with an emphasis on local impact and community engagement.

The goal is to prepare students to understand and address the environmental issues that affect our city.

In partnership,

The Resilient Salem Project Team

http://www.brsinc.com/resilient-nj-salem

Introduction to Salem City's Climate Change Curriculum

Welcome to Salem City's Climate Change Curriculum, an innovative and locally-focused educational journey designed for our young learners. In a world where climate change is increasingly impacting our daily lives, it's crucial to equip the next generation with the knowledge and skills necessary to navigate and respond to these changes, especially those occurring in our own community.

Our curriculum is tailored to meet the educational needs of students across elementary, middle, and high school levels. It is structured to grow in complexity and depth as students advance, ensuring that each stage of learning is age-appropriate and engaging.

Salem City, like many communities, is experiencing the tangible effects of climate change. Increased storms, heavier rainfall, the challenges of urban heat islands, and the risk of flooding are no longer abstract concepts but realities that affect our environment, health, and economy. By focusing on Salem City, we aim to make climate education relevant and tangible to our students. They will not only learn about global and national climate issues but also understand and engage with the local environmental challenges and solutions specific to our community.

Curriculum Highlights

- **Elementary School**: Introducing the basics of weather, climate, and the local environment in a fun and interactive way. Young learners will explore the relationship between their daily lives and the changing climate, emphasizing simple actions they can take to make a difference.
- **Middle School**: Delving deeper into climate science, students will explore how human activities impact the climate, particularly in Salem City. This phase includes project-based learning, encouraging students to investigate local environmental issues.
- **High School**: Offering a comprehensive and in-depth understanding of climate change, its global implications, and local effects. Students will engage in advanced studies, research projects, and community involvement, preparing them to become informed and proactive citizens.

Our Commitment

As educators, we are committed to providing a curriculum that not only informs but also inspires. We believe that by understanding the challenges and engaging in solutions, our students can become effective stewards of the environment and active participants in creating a sustainable future for Salem City and beyond.

Join us in this important journey of discovery, learning, and action. Together, we can make a difference in our community and in the world.

To address local environmental issues like flooding, increased storms, rain, and the urban heat island effect, would make the subject matter more relevant and engaging for students. Here's how each educational level's curriculum can be adapted:

Elementary School Curriculum for Salem City, NJ

1. **Local Weather and Climate**
    - Discuss Salem City's typical weather patterns.
    - Introduce concepts of flooding and heavy rains.

2. **Salem City's Environment**
    - Explore local environments: nearby rivers, parks, and urban areas.
    - Discuss how these areas are affected by weather.
3. **Local Wildlife and Plants**
    - Study plants and animals found in New Jersey.
    - Effects of changing weather on local ecosystems.
4. **Climate Change in Salem City**
    - Simple explanations of how increased storms and flooding affect Salem City.
    - Discuss urban heat island effect in simple terms.
5. **Local Actions to Help Environment**
    - Planting trees and community gardens to reduce urban heat.
    - Understanding the importance of storm drains and keeping them clean.

Middle School Curriculum for Salem City, NJ

1. **Detailed Study of Salem City's Climate**
    - Focus on historical weather patterns in Salem City and changes observed.
    - Study of local flood zones and their expansion.
2. **Human Impact on Salem City's Climate**
    - Relation between local industries and urban heat island effect.
    - Increased rainfall and storms in the area.
3. **Local Climate Change Impacts**
    - Effects on Salem City's agriculture, health, and infrastructure.
    - Role of local policies in managing climate risks.
4. **Environmental Conservation in Salem City**
    - Local conservation efforts and how students can participate.
    - Projects focusing on urban greening initiatives.
5. **Projects and Experiments**
    - Monitoring local weather patterns and rainfall.
    - Experiments demonstrating urban heat island effect.

High School Curriculum for Salem City, NJ

1. **Advanced Study of Climate Change in Salem City**
    - Analyzing data on local climate change: temperature trends, rainfall patterns.
    - Understanding the science behind urban heat islands.
2. **Global and Local Responses to Climate Change**
    - How global climate initiatives affect Salem City.
    - Salem City's response to climate risks.
3. **Socio-Economic Impacts on Salem City**
    - How climate change is impacting local economy and communities.
    - Discussions on environmental justice within Salem City.
4. **Local Innovations and Solutions**
    - Study of local renewable energy initiatives and sustainable urban planning.
    - Encourage students to propose solutions for Salem City.
5. **Capstone Projects**
    - Research on Salem City's specific climate change challenges.
    - Collaboration with local environmental groups and government.

Cross-Level Activities

- **Field Trips**: Visits to local water management facilities, urban green spaces.
- **Local Experts**: Talks from city planners, local environmentalists.
- **Salem City Focused Multimedia Resources**: Use of local news and reports.
- **Community Engagement**: Participation in local environmental initiatives like flood prevention programs and urban greening projects.

Resilient Salem

The "Resilient Salem Project" is a significant resource for educators in Salem City, NJ, particularly in the context of a climate change curriculum. This project's website offers insights into local climate resilience initiatives, strategies, and plans that are directly relevant to the community. It's an excellent resource for educators to incorporate local, real-world examples of climate adaptation and resilience planning into their teaching.

Educators can use this website to:

1. **Understand Local Climate Challenges**: Gain detailed knowledge about the specific climate change challenges facing Salem City, such as flooding, increased storms, and the urban heat island effect.
2. **Explore Resilience Strategies**: Learn about the strategies and plans that Salem City is implementing to become more resilient against the impacts of climate change.
3. **Engage Students with Local Initiatives**: Incorporate case studies and current initiatives from the Resilient Salem Project into the curriculum, allowing students to see the practical application of climate resilience concepts.
4. **Develop Project-Based Learning**: Use the information from the website to create project-based learning opportunities where students can propose or contribute to local resilience solutions.
5. **Connect with Local Experts**: The project may also offer opportunities for educators to connect with local experts for guest lectures or field trips, providing students with firsthand insights into climate resilience efforts.

For more information, you can visit the Resilient Salem Project Website.

Online Educational Platforms and Databases

1. Resilient Salem Project Website: https://brsinc.com/resilient-nj-salem
2. **NASA Climate Kids**: This website offers interactive games, videos, and activities to teach children about climate change and Earth science. It's a great resource for introducing young students to these concepts in a fun and engaging way. NASA Climate Kids
3. **A Guide to Climate Change for Kids by NASA Climate Kids**: This section of the NASA Climate Kids website provides a comprehensive guide to climate change specifically designed for kids. It

includes explanations of key concepts and answers to common questions about climate change. A Guide to Climate Change for Kids

4. **National Geographic Education**: National Geographic provides resources on environmental science, including lesson plans and multimedia materials. Their content is known for its high-quality visuals and engaging storytelling. National Geographic Education
5. **NOAA's Climate.gov**: This site features teaching resources, scientific data, and educational tools about climate science, making it a valuable resource for more in-depth study. NOAA's Climate.gov
6. **EPA's Climate Change Resources for Educators**: The Environmental Protection Agency offers lesson plans, data, and information specifically tailored to teaching about climate change. EPA's Climate Change Resources for Educators
7. **Project Learning Tree**: Provides environmental education resources and curriculum focused on climate change and sustainability. This platform is excellent for hands-on learning activities. Project Learning Tree
8. **New Jersey Department of Environmental Protection - Education Resources**: Offers various materials and programs about local environmental issues and conservation efforts, which can be very relevant for Salem City. NJDEP Education Resources
9. **Rutgers New Jersey Agricultural Experiment Station (NJAES)**: Offers resources and outreach programs on environmental and agricultural education, which can be particularly useful for understanding local environmental issues. NJAES
10. **The New Jersey Climate Adaptation Alliance**: Provides local data, reports, and resources focused on climate change impacts and adaptation in New Jersey. NJ Climate Adaptation Alliance
11. **Salem County Environmental Education Center**: Offers local environmental education programs and resources, including field trip opportunities, which can provide hands-on learning experiences for students. Salem County Environmental Education