City of Brigantine

Floodplain Management Plan

Prepared By

Rutala Associates

Adopted

February 19, 2020

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Executive Summary

Why Plan for Flooding?

The threat of flooding and the desirability of coastal living has long been a conflict that Brigantine residents and property owners have faced since the island was first settled. The waters that lend the City its vitality is also its most pressing threat. While Superstorm Sandy was a major catalyst in this effort, even absent a major storm Brigantine remains both uniquely vulnerable to flooding and uniquely positioned to benefit from its surrounding waters.

With flooding being a multi-dimensional and compounding risk, it is increasingly apparent that a comprehensive, multi-front approach to flooding is needed to address flooding in Brigantine while simultaneously understanding the scope and of the challenges that flooding entails. This Floodplain Management Plan (FMP) is the City's attempt to address that scope.

The Floodplain Management Plan is an important component of the City's participation in the National Flood Insurance Program (NFIP), Community Rating System (CRS). Developing a Floodplain Management Plan is among the activities that earn CRS credit toward reduced flood insurance rates and is a prerequisite for a class 4 designation. The CRS program sets forth requirements that floodplain management plans be updated on a three-year cycle and that progress on meeting plan objectives be reviewed annually.

What is a Floodplain Management Plan?

Hazard mitigation is defined as "sustained action taken to reduce or eliminate long-term risk to life and property". It involves planning, policy changes, programs, projects and other activities that can mitigate the impacts of hazards on a defined planning area. A floodplain management plan is "an overall strategy of programs, projects, and measures that will reduce the adverse impact of the hazard on the community and help meet other community needs". The responsibility for flood hazard mitigation lies with many, including private property owners, business, industry, and local, state and federal government. Recognizing that there is no one solution for mitigating flood hazards, planning provides a mechanism to identify the best alternatives within the capabilities of a jurisdiction. A Floodplain Management Plan achieves the following in order to set the course for reducing the risk associated with flooding:

- Ensuring that all possible floodplain management activities are reviewed and implemented so that local problems are addressed by the most appropriate and efficient solutions.
- Ensuring that floodplain management activities are coordinated with one another and with other community goals and activities, preventing conflicts and reducing the cost of implementing each individual activity.
- Coordinating local floodplain management activities with federal, state and regional programs.

- Educating residents on the flooding hazard, loss reduction measures, and the natural and beneficial functions of floodplains.
- Building public and political support for mitigation projects.
- Fulfilling planning requirements for obtaining state or federal assistance.
- Facilitating the implementation of floodplain management and mitigation activities through an action plan that has specific tasks, staff assignments and deadlines.

The Brigantine Floodplain Management Plan identifies mitigation actions, chosen through a facilitated process that focused on meeting these objectives. The Brigantine Repetitive Loss Area Analysis, prepared separately from this Plan, will provide a detailed assessment of areas that have experienced repeated flood damage in the past and recommended actions to mitigate flooding at each specific repetitive loss area.

What is the Community Rating System?

The Community Rating System is a voluntary program within the National Flood Insurance Program that encourages floodplain management activities that exceed the minimum NFIP requirements. The CRS outlines 18 creditable activities that fulfill the program goals of reducing flood losses, facilitating accurate insurance rating and promoting awareness of flood insurance. The activities are in four categories:

- Public information,
- Mapping and regulations,
- Flood damage reduction, and
- Flood preparedness.

Flood insurance premiums in participating communities are discounted to reflect the reduced flood risk resulting from community actions to meet the CRS goals. The City of Brigantine has participated in the CRS program since October 1992. The City has a Class 5 rating, so property owners within the 100-year floodplain can receive a 25-percent discount on flood insurance; outside the 100-year floodplain they receive a 5-percent discount.

The City of Brigantine had 6,727 NFIP flood insurance policies in place in 2018, providing $1,594,770,100 of property coverage with total annual premiums of $4,278,185. With a Class 5 rating, the total City-wide premium savings of $1,069,546 in 2018 alone. This saving will increase as flood insurance premiums continue to rise. The Floodplain Management Plan will help the City maximize its credit potential under the CRS and is a prerequisite for a Class 4 designation, which will result in an additional $213,909 in annual savings.

Plan Development Methodology

The first priority for this Plan is to benefit the property owners of the City of Brigantine by providing protection against the hazard posed by potential flooding. In addition, the Plan has been developed to follow the guidelines for flood planning presented by the Federal

Emergency Management Agency (FEMA) for the CRS program. To earn CRS credit for the Floodplain Management Plan, the city's process for developing the Plan must include at least one item from each of 10 steps. The organization of this document corresponds with these steps:

Figure 1: Floodplain Management Plan Steps

FMP Step #	Floodplain Management Plan Chapters
Part 1: Planning Process and Project Background	
1- Organize	1
2- Involve the Public	2
3- Coordinate	3-5
Part 2: Risk Assessment	
4- Assess the hazard	6, 7, 8
5- Assess the problem	9, 10
Part 3: Mitigation Strategy	
6- Set goals	11
7- Review possible activities	12
8- Draft an action plan	13
Part 4: Plan Maintenance	
9- Adopt the plan	14
10 - Implement, evaluate and revise	15

The following sections provide summaries of the planning process and recommendations of the Brigantine Floodplain Management Plan corresponding with the document organization presented above.

Planning Process and Project Background

A 10-member Floodplain Management Committee, consisting of City officials, property owners and other stakeholders including a banker, insurance broker and realtor, was appointed to oversee the development of the plan. This committee met five times over a 12-month period to provide guidance and oversight to a planning team consisting of City staff and a technical consultant. The planning team was responsible for the development of the plan.

Coordination with regional, state and federal agencies involved in flood hazard mitigation occurred throughout the plan's development. A comprehensive review was completed of existing plans and programs that can support flood hazard mitigation. The Floodplain Management Committee developed a public involvement strategy that was implemented by the planning team and included five public meetings, three City Council presentations, an additional public meeting to gain input at the beginning of the planning process and a public meeting to review the draft plan, a City-sponsored webpage dedicated to the plan, and multiple media releases.

The Flood Hazard Risk Assessment

Risk assessment is the process of measuring the potential loss of life, personal injury, economic injury, and property damage resulting from natural hazards such as flooding. It allows emergency management personnel to establish early response priorities by identifying potential hazards and vulnerable assets.

Mitigation Statement, Goals and Objectives

The Floodplain Management Committee identified a mission statement, goals and objectives.

- Mission statement—Protect life, property, the economy and the environment of Brigantine by identifying and communicating risks and sustainable actions to reduce flood hazards.
- Goals
    1. Protect life, safety, property, and economy.
    2. Work with local property owners and watershed management groups so that residents understand the flood hazard of the region based on best available data and science.
    3. Increase resilience of infrastructure and critical facilities.
    4. Account for flood risk in land use and planning.
    5. Preserve, enhance, or restore the natural environment's floodplain functions.
    6. Encourage the development and implementation of long-term, cost-effective, and environmentally-sound mitigation projects.
- Objectives
    - Work cooperatively with public agencies with responsibility for flood protection and with stakeholders in planning for flood and inundation hazards.
    - Utilize best available data, science, and technologies to improve understanding of the location and potential impacts of flood hazards.
    - Provide state, county, and local agencies and stakeholders with updated information about flood hazards, vulnerabilities, and mitigation measures.
    - Create a public outreach strategy.
    - Discourage new development in known flood hazard areas or ensure that, if development occurs in those areas, it is done in a way to minimize flood risk.
    - Consider open space land uses within known flood hazard areas.

- Provide the highest degree of flood hazard protection at the least cost by working with environmentally friendly natural systems and by using prevention as the first priority.
- Retrofit, purchase, and relocate structures in known flood hazard areas, especially those known to be repetitively damaged.
- Provide flood protection by maintaining flood control systems.
- Sustain reliable local emergency operations and facilities during and after a flood event.
- Consider climate change implications in planning for flood and inundation hazards.

These planning components all directly support one another. Goals were selected that support the mission statement, and objectives were identified that fulfill multiple goals. Mitigation initiatives were identified that achieve multiple objectives.

Mitigation Initiatives

The action plan is a key element of the floodplain management plan. It is through the implementation of the action plan that the City of Brigantine can strive to become flood disaster resilient. The action plan includes an assessment of the capabilities of the City to implement hazard mitigation initiatives, a review of alternatives, and a mitigation strategy matrix and prioritization matrix that identify the following:

- Description of the action
- Objectives addressed
- Lead implementation agency (or agencies)
- Estimated benefits
- Estimated costs
- Timeline for implementation
- Funding sources
- Prioritization

For the purposes of this document, mitigation initiatives are defined as activities designed to reduce or eliminate losses resulting from the impacts of flooding.

Although one of the driving influences for preparing this plan was CRS, this plan does not focus solely on CRS credits. It was important to the City and the Floodplain Management Committee to examine initiatives that would work through all phases of emergency management. Some of the initiatives outlined in this plan fall outside CRS credit criteria, and CRS creditability was not the focus of their selection. Rather, the focus was on the initiatives'

effectiveness in achieving the goals of the plan and whether they are within the City's capabilities.

Plan Maintenance

After the plan has been adopted by City Council and reviewed by the Insurance Services Office, the contractor for the CRS, plan implementation and maintenance will begin. This plan includes a plan implementation and maintenance section that details the formal process for ensuring that the plan remains an active and relevant document. The plan maintenance process includes a schedule for monitoring and evaluating the plan's progress annually and producing a plan revision every five years. Plan implementation and maintenance includes continued public involvement and incorporation of the recommendations of this plan into other planning mechanisms of the City, such as the general plan, capital improvement program, and hazard mitigation plan.

Full implementation of the recommendations of this plan will require time and resources. This plan reflects an adaptive management approach in that specific recommendations and plan review protocols are provided to evaluate changes in vulnerability and action plan prioritization after the plan is adopted. The true measure of the plan's success will be its ability to adapt to the ever-changing needs of hazard mitigation. Funding resources are always evolving, as are programs based on state or federal mandates.

The City of Brigantine has a long-standing tradition of proactive response to issues that may impact its property owners. The City's commitment to proactive floodplain management is evidenced by its participation in the CRS program and the development of this plan. Its well-established programs and policies have strived to maintain the flood risk at a steady level without increase. The framework established by this plan will help maintain this tradition in that it identifies a strategy that maximizes the potential for implementation based on available and potential resources. It commits the City to pursue initiatives when the benefits of a project exceed its costs. Most important, the City developed this plan with extensive public input. These techniques will set the stage for successful implementation of the recommendations in this plan. The governing body of the City of Brigantine will assume responsibility for adopting the recommendations of this plan and committing City resources toward its implementation.

PART 1 — PLANNING PROCESS AND PROJECT BACKGROUND

CHAPTER 1 - INTRODUCTION

1.1 Background and History

Until late 1960s, a two-pronged approach of large-scale flood control projects and disaster relief to flooding victims defined the federal policy towards flood hazards. These policies – through the absorption of risks and costs and the provision of relief – served as incentives that encouraged floodplain development. Construction in high-risk areas continued, fueled by the assumption that otherwise vulnerable development would be protected, with the costs being absorbed by entities such as the federal government.

The 1968 creation of the National Flood Insurance Program led to a significant change in the federal government's relationship to floodplain management. Through cooperative federalism, the NFIP establishes an agreement between local communities and the federal government. If a community adopts and enforces a floodplain management ordinance to reduce future flood risks, then the federal government will enable federal flood insurance to be available within the community as a financial protection against flood losses. The Federal Emergency Management Agency is responsible for administering the NFIP. All communities that participate in the NFIP must adopt and enforce minimum standards for managing construction and development in designated "special flood hazard areas" (SFHA). Special flood hazard areas are determined by flood maps that are adopted for enforcement and insurance purposes by local communities. Communities that achieve a higher level of safety and protection than provided by the minimum standards can participate in the NFIP's Community Rating System to obtain discounts on flood insurance premiums.

Brigantine's coastal barrier island location has long made it vulnerable to flooding conditions. Though its low-lying topography inhibits drainage from rainfall events, its acute and most pressing vulnerability is from coastal flooding. The vast majority of Brigantine Beach is within a Special Flood Hazard Area, meaning that each year there is a one percent chance of inundation from a storm event that produces flood levels up to a "base flood elevation". In most of Brigantine, that level is nine or ten feet NAVD 88, meaning that the amount of flooding is the difference between the ground elevation and the base flood elevation.

To make the island that would become Brigantine inhabitable, the City's earliest developers leveled dunes and pumped sand and fill into back bay marsh areas to fill them for development. Once filled, these areas were graded, with streets and utilities laid out to support future development. Barriers against the sea in the form of bulkheads were constructed along the Ocean and back bays to retain fill materials and protect against erosion and inundation.

When Brigantine was first developed, it did not have a floodplain management ordinance or a Flood Insurance Rate Map. As a result, many homes are not elevated or constructed to withstand flooding. A number of homes demonstrate a "slab-on-grade" construction, or a house built on a crawlspace that is elevated off grade by just one or two cinderblocks. With

these homes so low to the ground with building utilities exposed, flood losses have been felt severely, particularly in the wake of Superstorm Sandy.

Today, Brigantine's flood protection system contains a patchwork of infrastructure protection and local mitigation efforts. The oceanfront remains protected through a dune system in the south and a bulkhead system in the North End. Dunes are maintained through long-standing agreements with the US Army Corps of Engineers. The Army Corps undertakes regular beach replenishments to ensure that dunes are functional, and erosion is stop-gapped. Brigantine's back bay flood protection is in the form of private and public bulkheads.

1.2 Why Prepare a Floodplain Management Plan

The City of Brigantine participates in both the NFIP and the CRS, and the Brigantine Floodplain Management Plan is an important part of the City's participation in those programs. Developing a comprehensive floodplain management plan is among the activities that earn CRS credits toward reduced flood insurance rates. This floodplain management plan was developed to meet the following objectives:

- Comply with local, state and federal requirements for floodplain management planning.
- Meet requirements allowing the City of Brigantine to enhance its CRS classification.
- Coordinate existing plans and programs so that high-priority initiatives and projects to mitigate possible disaster impacts are funded and implemented.
- Create a linkage between the floodplain management plan and established plans of the City of Brigantine so that they can work together in achieving successful mitigation. This plan describes the flood hazard in the City and presents measures to mitigate those hazards. The purpose of these measures is to reduce or alleviate the loss of life, personal injury, and property damage that can result from flooding. They involve long- and short-term strategies such as planning, policy changes, programs, projects, and other activities to mitigate the impacts of floods.

1.3 Previous Floodplain Management Plans

In February 2016 the Atlantic County Board of Chosen Freeholders adopted the *Atlantic County Multi-Jurisdictional Hazard Mitigation Plan.* The plan was approved by FEMA the same month and adopted by the City of Brigantine in March 2016. The Brigantine Annex to the County Plan is included as an appendix to this report.

1.4 The Brigantine Floodplain Management Plan

The Brigantine Floodplain Management Plan is a comprehensive planning document that contains actionable recommendations to increase the resilience of infrastructure and buildings. The Floodplain Management Plan is an overall strategy of programs, projects, and measures aimed at reducing the adverse impacts of flood hazards on the community. The FMP identifies and addresses the impacts caused by flood hazards and provides specific mitigation measures to help protect the properties and their occupants. The County adopted

its most recent FMP in 2016. The National Flood Insurance Program requires the County to update its FMP every five years.

Development of the FMP was guided through the efforts of a Floodplain Management Committee. The Floodplain Management Committee is comprised of representatives from local government, businesses (banking, insurance and real estate), and members of the general public. Interactive meetings were held with the Floodplain Management Committee on a monthly basis, these meetings were advertised and open to the public.

Floodplain management is the operation of a community program of preventive and corrective measures to reduce the risk of current and future flooding, resulting in a more resilient community. These measures take a variety of forms, are carried out by multiple stakeholders with a vested interest in responsible floodplain management and generally include requirements for zoning, subdivision or building, building codes and special-purpose floodplain ordinances. While FEMA has minimum floodplain management standards for communities participating in the National Flood Insurance Program, adopting higher standards will lead to safer, stronger, more resilient communities.

State and federal agencies, county governments, local communities and property owners have a role in reducing flood risk and helping communities become more resilient. From states providing strong model ordinances, to communities adopting and enforcing higher-standard building practices, to property owners elevating their homes, everyone can play a part in making communities safer and more resistant to flood disasters.

To ensure the plan's success, a series of public meetings was held to gather input from the people who live and work in the City. During the course of preparing this report, meetings were also held with the New Jersey Department of Environmental Protection, (NJDEP) and the U.S. Army Corps of Engineers (USACE).

CHAPTER 2 – PLAN DEVELOPMENT METHODOLOGY

The process followed to develop the Brigantine Floodplain Management Plan had the following primary objectives:

- Form a planning team,
- Define the planning area,
- Establish a Floodplain Management Committee,
- Coordinate with other agencies,
- Review existing programs,
- Engage the public in development of the floodplain management plan.

These objectives are discussed in this chapter.

2.1 Formation of the Planning Team

This planning project was initiated and overseen by the City Manager's Office of the City of Brigantine. The City of Brigantine retained Rutala Associates to develop the plan. The planning team was formed to lead the planning effort (CRS Step 1), made up of the following members:

- James M. Rutala, PP, AICP, CFM
- Brian Kempf, CFM, AICP
- Edward Stinson, PE, City CFM Coordinator
- Rachael Beckner, Assistant City CFM Coordinator

2.2 Defining the Planning Area

The planning area was defined as the entire City of Brigantine. The primary focus of the plan is the area south of 15th Street North. All property north of the City is owned by the State as a Natural Area and is undeveloped.

2.3 Establishing the Floodplain Management Committee

A Floodplain Management committee was formed to oversee all phases of the planning effort. The members of this committee included key staff, property owners, and other stakeholders from within the City. The Floodplain Management Committee included the following individuals:

- Joe Musumeci, Real Estate Professional
- Anne Scotland, Resident

- Paul Lauriello, Insurance Professional
- Larimar Tarud, Banking Professional
- Ron Powell, Resident
- Jim Bennett, City Manager
- Richard Stevens, City Construction Official
- Brian Feehan, City Office of Emergency Management
- Lance Landgraf, City Planner
- Edward Stinson, City CRS Coordinator

Ground rules were established during the Floodplain Management Committee's initial meeting on June 6, 2019. The Committee agreed to meet monthly as needed throughout the course of the plan's development. The planning team facilitated each Floodplain Management Committee meeting, which addressed a set of objectives based on an established work plan. The Floodplain Management Committee met five times from June 2019 through December 2019. Meeting agendas and attendance logs are available for review upon request. Appendix C includes a full list of members, agendas and sign in sheets. All Floodplain Management Committee meetings were open to the public and advertised as such on the City's website.

Figure 2: Enabling Resolution

RESOLUTION NO. 2019 – 85

TO APPOINT THE FLOODPLAIN MANAGEMENT PLANNING COMMITTEE TO ADVISE ON FEMA COMMUNITY RATING SYSTEM ACTIVITIES

WHEREAS, to ease the financial and flooding impacts to the residents, the City of Brigantine has maintained a rigorous floodplain management program and was recognized by the Federal Emergency Management Agency (FEMA) through the Community Rating System (CRS) for its progressive floodplain planning, maintenance and public outreach.

WHEREAS, Brigantine holds a Class 5 CRS rating affording city property owners benefit from improved floodplain management and over $1,000,000 in flood insurance premium savings based on a 25 – percent flood insurance premium discount.

WHEREAS, the City wishes to formally appoint and recognize a Floodplain Management Committee to assist in the development, implementation, and maintenance of the City's floodplain management planning efforts pursuant to Activity 510 of the *CRS Coordinator's Manual.*

WHEREAS, the Floodplain Management Planning Committee shall include the following members:

- Member of the Public
  - Joseph Musumeci, Real estate (PPI Committee)
  - Anne Scotland, Brigantine resident (PPI Committee)
  - Paul Lauriello, Insurance (PPI Committee)
  - Lorimar Tarud, Banking Industry
  - Ron Powell, Brigantine Resident (PPI Committee)
- City Staff
  - Jim Bennett, City Manager
  - Richard Stevens, Construction Official (PPI Committee)
  - Brian Feehan, OEM
  - Lance Landgraf, Planner
  - Edward Stinson, CRS Coordinator (PPI Committee)
- Advisor
  - John Doring, Public Works
  - Jim Rutala, CRS Consultant

WHEREAS, to maximize Community Rating System credit and comply with hazard mitigation planning guidelines, the committee shall adhere to the following conditions set forth in the *CRS Coordinator's Manual*:

- The committee shall meet a sufficient number of times to maximize potential credit for the floodplain management planning activity (including for Steps 4, 5, 6, 7, and 8).

- The meetings must be open to the public and the meeting schedule must be publicly posted

WHEREAS, the committee shall assist in the preparation of annual and five-year updates required per the *CRS Coordinator's Manual.*

WHEREAS, the committee shall designate a member to act as chairperson and report activities to the City Council and nominate additional or replacement members to the committee at City Council's consent.

WHEREAS, the committee shall be instructed to undertake appropriate outreach with regard to the planning process to solicit feedback and report findings, including the hosting of at least one separate public information meeting to collect input and at least one separate public meeting to obtain input on the recommended plan at least two weeks before submittal of the plan to City Council.

NOW, THEREFORE, BE IT RESOLVED by the Mayor and Council of the City of Brigantine, County of Atlantic and State of New Jersey that the committee membership is hereby appointed to assist in the development, implementation, and maintenance of the Floodplain Management Plan.

Certification:
I hereby certify that the above resolution is a true copy of the resolution adopted by the Mayor and Council at their Regular Meeting held on 5/1/2019 at 6:00 p.m. in the Brigantine Municipal Building, 1417 West Brigantine Avenue, Brigantine, New Jersey.

Lynn Sweeney, RMC
CLERK

RECORD VOTE OF COUNCIL ON FINAL PASSAGE

COUNCIL MEMBERS	Y	N	NV	AB
SIMPSON	/			
RIORDAN	/			
SERA	/			
BEW	/			
LETTIERI	/			
HANEY	/			
DeLUCRY	/			

X-INDICATES VOTE NV=NOT VOTING AB=ABSENT

2.4 Coordination with Other Agencies

Opportunities for involvement in the planning process were provided as follows to neighboring communities, local and regional agencies involved in floodplain management, agencies with authority to regulate development, businesses, academia, and other private and nonprofit interests (CRS Step 3):

- Floodplain Management Committee Involvement—Agency representatives were invited to attend Floodplain Management Committee meetings.
- Agency Notification—The agencies that were invited to participate in the plan development from the beginning and were kept apprised of plan development milestones are identified in Appendix C.

These agencies were invited to participate in the planning process by monitoring the City's web site. All the agencies listed above were provided an opportunity to review and comment on this plan as described in Chapter 5. Each agency was sent an e-mail message informing them that draft portions of the plan were available for review. In addition, the complete draft plan was sent to the Insurance Services Office, FEMA's CRS contractor, for a pre-adoption review to ensure CRS program compliance.

2.5 Review of Existing Plans

The planning effort included review and incorporation as appropriate of existing plans, studies, reports and technical information. Chapter 4 of this plan provides a review of laws and ordinances in effect that can affect mitigation actions, including an assessment of all City's regulatory, technical and financial capabilities to implement flood hazard mitigation actions. In addition, the following programs can affect flood hazard mitigation in City of Brigantine:

- City of Brigantine 2016 Master Plan Reexamination
- Brigantine Beach Bicycle and Pedestrian Master Plan (October 2013)
- Floodplain Damage Prevention (Chapter 181 of the Code of the City of Brigantine)
- Land Use Regulations (Chapter 198 of Code of the City of Brigantine)
- Stormwater Control (Chapter 258 of the Code of the City of Brigantine)
- NFIP Community Rating System
- Atlantic County Multi-Hazard Mitigation Plan
- Brigantine Capital Improvement Programs

2.6 Public Involvement

Broad public participation in the planning process helps ensure that diverse points of view about local needs are considered and addressed. CRS credits are available for providing opportunities to comment on disaster mitigation plans during the drafting stages and prior to plan approval, as well as for optional public involvement activities (CRS Step 2).

The City keeps its residents well-informed about flooding by having an effective public information program. The CRS provides credit for a full range of public information activities, including map information, outreach projects, real estate disclosure, libraries, websites, and providing technical advice and assistance. However, often these activities are not coordinated and often they are not implemented in the most effective manner. In the 2013 *CRS Coordinator's Manual*, the CRS introduces a new approach to coordinate public information activities and develop activities that reflect what recent research has found to lead to more effective programs. The approach is called the Program for Public Information (PPI). Brigantine has a robust PPI which is has continued to update on an annual basis.

Strategy

The strategy for involving the public in this plan emphasized the following elements:

- Include members of the public on the Floodplain Management Committee,
- Attempt to reach as many property owners as possible using multiple media,
- Identify and involve stakeholders,
- Update the Program for Public Information, and
- Conduct public meetings to invite the public's input.

Stakeholders and the Floodplain Management Committee members are the individuals, agencies and jurisdictions that have a vested interest in the recommendations of this plan. The effort to include stakeholders in this process included stakeholder participation on the Floodplain Management Committee. Stakeholders targeted for this process included:

- Community representatives,
- Brigantine staff responsible for activities relevant to floodplain management,
- Environmental advocacy groups,
- Local disaster preparedness and response agencies,
- Owners and operators of businesses within the floodplain, and
- Repetitive loss area representatives.

CRS Step 2 awards credit for a planning process conducted through a committee that includes members of the public and/or non-governmental stakeholders. The ten-member Floodplain Management Committee includes five nongovernmental stakeholders.

Floodplain Management Plan Website

At the beginning of the development of the current plan, a Floodplain Management Plan section was developed on City of Brigantine's website to keep the public informed about planning activities and to solicit input. The site's address (www.brigantinebeach.org) was publicized in all press releases, mailings and public meetings. The site provided the public

with information on the plan development process, the Floodplain Management Committee and drafts of the Plan. The City of Brigantine will keep the website active after the plan's completion to keep the public informed about mitigation projects and future plan updates.

https://sites.google.com/view/brigantinefpm/home

Public Meetings

Meaningful public participation was essential for the planning process. Public meetings were held to disseminate information and to solicit input from community members, as summarized herein. Documents supporting these meetings can be found in the attached appendix.

Meeting Dates:

June 6, 2019 - Organizational/Kickoff Meeting
July 11, 2019 - Public Meeting Preparation
July 30, 2019 - Public Meeting
August 8, 2019 - Watershed Management Plan Presentation
September 12, 2019 - US Army Corps/NJDEP Meeting
October 10, 2019 - Review Floodplain Management Plan
January 9, 2020 – Review Next Steps/Adoption
January 28, 2020 – Public Meeting
February 19, 2020 – Anticipated City Council Adoption

Public Meeting Notification

Multiple means were used to provide broad public notice of the open house public meetings:

- Notice of all public meetings was posted on Facebook and the City website www.brigantinebeach.org
- Announcements were made at the City Council meetings that are televised.
- Press releases were distributed to the media announcing meeting times and locations.
- Flyers were developed and distributed throughout the community.

Public Meeting Format

The public meeting format allowed attendees to examine maps and handouts and have direct conversations with project staff. Reasons for planning and information generated for the risk assessment were shared with attendees via a PowerPoint presentation. Mapping of Superstorm Sandy impacts, sea level rise, and repetitive loss areas was presented. Each citizen attending the open houses was asked to complete a survey, and each attendee was given an opportunity to provide written comments to the Floodplain Management Committee.

Presentations to Mayor and City Council

In addition to the public meetings described above, the planning team presented the plan to City Council on February 19, 2020.

2.7 Revising Program for Public Information

As part of the process to prepare the Floodplain Management Plan, the Program for Public Information was revised and enhanced.

2.8 Plan Development Chronology/Milestones

See Appendix

CHAPTER 3 – CITY OF BRIGANTINE PROFILE

3.1 Overview

The City of Brigantine is a 10.4 square mile barrier island in Atlantic County, New Jersey. Brigantine is home for over 9,450 residents (2010 Census). The City has 6.4 square miles (62 percent) of land surface and 4.0 square miles (38 percent) of open water. The City is actually bounded by water, including the Absecon State Wildlife Management Area estuary to the west, Absecon Channel to the south, the Atlantic Ocean to the east, and Brigantine Channel to the north. A total of 5.5 square miles of the City is in the FEMA 100-year (1 percent) flood zone (AE, Special Flood Hazard Area) and an additional 1.0 square miles is in the FEMA 100-year (1 percent) chance flood zone with additional hazards due to storm-induced velocity wave action (VE, Coastal High Hazard Areas.

Of the 6.8 square miles of the City analyzed by FEMA, only 4 percent of the land area is not impacted by a 100-year (1 percent) event. The City was devastated by Super Storm Sandy in 2012 when it moved ashore on October 29. Storm surges and wind damaged approximately 2,300 homes.

The population trend of this community has been in decline since 2000 when the population peaked at 12,594, a 25 percent decrease in a decade. The population balloons to over 30,000 during the summer season. The City provides a wide variety of recreational opportunities because of its pristine beaches, abundance of water access and parking facilities, and its open space along the back-bay area.

There were 9,222 housing units in the City as of the 2010 U.S. Census. With an average household size of 2.2, approximately 4,295 units are occupied on a year-round basis and the remaining 4,926 units are seasonal – second homes and seasonal rentals.

The total area of the City is 10.364 square miles with 38.37 percent of that area or 3.977 square miles consisting of water. The total land area in Brigantine is 6.387 square miles, resulting in a population density of 1,479.5 per square mile.

As noted in the Community Rating System Annual Recertification dated October 15, 2018, there are currently 7,610 buildings in the Special Flood Hazard Area (SFHA). Total acreage of the SFHA is 4,205. The next verification visit will be in October 2020.

The only road to and from Brigantine is New Jersey Route 87 via the Justice Vincent S. Haneman Memorial Bridge. The original bridge to the island was built in 1924 and was destroyed in the Great Atlantic Hurricane of 1944. The current bridge was constructed in 1972. The bridge provides emergency access via the Brigantine Connector to the Atlantic City Expressway.

The initial Flood Hazard Boundary Maps (FHBM) for Brigantine were issued on December 28, 1973 by FEMA. Almost a decade later, the Flood Insurance Rate Maps (FIRM) were released. The FIRMs are based on historic, meteorological, hydrologic and hydraulic data, as well as open-space conditions, flood-control works, and development.

3.2 Documented Damage from Superstorm Sandy

The USGS tide gauge at the Atlantic City Coast Guard Station (just 2,800 feet west of The Cove) registered a record water elevation of 7.8 feet NAVD88. Storm surge inundated nearly the entirety of the north end of the island, leaving only the "A-Section" (the area between Brigantine Avenue and the beach) and portions of the south end dry.

A total of 264 structures were deemed substantially damaged as of January 1, 2014 by the City's Building Official. A substantially damaged structure as defined in 59.1 of the National Flood Insurance Program regulations is when:

> *"damage of any origin is sustained by a structure whereby the cost of restoring the structure to its before damaged condition would equal or exceed 50 percent of the market value of the structure before the damage occurred."*

A substantially damaged structure must be brought into compliance with NFIP regulation for new construction; that is, the structure must be elevated (or flood-proofed if it is a non-residential or historic structure) to or above the level of the base flood elevation.

If a substantially damaged structure is located in a velocity zone (V-Zone), it not only must be elevated but it also must comply with additional requirements contained in the NFIP regulations. These regulations call for the elevation to be on pilings or columns so that the bottom of the lowest horizontal structural member of the lowest floor is elevated to or above the base flood elevation.

The ratable base of the City was reduced by more than $11,360,900 as of March 1, 2013, the largest decrease in ratables caused by Superstorm Sandy in Atlantic County.

In addition, as of March 20, 2013 the U.S. Small Business Administration (SBA) had issued 133 loans to Brigantine homeowners totaling $7,054,500. The average loan was $53,041, and loans to homeowners ranged from $2,900 to $240,000. The SBA also provided loans to six businesses totaling $396,600 with the loans ranging from $7,300 to $164,300. Due to the disaster declaration, homeowners were eligible to receive a loan of up to $200,000 for real estate, and homeowners and renters could get as much as $40,000 to repair or replace personal items. Businesses and nonprofits could get up to $2 million for damaged or destroyed buildings and equipment. Owners could receive a loan of up to 20 percent more than the value of a loss to make improvements that lessen the risk of the property being damaged in the future -- for instance, for raising a home above flood level. Small businesses also are eligible for economic-injury disaster loans to help meet working-capital needs. Interest rates on SBA Sandy loans, available at terms of up to 30 years, are as low as 1.7 percent for homeowners and renters, 3 percent for nonprofits and 4 percent for businesses.

The City of Brigantine was without power for six days, making the recovery very challenging. Emergency generators were used to power the Community Center and various infrastructure pumps. Well #9, which serves the south end of the City, was within inches of being contaminated since the storm surge was very close to entering the well.

City of Brigantine
Sandy Surge Extent
Sandy Surge
Parcels
Prepared by Rutala Associates
Data Sources: Atlantic County, FEMA, NJDEP, NJOIT-OGIS, USGS
0
3,200
Feet
N
East Shore Drive
11th Street North
12th Street North
Evans Boulevard
Sheridan Place
Layfayette Boulevard
Brigantine Boulevard
Sheridan Boulevard
Watson Road
West Shore Road
Bobby Jones Drive
Beach Avenue
9th Street South
10th Street South
18th Street South
19th Street South
20th Street South
22nd Street South
23rd Street South
24th Street South
Bay Shore Avenue
Revere Boulevard
Ocean Avenue
38th Street South
Brigantine Avenue
Lagoon Boulevard
Harbor Beach Boulevard

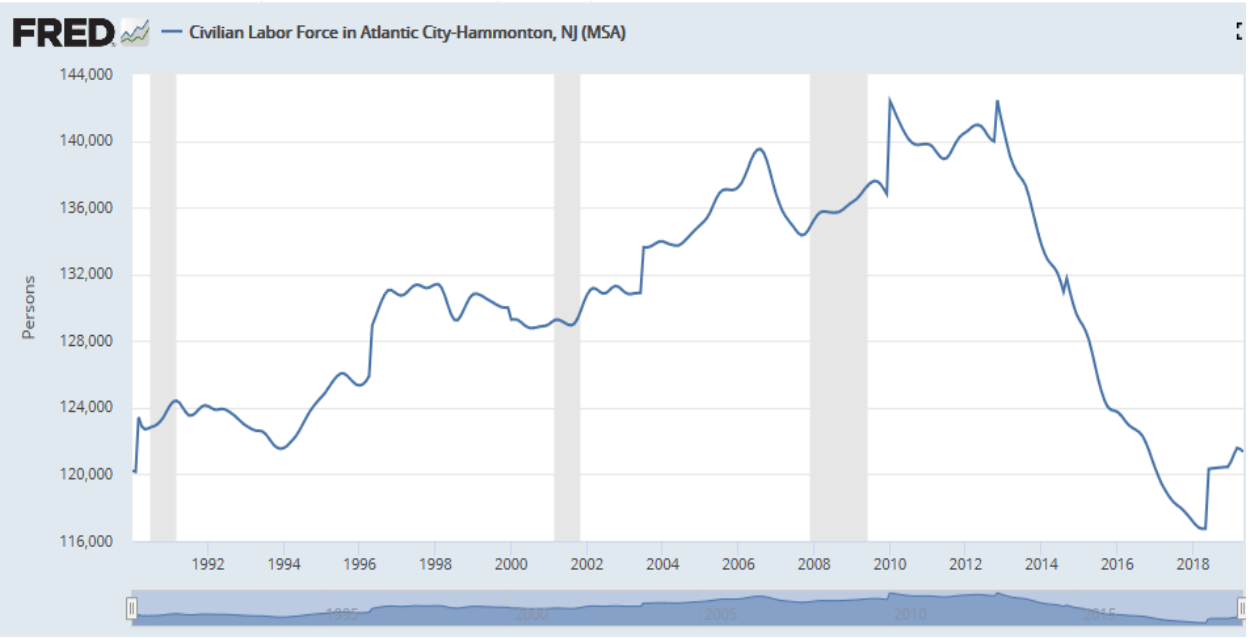
The City was cut off from the mainland for a day before and after the storm. Evacuation efforts were abandoned the day before the storm since Brigantine Boulevard was not passable due to flooding.

The Community Center served as the emergency facility before and after the storm. The City is working to gain funding for emergency generators for the municipal building so that is can also serve as a critical facility.

BrigStrong is a Long-Term Recovery Group (LTRG) which was established for the sole purpose of helping the City of Brigantine to recover from Superstorm Sandy. BrigStrong was formed by a group of concerned and dedicated Brigantine residents. Using a template established by Atlantic County's LTRG which is composed of support groups such as the Salvation Army, United Way, Habitat for Humanity and faith based and community support groups. Initiated by Reverend John Scotland of the Brigantine Community Presbyterian Church, BrigStrong operates as a committee of the community's True Spirit Coalition. The group selected the name BrigStrong as best emblematic of the group's focus and commitment. The mission statement adopted by BrigStrong reads,

> "The purpose of BrigStrong is to direct, assist and coordinate member organizations in providing long-term recovery services effectively and efficiently as possible while avoiding unnecessary duplication of efforts. BrigStrong will provide spiritual, emotional, physical and financial resources to those affected by a declared disaster regardless of race, creed, color gender, sexual orientation or religious preference."

Figure 3: Civilian Labor Force in Atlantic City-Hammonton MSA, 1990-2019

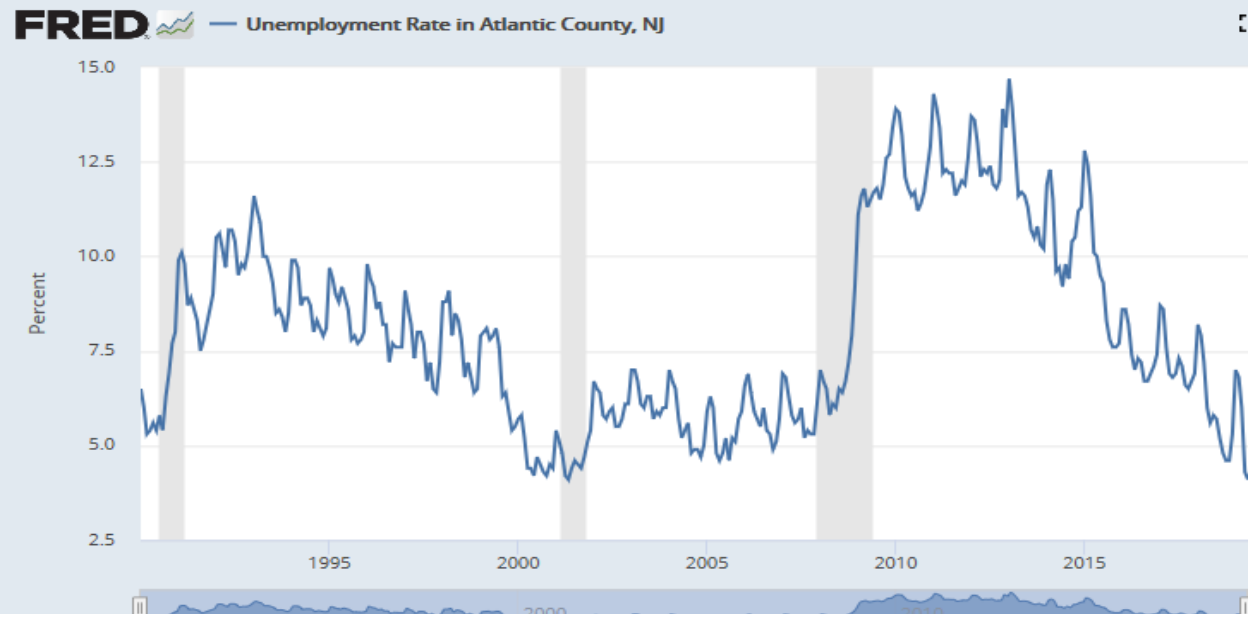


The Jersey Shore economy has not fully recovered since Superstorm Sandy. The civilian labor force dropped from its high in 2012 until 2018 when the recovery began, sparked by

the opening of Ocean Casino Hotel, Hard Rock Casino Hotel, the Stockton University Atlantic City campus and the Corporate Headquarters of South Jersey Gas. Civilian labor force is a term used by the U.S. Bureau of Labor Statistics to describe the subset of Americans who have jobs or are seeking a job. The civilian labor force for Atlantic County was starting to recover before Superstorm Sandy, but it has rapidly declined since the storm, from 142,400 to 116,800 by May 2018. The post 2018 recovery has resulted in a peak of 121,600 far less jobs than prior to the storm. The rapidly decreasing labor force has had a significant impact on the regional housing market, commercial growth and the overall ratable base.

The unemployment rate in the Atlantic City-Hammonton MSA peaked in January 2013 at 14.7 percent. When the unemployment rate and the civilian labor force decrease, generally it is because for various reasons people have opted out of the labor market. The unemployment rates dipped to 7.0 percent in January 2019 and 4.0 percent in June 2019 demonstrating significant seasonal fluctuation.

Figure 4: Unemployment Rate in Atlantic County, 1990-2019



3.3 Funding Assistance Provided

The ReNew Jersey Stronger web site reports that $46,073,15 in CDBG-DR funds have been distributed to homeowners, renters, businesses and government in Brigantine as of March 31, 2019.

The State allowed $710 million from the first tranche of Community Development Block Grant – Disaster Recovery (CDBG-DR) funds to the Reconstruction, Rehabilitation, Elevation and Mitigation (RREM) Program. These RREM funds only addressed 41 percent of the need. To address the unmet need, the second tranche of CDBE-DR funds allocates another $390 million to the RREM Program. Even with these additional funds it in not expected that all of

the wait-listed owners will receive funding. Additional funding sources for home elevation will be discussed later in this Report.

As of January 20, 2014, $1,139,294 in RREM funds were paid to 25 Brigantine homeowners. A total of 511 homeowners applied for the RREM a grant of up to $150,000 and 48 owners were awarded grants of the 132 applicants were found eligible in addition 276 were wait-listed, 39 were in intake, 60 were rejected and 4 are on appeal.

Figure 5: Home Being Elevated in the Golf Course Section of Brigantine

A total of 730 homeowners in the City of Brigantine applied for New Jersey Resettlement Grants and 613 grants were awarded. These grants provided $10,000 to encourage homeowners to stay in their existing home or in the same county. This grant can be used for many expenses, including payment of flood insurance premiums. A total of $215 million in Resettlement Grants were paid by January 20, 2014.

In addition, the State has committed $100 million in FEMA Hazard Mitigation Grant Program (HMGP) funds to elevate 2,700 primary residents in the nine impacted counties, including Atlantic County. Eligible recipient will be awarded up to $30,000 for work and will be reimbursed after it is completed. Homeowners who receive grants from the RREM Program are not eligible for HMGP funds. Twenty-six in Brigantine have received HMGP grants.

According the New Jersey Office of State Comptroller, as of March 31, 2019 the residents of the City of Brigantine had received $5.25 million in FEMA Individual Assistance, which can

include grants, rental assistance and/or funds for temporary or more permanent home repair. The City has received $2.79 million in FEMA Public Assistance to respond and recover from the disaster, which can include grants for both emergency and permanent restorative work. The majority of these funds were for debris removal with some additional funds for road repairs, bulkhead repairs, damage to City facilities and emergency protective measures.

Figure 6: President Obama Tours Brigantine after Superstorm Sandy

CHAPTER 4 – RELEVANT PROGRAMS AND REGULATION

4.1 Federal Assistance

4.1.1 National Flood Insurance Program

The National Flood Insurance Program was established with the passage of the National Flood Insurance Act of 1968. The NFIP is a federal program enabling property owners in participating communities to purchase insurance as a protection against flood losses in exchange for state and community floodplain management regulations that reduce future flood damages. More than 21,000 communities participate in this program.

As of September 30, 2018, there were 224,541 flood insurance policies in place for the residents of New Jersey. Nationally, that number has risen well beyond 5.1 million. Significant changes have also been made over the years to the NFIP, most notably the establishment of the Community Rating System (CRS) during the 1990s and a grant program for mitigation projects and plans.

Nearly 100 private companies now offer nationwide flood insurance backed by the federal government. Because of the NFIP, millions of taxpayer dollars are saved every year when it comes to disaster recovery.

As of June 30, 2019, there were 6,727 NFIP Flood Insurance Policies in effect in the City of Brigantine, insuring property valued at $1,594,770,000. The total cost of premiums was $4,278,185.

The City's records show that there were 87 repetitive-loss (RL) properties in Brigantine in 2018, this is down from 158 RL properties in 2016. A property is considered a repetitive-loss property when there are two or more losses reported that were paid more than $1,000 for each loss. The two losses must be within 10 years of each other and be as least 10 days apart. Only losses from January 1, 1978 that are closed are considered.

A Severe Repetitive Loss (SRL) property is defined as a residential property that is covered under an NFIP flood insurance policy and:

- That has at least four NFIP claim payments (including building and contents) over $5,000 each, and the cumulative amount of such claims payments exceeds $20,000; or
- For which at least two separate claims payments (building payments only) have been made with the cumulative amount of the building portion of such claims exceeding the market value of the building.
- For both (a) and (b) above, at least two of the referenced claims must have occurred within any ten-year period and must be greater than 10 days apart.

The program's CRS is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. Through the CRS a community can obtain a discount on flood insurance premiums for its residents of up to 45 percent. There are 18 activities in the CRS program under four

categories: Public Information, Mapping and Regulations, Flood Damage Reduction and Flood Preparedness.

The Biggert-Waters Reform Act of 2012 required the NFIP to raise insurance rates for some pre-FIRM properties to reflect the actual cost without subsidies. There are 88,601 pre-FIRM properties in New Jersey, or 37 percent of the housing stock. Pre-FIRM for the City of Brigantine is prior to January 1, 1975. Many of the pre-FIRM properties in high-risk areas do not meet current standards for construction and elevation, and they have been receiving subsidized rates that do not reflect their actual risk. The subsidized rates are being eliminated in some cases, as noted in the chart below. Some current policyholders and all future policyholders owning pre-FIRM properties in high-risk areas will pay rates based on their full risk of flood damage. However, most NFIP-insured properties are not affected by the changes.

FEMA is currently producing new flood-risk data for the State of New Jersey.

Figure 7: Projected NFIP Annual Flood Insurance Premiums for V Zone and A Zone Properties with $250,000 Residential Building Coverage

V Zone

Lowest Floor Elevation	No Contents Covered	$100,000 Contents Covered
3 Feet Above	$2,403	$2,923
2 Feet Above	$3,278	$4,048
1 Feet Above	$4,728	$5,918
At BFE	$6,803	$8,603
1 Foot Below	$9,003	$11,583
2 Feet Below	$12,074	$15,764
3 Feet Below	$15,524	$20,474
4 Feet Below	$17,334	$23,304
6 Feet Below	$23,449	$32,019

A Zone

Lowest Floor Elevation	No Contents Covered	$100,000 Contents Covered
3 Feet Above	$376	$561
2 Feet Above	$448	$633
1 Feet Above	$660	$845
At BFE	$1,359	$1,724
1 Foot Below	$4,527	$5,225
2 Feet Below	$5,924	$8,308
3 Feet Below	$7,204	$10,554
4 Feet Below	$9,551	$14,370
6 Feet Below	$18,830	$28,535

In April 2014, the Homeowner's Flood Insurance Affordability Act was signed by President Obama to address rate hikes associated with FEMA's National Flood Insurance Program, bringing relief to homeowners while not significantly impacting the program's solvency. The changes implement the following measures:

1. Creates a firewall on annual rate increases - Prevents FEMA from raising the average rates for a class of properties above 15 percent and from raising rates on individual policies above 18 percent per year for virtually all properties.

2. Repeals the property sales trigger - Repeals the provision in Biggert-Waters that required homebuyers to pay the full-risk rate for pre-FIRM properties at the time of purchase. This provision caused property values to steeply decline and made many homes unsellable, hurting the real estate market. Under the Menendez/Grimm Bill, homebuyers will receive the same treatment as the home seller.

3. Repeals the new policy sales trigger - Repeals the provision in Biggert-Waters that required pre-FIRM property owners to pay the full-risk rate if they voluntarily purchase a new policy. This provision dis-incentivizes property owners from making responsible decisions and could hurt program participation. The Act allows pre-FIRM property owners to voluntarily purchase a policy under pre-FIRM conditions.

4. Reinstates grandfathering - Repeals the provision in Biggert-Waters that would have terminated grandfathering. If grandfathering was terminated, property owners mapped into higher risk would have to either elevate their structure or have higher rates phased in over 5 years. The Menendez/Grimm Bill allows grandfathering to continue and sets hard caps on how high premiums can increase annually.

5. Refunds homeowners who overpaid - Requires FEMA to refund policyholders for overpaid premiums.

6. Affordability goal - Requires FEMA to minimize the number of policies with annual premiums that exceed one percent of the total coverage provided by the policy. The Homeowner Flood Insurance Affordability Act of 2014 also establishes the following requirements to enhance FEMA transparency and outreach:
    a. Reimburse successful appeals - Allows FEMA to utilize the National Flood Insurance Fund to reimburse policyholders and communities who successfully appeal a map determination. FEMA currently has the authority to reimburse successful appeals of map findings, but Congress has never appropriated funding for this purpose. Making appeal reimbursement an eligible expense of the NFIF would give FEMA the incentive to "get it right the first time" and repay homeowners and communities for contributing to the body of flood risk knowledge.
    b. Flood insurance advocate - Establishes a flood insurance advocate within FEMA to answer current and prospective policyholder questions about the flood mapping process and flood insurance rates. The flood insurance advocate will be responsible for educating policyholders about their

individual flood risks, their options in choosing a policy, assisting property owners through the map appeals process, and improve outreach and coordination with local officials, community leaders, and Congress.

c. Urban mitigation fairness - Requires FEMA to establish guidelines on alternative mitigation methods for urban structures where tradition mitigation efforts such as elevation are impractical, i.e. rowhouses in Hoboken. This section makes clear that such alternative forms of mitigation shall be considered in the calculation of risk premium rates.
d. Clear communication - Requires FEMA to clearly communicate full flood risk determinations to policyholders even if their premium rates are less than full risk. This helps to inform policyholders as to their true flood risk.
e. Fairness for small businesses, houses of worship, nonprofits and low-income homes - Requires FEMA to report to Congress on the impacts of rate increases on small businesses, nonprofit entities, houses of worship, and residences with a value equal to less than 25 percent of the area median home value. If FEMA determines there is an effect on affordability for these properties, it must provide recommendations to Congress within three months after making the determination.
f. Mapping accuracy - Requires FEMA to certify its mapping process is technologically advanced and to notify and justify to communities that the mapping model it plans to use to create the community's new flood map are appropriate. Also requires FEMA to send communities being remapped the data being used in the mapping process.
g. Notification - Requires FEMA, at least six months prior to implementation of rate increases as a result of this Act to make publicly available the rate tables and underwriting guidelines that provide the basis for the change, providing consumers with greater transparency.

4.1.2 US Army Corps of Engineers

Shore Protection

Throughout the Jersey Shore, the US Army Corps, NJDEP Division of Coastal Engineering, and local municipalities partner for periodic beach replenishments. In this process, sand is pumped from offshore locations onto eroding coastlines and is graded to meet a design height. After the initial beachfill, the project is maintained cyclically. Dunes have been effective in protecting property on the landward side of the dune and for re-creating the typical barrier island habitat and its inherent shore protection qualities.

Brigantine does not currently receive beach replenishments. The southward littoral current has caused sand to accumulate at the Absecon Inlet seawall, giving Brigantine robust and wide dunes particularly towards the southern end of the island. However, the north end of the island (particularly north of 8th Street) has seen continual erosion. The north end of the island in the Natural Area has much more dynamic geomorphology owing to the lack of a human-maintained system.

The Army Corps constructed a seawall between 9th Street North and 15th Street North during the 1990s. The project was funded by a partnership between the Army Corps, NJDEP Shore Protection Fund, and the City of Brigantine. The City is currently seeking a northern extension of the seawall by approximately 275 feet.

Back Bay Study

The Army Corps of Engineers is currently undertaking a study to reduce flooding resulting from storm events in the back-bay areas of the Jersey Shore, including Brigantine. According to the Army Corps, the following efforts will be undertaken:

- *Assess the study area's problems, opportunities and future without project conditions;*
- *Assess the feasibility of implementing system-wide coastal storm risk management solutions such as policy/programmatic strategies, storm surge barriers at selected inlet entrances, or tidal gates at selected lagoon entrances;*
- *Assess the feasibility of implementing site-specific perimeter solutions such as a combination of structural, non-structural, and natural and nature-based features;*
- *Assess the impacts of back bay strategies and solutions on the Atlantic Coast Coastal Storm Risk Management Program towards developing recommendations within a systems context given likely future scenarios.*

An interim report was released in 2019 and serves as a first step towards achieving an engineering solution, project selection, and funding. Efforts being studied currently include nature-based features, floodwalls, storm surge barriers, and non-structural measures such as elevating structures. Environmental concerns and logistical challenges may prevent storm surge barriers in the back-bay areas located north of the City, which indicates that non-structural or smaller-scale solutions may be more feasible for Brigantine specifically. The Plan is currently under development at the time of this Plan's drafting and the City will continually monitor the Army Corps' efforts.

4.2 State Coastal Engineering Project/Shore Protection Program

The New Jersey Department of Environmental Protection holds significant influence in Brigantine for its administration of coastal engineering projects/Shore Protection Program and its regulation of coastal areas through permitting and land use. Brigantine is within the State of New Jersey's CAFRA (Coastal Area Facility Review Act) Zone, which includes regulations for a variety of developments in the coastal zone. The state also regulates coastal wetlands, waterfront development, and provides consistency determinations for federally funded projects. The NJDEP also undertakes shore protection projects such as beach nourishment and construction/maintenance of shore protection structures throughout the State. For example, the NJDEP assisted with the construction of the seawall located at the North End.

The New Jersey Department of Environmental Protection is currently undertaking a Coastal Resilience Plan to serve as a guide for future investment in mitigation projects. According to the Department, the plan will function as follows:

> *The DEP will develop a Coastal Resilience Plan and tools to move New Jersey forward in preparing for sea-level rise and coastal storms. The plan will evaluate policies, programs, and regulations that must be modified or created to reduce risk, increase coordination across and within agencies, improve awareness and support local municipalities in achieving adaptation. It will identify existing and new strategies that will reduce physical, economic, and social risk to flood events, enhance state and local capabilities, and encourage innovative solutions to the complex challenges of rising sea levels. The plan will not prescribe projects for every reach of the shoreline but is intended as a first step to put New Jersey on a path to resilience. The plan will focus on four primary goals:*
>
> - *reduce risk from flooding in the coastal zone*
> - *improve awareness and understanding of coastal hazards*
> - *create consistent guidance for resilience and adaptation*
> - *make adaptation easier*

The Coastal Resilience Plan is currently under development as of the time of this Plan's drafting.

4.3 Local Flood Protection Efforts

The purpose of this review is to present the findings of a review of the City's planning reports and appropriate development ordinances to identify what Brigantine either has done or proposes to do to address flood hazards. The materials reviewed were:

- City of Brigantine 2010 Master Plan (adopted February 2011)
- Brigantine Beach Bicycle and Pedestrian Master Plan (October 2013)
- Floodplain Damage Prevention (Chapter 181 of the Code of the City of Brigantine)
- Land Use Regulations (Chapter 198 of Code of the City of Brigantine)
- Stormwater Control (Chapter 258 of the Code of the City of Brigantine)
- NFIP Community Rating System
- Atlantic County Multi-Hazard Mitigation Plan
- The Community Plan Checklist includes a list of municipal documents that may be helpful in developing a Strategic Recovery Planning Report.

Figure 8: Summary of Plans and Ordinances for the City of Brigantine

Plans, Ordinances, and Codes	Yes	No	Adopted Year	Update Frequency
Municipal Master Reexamination	x		2016	6 to 10 years
Vision Plan		x		

Plans, Ordinances, and Codes	Yes	No	Adopted Year	Update Frequency
All-Hazard Mitigation Plan	x			County Adopted
Floodplain Management Plan	x		2013	
Evacuation Plan	x			
Emergency Response Plan	x		1981	
Long Term CIP		x		5 Year Plan Prepared
Post-Disaster Recovery Plan		x		
Economic Development Plan		x		
Open Space Plan		x		
Stormwater Management Plan	x			Update Frequency
Historic Preservation Plan		x		
Zoning Ordinance	x		1999	As Needed
Subdivision Ordinance	x		2011	As Needed
Building Code	x		1980	
NFIP Flood Damage Prevention Ordinance	x		2012	
Cumulative Substantial Damage		x		
Greater than One Foot Freeboard	x		2012	
Bulkhead Ordinance				

4.3.1 Development Regulations

The Code of the City of Brigantine includes several chapters that contribute to the control and regulation of flood hazards. These include Land Use Regulation (LUR) (Chapter 198), Flooding Damage Protection (Chapter 181) and Stormwater Control (Chapter 258).

The common methods typically found in development regulations to address and/or minimize flood hazards include how building height is defined, building/lot coverage and stormwater management requirements.

The Land Use Regulations define "building height" as being measured from a point two feet above the base flood elevation applicable to the property. While the City has taken the step to create a significant freeboard area, this needs to be coordinated with the Flood Damage Protection ordinance as that chapter of the Code sets the lowest finished floor elevation for residential structures at six-tenths of a foot (0.6 foot) above base flood elevation.

The amount of impervious coverage (both building and lot coverage) allowed in the LUR varies depending on the zoning district and type of development. In one- and two-family residential districts, up to 60 percent impervious coverage is permitted, while a maximum 75 percent impervious coverage is allowed in non-residential zones. The Land Use Regulation does not require stormwater review for residential development on existing lots.

In addition to establishing the minimum floor elevation for structures, the Flood Damage Protection ordinance also incorporates regulations requiring structures to be brought into compliance if they are subject to substantial damage or undergo substantial improvement. Substantial damage is defined as the cost for restoring a structure to pre-damage condition being equal to or greater than 50 percent of the pre-damage market value. Substantial improvement is defined as any improvement the cost of which exceeds 50 percent of the pre-improvement market value of the structure. The substantial improvement definition is limited in that it requires consideration only of an application that is currently submitted to the Construction Official and does not take into consideration the cumulative value of a series of improvements made to a structure over a period of years.

The development regulations include design requirements for stormwater control and stormwater management systems, which are intended to avoid increases in stormwater runoff from new development. It should be noted that stormwater management systems requirements do not apply to single- and two-family residential construction that is not part of a major subdivision. The following recommendations should be considered:

- Reduction of the amount of impervious surface that is permitted on development sites, particularly for individual one- and-two family dwellings, in order to lessen stormwater runoff and help reduce ponding and urban flooding.
- Amending the Flood Damage Prevention ordinance so that the minimum finished floor elevation in residential structures is at least two feet above BFE and is consistent with the building height definition in the Land Use Regulations.
- Amending the Flood Damage Prevention ordinance by:

    - Changing the definition of substantial damage to reduce the threshold percentage to 40 percent of the pre-damage market value.
    - Changing the definition of substantial improvement to reduce the threshold improvement value to 40 percent of the pre-improvement market value and required the consideration of all improvements undertaken during a "look back" period (e.g. 5 years).

4.3.2 NFIP Community Rating System

The City has been actively involved in the NFIP's Community Rating System and is a statewide leader. The City currently has a Class 5 rating, which provides for a 25 percent discount on flood insurance. More than 1,200 communities nationwide, including 61 in New Jersey, participate in the CRS. Only a dozen communities are in Class 5, the highest ranking for any community in the State of New Jersey. Currently only Roseville, California is in Class 1 which receives a 45 percent insurance discount.

The CRS recognizes and encourages community floodplain management activities that exceed the minimum NFIP standards. In addition to the benefit of reduced insurance rates, CRS floodplain management activities enhance public safety, reduce damage to property and public infrastructure, avoid economic disruption and losses, reduce human suffering and protect the environment. Participating in the CRS provides an incentive to maintain and improve a community's floodplain management program over the years. Implementing some CRS activities can help projects qualify for certain other federal assistance programs. Participating communities can earn credit for undertaking a variety of flood-reduction measures, including preserving open space, mandating that buildings in flood zones be elevated higher than FEMA requires, and incorporating predictions of future sea-level rise into their regulatory maps. Overall, creditable activities are grouped into four categories: public information, mapping and regulations, flood damage reduction, and warning and response. Different amounts of points are awarded for different measures, as explained in the FEMA manual.

4.3.3 Atlantic County Multi-Hazard Mitigation Plan 2005

Mitigation plans form the foundation for a community's long-term strategy to reduce disaster losses and break the cycle of disaster damage, reconstruction and repeated damage. The planning process is as important as the plan itself. It creates a framework for risk-based decision making to reduce damage to lives, property and the economy from future disasters. Hazard mitigation is sustained action taken to reduce or eliminate long-term risk to people and their property from hazards.

4.3.4 Atlantic County Flood Control Study 2007

The Atlantic County Flood Hazard Inventory identifies recurring flooded roadways. Each flood hazard mitigation project identified in this study is given a score of up to 100 points based on three major criteria: emergency travel factors – whether it is a major evacuation route (45 possible points); daily travel factors – traffic counts, population served, etc.; and cost-effectiveness feasibility–estimated cost/traffic volumes.

Figure 9: Brigantine Projects Identified in the Atlantic County Flood Control Study

Road	Score	Cost	Description
Brigantine Blvd.	75	$22,000,000	Raise road elevation
Hackney Place	64	$3,750	Install check valve
Bayshore Avenue	55	$439,717	Raise road elevation

Twelfth Street	54	$1,195,430	Raise road elevation
Sheridan Avenue	54	$300,000	Pump at Caverly Dr. /Sheridan Boulevard
Evans Boulevard	47	$1,080,000	1800 LF to bay at 12th Street North
Lafayette Blvd.	46	$1,140,000	1900 LF to bay at 6th St. South street end
Sarazan Drive	43	$480,000	Connect to pump section on Sheridan Ave.

CHAPTER 5 – PLANNING COORDINATION AND PUBLIC OUTREACH

A significant amount of public outreach was undertaken for this Floodplain Management Plan. In addition to public meetings and planning committee meetings, the planning team engaged a number of agencies to determine their interest and activities in Brigantine vis-à-vis floodplain management. A number of these agencies responded and provided useful guidance and information for the project.

A website was also created to publish meeting info: https://sites.google.com/view/brigantinefpm All e-mails exchanged with this planning process are attached as an Appendix to this report. The table below summarizes the extent of contact between the Planning Team and outside agencies.

Figure 10: Table of Contacts

Agency	Contact	Contact Dates (Phone/Email)	Notes
American Littoral Society	Tim Dillingham Executive Director 732-291-0055 tim@littoralsociety.org	E-Mail sent to Agency on June 24, 2019. No response received.	
American Red Cross-South Jersey	Carol Cohen Executive Director 609-646-8330 carol.cohen@redcross.org	E-mail	The American Red Cross is not undertaking mitigation projects but is participating in preparedness training and offers programming related to disaster response.
Atlantic City Electric Company	ACBrigReliability@exeloncorp.com	E-Mail: Response June 24, 2019	ACEC is planning a new substation at Harbor Beach and is submitting for Planning Board review in the fall. ACEC can provide building specifications once submitted for review. The substation will conform to the City's flood ordinance.
Atlantic County Department of Regional Planning	John Peterson Department Head (609) 645-5898 peterson_john@aclink.org.	E-Mail: Response June 24, 2019	Atlantic County does not have plans for resilience projects but is interested in participating in planning efforts and attending floodplain management meetings. The County asked to be included in announcements and invitations.

Agency	Contact	Contact Dates (Phone/Email)	Notes
Atlantic County-OEM	Vincent J. Jones III Director (609) 407-6742 jones_vincent@aclink.org	E-Mail sent to Agency on June 24, 2019. No response received.	
Brigantine Green Team	brigantinebeachgreenteam@outlook.com	E-Mail sent to Agency on June 24,2019. No response received.	
Builders League of South Jersey	Richard S. Van Osten Executive Vice President 856. 616.8460 rick@blsj.com	E-Mail sent to Agency on June 24,2019. No response received.	
Cape Atlantic Conservation District	*David Reilly*, District Manager (609) 625-3144 davidreilly@capeatlantic.org	E-Mail sent to Agency on June 24,2019. No response received.	
City of Atlantic City	Barbara Wooley-Dillon Direct of Planning and Development	E-Mail sent to Agency on June 24,2019. No response received.	
Comcast	Robert Clifton Director of Government and Community Affairs robert.clifton@comcast.net	E-Mail sent to Agency on June 24,2019. No response received.	
FEMA-Region 2	Michael Moriarty Direction, Region II Mitigation (347) 838-0427 michael.moriarty@dhs.gov	E-Mail sent to Agency on June 24,2019. No response received.	
Jacques Cousteau NERR	Michael P. De Luca Reserve Manager 848-932-3474 deluca@marine.rutgers.edu	E-Mail	JCNERR offers the NJFloodmapper.org tool to examine current and future flood hazards and includes GIS layers that show critical facilities, social vulnerability, etc. JCNERR also offers a

Agency	Contact	Contact Dates (Phone/Email)	Notes
			Coastal Training Program that has trainings, webinars, and workshops throughout the year to provide continuing education. JCNERR also offers direct technical assistance.
National Oceanic Atmospheric Administration	Darlene Finch, Mid-Atlantic Regional Lead Betsy Nicholson Mid-Atlantic Sub-Region Office for Coastal Management 617-869-9148, betsy.nicholson@noaa.gov	E-mail	NOAA provides data, tools, training, and information that supports coastal management efforts. NOAA also directed the City to visit the NOAA Digital Coast website.
National Weather Service	Dean Iovino Coastal Flooding Program Leader Jason Franklin Meteorologist-in-Charge jason.franklin@noaa.gov 609-261-6600	E-mail	The National Weather Service issues Coastal Flood Warnings, Watches, and Advisories for Atlantic County. NWS has developed a correlation between water levels at the Atlantic City tide gauges and the magnitude of tidal flooding in Brigantine. NWS has 20 years of data with regard to water levels and flooding reports.
NJ Department of Community Affairs	Nancy B. Diehl Sandy Recovery Division Nancy.diehl@dca.nj.gov (609) 633 2806	E-mail	DCA has provide funding for a variety of projects in Brigantine through the federal CDBG-Disaster Recovery program. Projects included Local Planning Services Grants, Debris Removal, streetscape improvements, and various public services.
NJDEP Climate and Flood Resilience	Dave Rosenblatt Assistant Commissioner/Chief Resilience Officer 609.292.9236	In-Person	Representatives from the Bureau of Flood Resilience met with the Army Corps and Floodplain Management Planning Committee on 12

Agency	Contact	Contact Dates (Phone/Email)	Notes
	Dave.Rosenblatt@dep.nj.gov		September 2019. The DEP briefly discussed its coastal resilience plan and issues surrounding the financing of protection projects.
NJDEP-Coastal Management Program	Kimberly Springer Office of Policy and Coastal Management *Kim.Springer@dep.nj.gov* 609-292-2178	E-Mail sent to Agency on June 24,2019. No response received.	
NJDEP-Natural and Historical Resources	Raymond Bukowski Assistant Commissioner *Ray.Bukowski@dep.nj.gov* 609-292-3541	E-Mail	The Natural and Historical Resources division manages property in and around the City as a Natural Area and Wildlife Management Area. The properties are maintained in a natural state.
NJDEP-NFIP Coordinator	John H. Moyle, PE State NFIP Coordinator (609) 292-2296 *John.Moyle@dep*.nj.gov	E-Mail sent to Agency on June 24,2019. No response received.	
NJDOT	Genevieve Clifton Program Manager-Office of Maritime Resources	E-Mail	The Office of Maritime Resources is interested in being a part of discussions should the City wish to pursue reuse of dredge material.
NJOEM	Chris Testa Mitigation Unit Manager 609-508-6557 lpptestc@gw.njsp.org	E-mail	NJOEM directed the City to consult with the State and County Hazard Mitigation Plans.
South Jersey Gas	Lauren Hurtt Supervisor, Public Affairs (609) 561-9000 ext. 4181 lhurtt@sjindustries.com	E-Mail sent to Agency on June 24,2019. No response received.	
Stockton University Coastal	Dr. Stewart Farrell Director, Stockton University CRC	E-mail	Stockton CRC provided a list of projects that it has assisted the City with completing. This

Agency	Contact	Contact Dates (Phone/Email)	Notes
Research Center	Stewart.farrell@stockton.edu		includes beach profiles, project design, the drafting of the City's Watershed Management Plan, nuisance flood studies, and similar projects.
South Jersey Transportation Planning Organization	Jennifer Marandino Executive Director jmarandino@sjtpo.org 856-794-1941	E-mail	SJTPO encouraged Brigantine to contact John Peterson at Atlantic County and copied David Heller, the program manager for resiliency and other environmental efforts at SJTPO.
US Army Corps – Philadelphia District	J. Bailey Smith NJ Back Bay CSRP Project Manager Steve Rochette 215-656-6432 stephen.rochette@usace.army.mil	In-Person	J. Bailey Smith, who manages the Corps' Back Bay Coastal Storm Risk Management Study, met with the DEP and Floodplain Management Planning Committee on 12 September 2019. Smith briefly reviewed the Study project and outlined various conditions and factors determining how the project will advance. The Army Corps requested more information about the City's mitigation efforts. Committee members expressed concern about the efficacy of proposed projects such as floodwalls and tide gates in preventing flooding.
US Fish and Wildlife Service	Steve Mars Senior Fish and Wildlife Biologist Steve_Mars@fws.gov 609-646-9310x5267		The US Fish and Wildlife Service reported that it had no actions that would impact flooding or resiliency in the City.
USDA-Natural Resources Conservation Service	Hilary Trotman Civil Engineer (856) 205-1225, ext. 3 hilary.trotman@nj.usda.gov	E-Mail sent to Agency on June 24,2019. No response received.	

In addition to these public agencies, information was collected via email from residents and property owners. Surveys were also distributed to attendees at the public meetings and were available on the City's floodplain management website. This correspondence is not attached to this Appendix in order to protect the privacy of those who have contacted the Planning Team. Property-specific information was masked and re-characterized to help protect privacy. A blank copy of the survey is attached as an Appendix to this application. A summary of these comments is provided below:

E-mail Contributions

- One recent resident described flooding occurring in the vicinity of 30th Street and Bayshore Avenue during extreme high tides. This contributed to traffic issues observed at Bayshore Avenue. The resident recommended bulkheads with "back flow capabilities" owing to the observation that water comes into the streets via sewer grates near the bulkhead (rather than overtopping). The resident advocated for working with the new owners of an adjacent waterfront building to coordinate bulkhead replacement.
- A resident noted possible non-compliance with the City's bulkhead ordinance in which the resident observed bulkhead cut-outs at least two properties (one at the 800 block of Bayshore Avenue and another in the vicinity of Sheridan and 8th Street South) that appear to allow flood waters to enter into the neighborhood.
- A resident volunteered information that no flood damage was claimed at the respondent's house in the Lighthouse District (36th Street South).
- A resident provided notice of a vacant lot at 28th Street and the bay and 26th Street Beach that may be contributing to flooding.

Survey Contributions

- A resident provided notice of garage flooding at respondent property in The Links neighborhood on the landward side of North Shore Drive. The respondent noted that heavy rains and high tides at the bay create street flooding and that wakes from vehicles are a concern.
- A resident asked the City to require bulkheads of sufficient heights on all waterfront properties.
- A resident in the 400 block of 36th Street South noted that street flooding is experienced with any amount of rain.
- A resident in the 300 block of 18th Street South noted that the street floods during heavy downpours.
- A resident identified the need for funding to be able to finish the respondent's house and personal financial difficulties (presumably related to flooding damage). Various residents were interested in learning about grants and other opportunities for elevation and floodproofing.
- A resident noted that the corner of the 20th Street South and Brigantine Avenue floods during heavy rains and is getting worse.

PART 2 – FLOOD HAZARD ASSESSMENT

CHAPTER 6 – HAZARD ASSESSMENT

This part of the Floodplain Management Plan evaluates the risk of the flood hazard in the planning area (CRS Step 5). Risk assessment is the process of measuring the potential loss of life, personal injury, economic injury, and property damage resulting from natural hazards such as flooding. It allows emergency management personnel to establish early response priorities by identifying potential hazards and vulnerable assets. The process focuses on the following elements:

- Exposure identification—Determine the extent of people, property, environment and economy exposed to the effects of the natural hazard.

- Vulnerability evaluation—Estimate potential damage from the natural hazard and associated costs.

The risk assessment describes the flooding hazard, the planning area's vulnerabilities, and probable event scenarios. The following steps were used to define the risk:

- Identify and profile the flooding hazard (CRS Step 4); the following information is given:
    - Principal sources of flooding in the planning area
    - Major past flood events
    - Geographic areas most affected by floods
    - Estimated flood event frequency
    - Estimates of flood severity
    - Warning time likely to be available for response
    - Existing flood protection programs and projects
    - Secondary hazards associated with the flood hazard
    - Potential impacts of climate change on flooding
    - Expected future trends that could affect the flood hazard
    - Scenario of potential worst-case flood event
    - Key issues related to floodplain management in the planning area.

- Determine exposure to the flood hazard—Exposure was determined by overlaying flood maps with an inventory of structures, facilities, and systems to determine which of them would be exposed to flood events.
- Assess the vulnerability of exposed facilities—Vulnerability of exposed structures and infrastructure was determined by interpreting the probability of occurrence of each flood event and assessing structures, facilities, and systems that are exposed.
- Evaluate repetitive loss properties—The City is planning to complete a separate Repetitive Loss Area Analysis in accordance with Section 512.b of the 2017 CRS Coordinators Manual. This document will be a companion document to this Comprehensive Floodplain Management Plan.

CHAPTER 7 – FLOOD HAZARD PROFILE

7.1 General Concepts

A floodplain is the area adjacent to a river, creek or lake that becomes inundated during a flood. Floodplains may be broad, as when a river crosses an extensive flat landscape, or narrow, as when a river is confined in a canyon.

When floodwaters recede after a flood event, they leave behind layers of rock and mud. These gradually build up to create a new floor of the floodplain. Floodplains generally contain unconsolidated sediments (accumulations of sand, gravel, loam, silt, and/or clay), often extending below the bed of the stream. These sediments provide a natural filtering system, with water percolating back into the ground and replenishing groundwater. These are often important aquifers, the water drawn from them being filtered compared to the water in the stream. Fertile, flat reclaimed floodplain lands are commonly used for agriculture, commerce and residential development.

Connections between a river and its floodplain are most apparent during and after major flood events. These areas form a complex physical and biological system that not only supports a variety of natural resources but also provides natural flood and erosion control. When a river is separated from its floodplain with levees and other flood control facilities, natural, built-in benefits can be lost, altered, or significantly reduced.

7.1.1 Measuring Floods and Floodplains

Floodplains are delineated using Flood Insurance Studies published by FEMA and adopted by local communities. Flood Insurance Studies take a number of factors into consideration, including local topography, to determine approximate flood heights during various storm events. Flood heights are determined for various bayfront and oceanfront transects and are incorporated into Flood Insurance Rate Maps, which show base flood elevations and the extent of flood zones.

The table below shows the range of Stillwater elevations for various transects in Brigantine:

Figure 11: Range of Elevations for Brigantine (Feet NAVD 88)

Flood Source	*Transect*		*Starting Wave Conditions for 1% Annual Chance*		*Starting Stillwater Elevations Range of Stillwater Elevations (ft NAVD88)*			
	#	*Coordinates*	*Significant Wave Height*	*Peak Wave Period*	*10%*	*2%*	*1%*	*0.2%*
Atlantic Ocean	8	N 39.437518 W 74.331367	11.52	13.32	7 7.1-7.0	8.6 7.9-8.6	9.5 8.4-9.5	12.2 9.7-12.2
Atlantic Ocean	9	N 39.424774 W 74.343753	10.12	13.38	6.7 6.2-8.3	8.5 8-8.8	9.3 8.6-9.4	12.1 9.9-12.1

Flood Source	*Transect*		*Starting Wave Conditions for 1% Annual Chance*		*Starting Stillwater Elevations Range of Stillwater Elevations (ft NAVD88)*			
	#	*Coordinates*	*Significant Wave Height*	*Peak Wave Period*	*10%*	*2%*	*1%*	*0.2%*
Atlantic Ocean	10	N 39.412555 W 74.355625	10.27	12.74	6.6 5.9-8.3	8.6 8-8.8	9.5 8.6-9.5	12.4 10-12.4
Atlantic Ocean	11	N 39.407162 W 74.360900	9.98	12.9	6.5 6.2-7.4	8.5 8-8.9	9.5 8.6-9.8	12.4 10-12.5
Atlantic Ocean	12	N 39.400549 W 74.367513	10.04	12.67	6.4 6.2-7.3	8.4 8-8.9	9.4 8.6-9.8	12.3 10-12.5
Atlantic Ocean	13	N 39.394843 W 74.374633	9.56	12.45	6.3 6.2-7.6	8.4 8-8.9	9.3 8.7-9.9	12.4 10-12.8
Atlantic Ocean	14	N 39.389310 W 74.382285	9.82	13.18	6.4 6.1-8	8.4 8-8.8	9.3 8.7-9.7	12.4 10-12.9
Atlantic Ocean	15	N 39.382313 W 74.391421	10.15	12.47	6.3 6.2-8.2	8.4 8-8.8	9.3 8.6-9.8	12.4 10-13.2
Atlantic Ocean	16	N 39.375635 W 74.400483	10.48	12.55	6.2 6.2-8.3	8.4 8-9	9.3 8.7-10.01	12.3 10.1-13.2
St. George's Thorofare	17	N 39.393014 W 74.407307	2.04	2.59	6.2 6.2-7.3	8.1 7.8-8.9	8.7 8.4-10.1	10 9.9-13.3
Bonita Tideway Bay	18	N 39.404299 W 74.374859	2.74	2.78	6.2	8	8.7 8.6-8.8	10 10-12
Somers Bay	19	N 39.422161 W 74.369806	2.11	2.33	6.2 6.2-6.7	8 8-8.5	8.7 8.6-9.3	10 10-12

8- Natural Area (Oceanfront)
9- Natural Area (Oceanfront)
10- North End- 12th Street (Oceanfront)
11- Roosevelt Boulevard (Oceanfront)
12- 11th Street South (Oceanfront)
13- 22nd Street South (Oceanfront)
14- 33rd Street South (Oceanfront)
15- Rainbow Drive (Oceanfront)
16- Surf Lane (Oceanfront)
17- Between Laurel Way and Gull Cove (Bayfront)
18- 14th Street South (Bayfront)
19- Somers Bay near Links (Bayfront)
Source: 2014 Flood Insurance Study, Atlantic County

The 2010 Atlantic County Hazard Mitigation Plan reports that the current (pre-Sandy) FIRMs already show 100 percent of the City lying in high-risk areas or zones identified as V, commonly known as Velocity, and A or AE, commonly known as the 100-year flood zone, putting hundreds of millions of dollars of improvements at risk of damage or destruction from flooding. FEMA is in the process of updating flood mapping in New Jersey, and in mid-2013 released preliminary work maps as a form of "best available data" for municipalities to use for guidance during the current stage of post-Sandy recovery. These maps reflect some modifications of zone boundaries and also identify a few areas in the City that may change to a 500-year flood hazard zone designation.

7.1.2 Effects of Human Activities

Because they border water bodies, floodplains have historically been popular sites to establish settlements. Human activities tend to concentrate in floodplains for a number of reasons: water is readily available; land is fertile and suitable for farming; transportation by water is easily accessible; and land is flatter and easier to develop. But human activity in floodplains frequently interferes with the natural function of floodplains. It can affect the distribution and timing of drainage, thereby increasing flood problems. Human development can create local flooding problems by altering or confining drainage channels. This increases flood potential in two ways: it reduces the stream's capacity to contain flows, and it increases flow rates or velocities downstream during all stages of a flood event. Human activities can interface effectively with a floodplain as long as steps are taken to mitigate the activities' adverse impacts on floodplain functions.

7.1.3 Floodplain Ecosystems

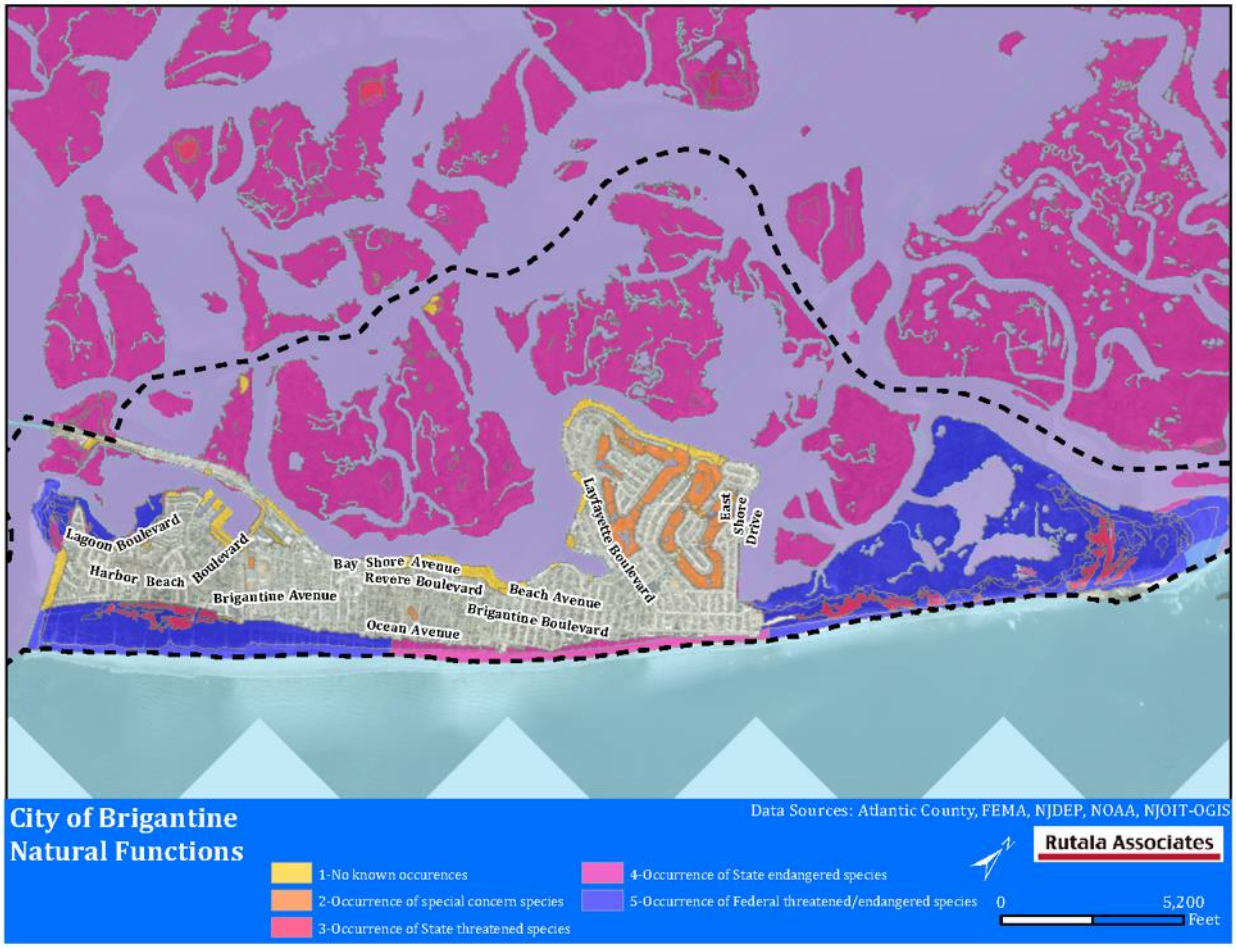
Floodplains support rich ecosystems that exhibit biodiversity, carbon absorption abilities, aesthetic and recreational qualities, flood-buffering abilities and are uniquely adapted to the dynamic conditions of flood-vulnerable areas. Brigantine is a barrier island that has a unique ecology. This ecology is best observed in the northern section of the island within the State-managed Brigantine Natural Area. The southern portion of the island has seen considerable human disturbance and development which transformed much of the island's dune and vegetated area into urbanized land use. This pattern is typical of Jersey Shore barrier islands.

The following map shows floodplain functions based on the presence of species in the habitat. Much of the urbanized parts of Brigantine (uncolored in the map) do not support ecosystem functions owing to the preponderance of pavement and manicured residential landscapes. The developed areas immediately inland from the Bayshore could support some species, though ultimately no rare or threatened species are present. Federally endangered and threatened species are found at the southernmost and northernmost beach sections of the island.

The southernmost beaches in Brigantine are preserved, vegetated dune communities and shrub wetlands. The wetlands have known occurrences of Black-crowned night heron and the Cattle egret. The Vegetated dune communities are home to several important species, including the State Endangered and Federally Threatened Piping Plover and various types of

terns. Brigantine's south end nature area is significant because of its size – roughly 1,500 feet wide at its widest point – and more than two miles long. This dune area provides a crucial buffer natural barrier against wave action, directly protecting inland properties and preventing a "wash over" where the ocean and bay flood waters can meet. The ecosystem is so robust that beach replenishments do not take place in Brigantine because so much sand has been able to accumulate through mostly natural processes aided by a jetty along Absecon Inlet.

Map 1: Floodplain Functions

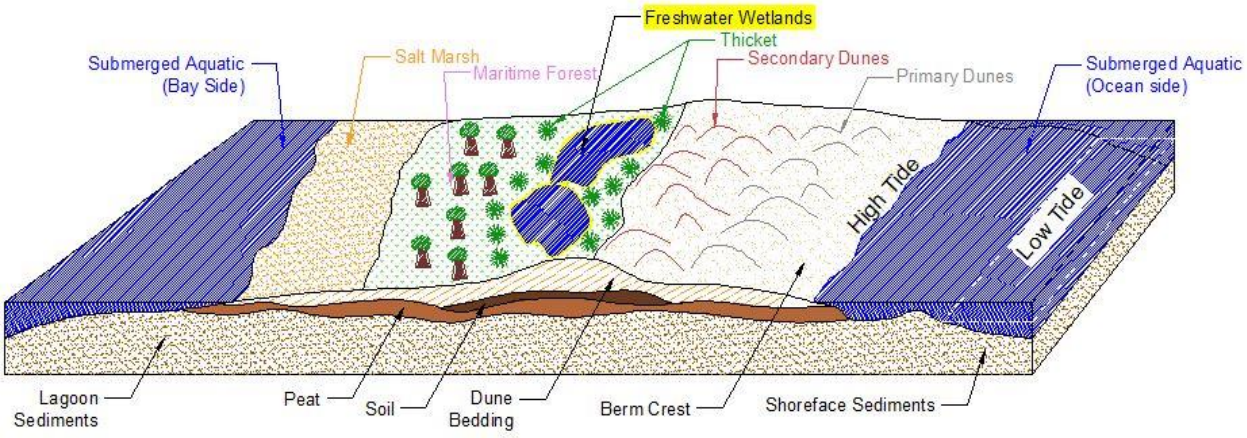


In the northern section of Brigantine, The Links golf course provides several isolated areas of species habitat. Despite being a manmade and maintained golf course, the artificial, tidally drained ponds that serve as water hazards have been the sites of sightings of various species, include State Endangered and Threatened birds. The Links was purchased from private owners by the City to help provide 150 acres of preserved land that assists with neighborhood drainage, reduces runoff, and prevents floodplain development in low-lying areas. The more than 1,300-acre North Brigantine Natural Area stretches nearly three miles from 15th Street North to the Brigantine Inlet. This area is completely undeveloped and is left in its natural state and allows the barrier island ecosystem to function without significant

human intervention. The dune system protects the back-bay wetlands areas from being directly exposed to wave action, thus protecting upland and wetland areas being the island.

In addition to these two areas, a 1,000-plus-acre portion of the state-owned Absecon Wildlife Management Area is located in the saline low marshes on the bayside of Brigantine. It consists mainly of two large marsh islands that are home to nearly two-dozen occurrences of State threatened, endangered, and special concern species. These wetlands also provide natural wave attenuation that protect both surrounding marshes and the urbanized, hardened shoreline in the developed section of Brigantine.

The image below shows the seven major transects of a barrier island ecosystem, which includes submerged aquatic vegetation, primary dunes, secondary dunes, thickets, freshwater wetlands, maritime forests, and salt marshes. These seven transects exhibit a multitude of plant and animal species, such as *Spartina alterniflora* (smooth cordgrass) in the marsh, *Ammophila brevilligulata* (American beachgrass) in the dunes, and endangered gull-billed terns, sandpipers, oystercatchers, bald eagles, and osprey found throughout the island.



Coastalcare.org

Barrier islands, particularly in their undeveloped state, serve as crucial buffers for flooding. However, the advent of barrier island development means that these natural barriers decrease in size and are hampered in their ability. Natural dune systems gradually became replaced with bulkheads, and salt marshes in the western section of the island were filled to create developable land.

Wetting of the floodplain soil releases a surge of nutrients: those left over from the last flood, and those that result from the rapid decomposition of organic matter that has accumulated since then. Microscopic organisms thrive and larger species enter a rapid breeding cycle. Opportunistic feeders—particularly birds—move in to take advantage. The production of nutrients peaks and falls away quickly, but the surge of new growth endures for some time. This makes floodplains particularly valuable for agriculture. Riparian zone species have significant differences from those that grow outside of floodplains. For instance, riparian

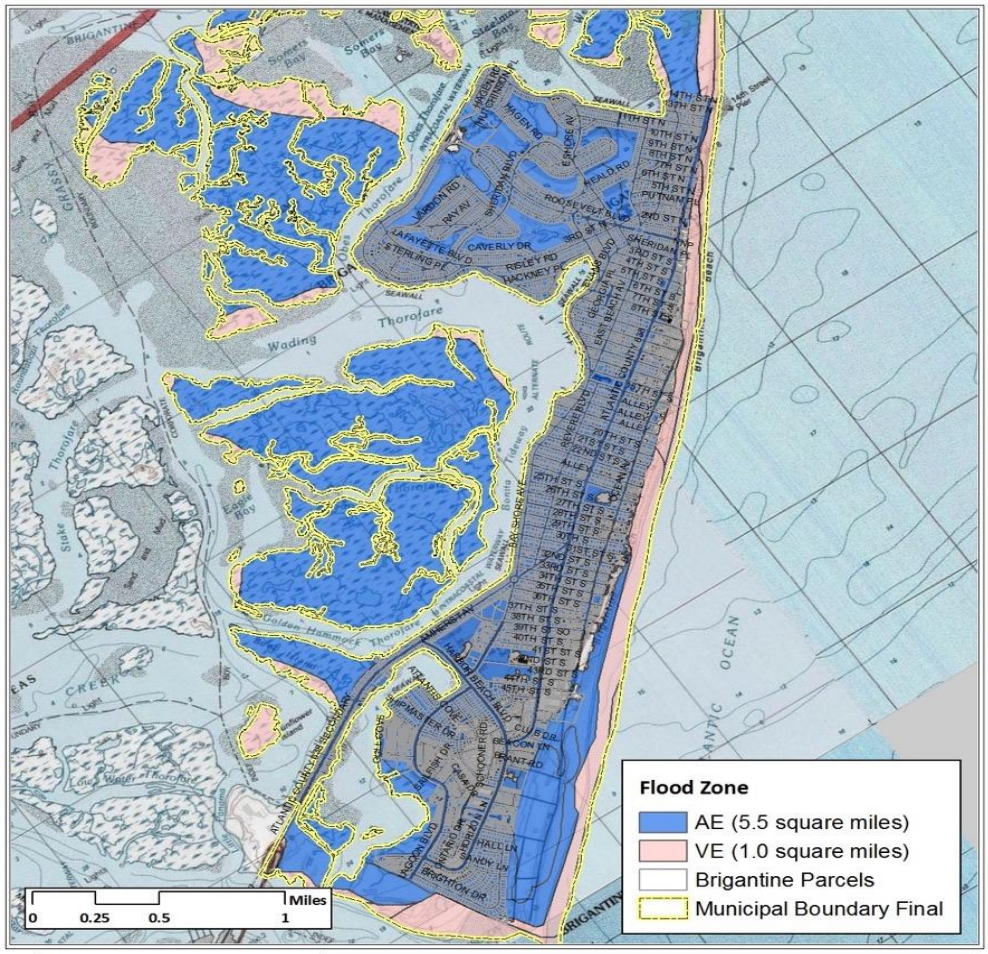
trees tend to be very tolerant of root disturbance and tend to be very quick growing compared to non-riparian trees.

7.2 Flooding Types

This Floodplain Management Plan has identified the following types of flooding impacting Brigantine. The City's unique geography and climate means that often these types of flooding are intertwined, with the impact of one type of flooding not easily discernible from another.

1) Storm surge flooding (hurricanes, nor'easters, and other coastal storms)
2) Stormwater/rain flooding
3) Nuisance flooding
4) Future Flooding (Sea Level Change in combination with the prior three flooding types)

Map 2: Special Flood Hazard Areas in Brigantine



The Vulnerability Assessment in the following sections will treat these four flooding types as one because they all derive from a single direct hazard. The island's location and low topography leaves virtually no piece of land in the City safe from flooding, even with various parts of the City in the 500-year flood zone.

7.3 Principal Flooding Sources

Federal disaster declarations are typically issued for hazard events that cause more damage than state and local governments can handle without assistance from the federal government, although no specific dollar loss threshold has been established for these declarations. A federal disaster declaration puts federal recovery programs into motion to help disaster victims, businesses and public entities. Some of the programs are matched by state programs. The City of Brigantine has experienced eight events since 2007 for which federal disaster declarations were issued, as summarized below. Review of these events helps identify targets for risk reduction and ways to increase a community's capability to avoid largescale events in the future. Many flood events do not trigger federal disaster declaration protocol but still have significant impacts on their communities. These events are also important to consider in establishing recurrence intervals for flooding.

The City of Brigantine has experienced many natural-hazard events that received a federal declaration, including the most recent events listed below:

April 14 – 20, 2007	Nor'easter	DR-1694
November 11 – 15, 2009	Nor'easter	DR-1967
December 19 – 20, 2009	Snowstorm	DR-1873
February 5 – 6, 2010	Severe Winter Storm	DR-1889
December 26 – 27, 2010	Severe Winter Storm	DR-1897
August 26 – September 5, 2011	Hurricane Irene	DR-4021
June 29 – 30, 2012	Derecho	DR-4070
October 22, 2012	Superstorm Sandy	DR-4086

CHAPTER 8 – HISTORIC FLOODING DAMAGE

Since 1977, the City of Brigantine has experienced at least $99.1 million in damages based solely on the value of NFIP flood claims in that time. Approximately 91.6 percent of these losses are attributed to a single flood event – Superstorm Sandy – which occurred in October 2012. That event accounts for about two-thirds (64.6 percent) of all NFIP claims in the program's history in Brigantine.

Between 1977 and 2011, the largest single flooding event generated nearly 800 losses and $5.8 million in value of losses. In 2012, Superstorm Sandy shattered this number, creating more than 2,300 NFIP claims and $90.7 million in losses. Notably, the value of loss for Superstorm Sandy was nearly five times higher than that of the loss during the 1992 storm. This indicates that even though more structures were damaged, the extent of damage to each structure was unlike anything experienced before.

The tables below show the value and number of NFIP losses in Brigantine between 1977 and 2011. Superstorm Sandy had such an unprecedented impact that it is not listed on these graphs for readability.

Figure 12: Value of NFIP Losses

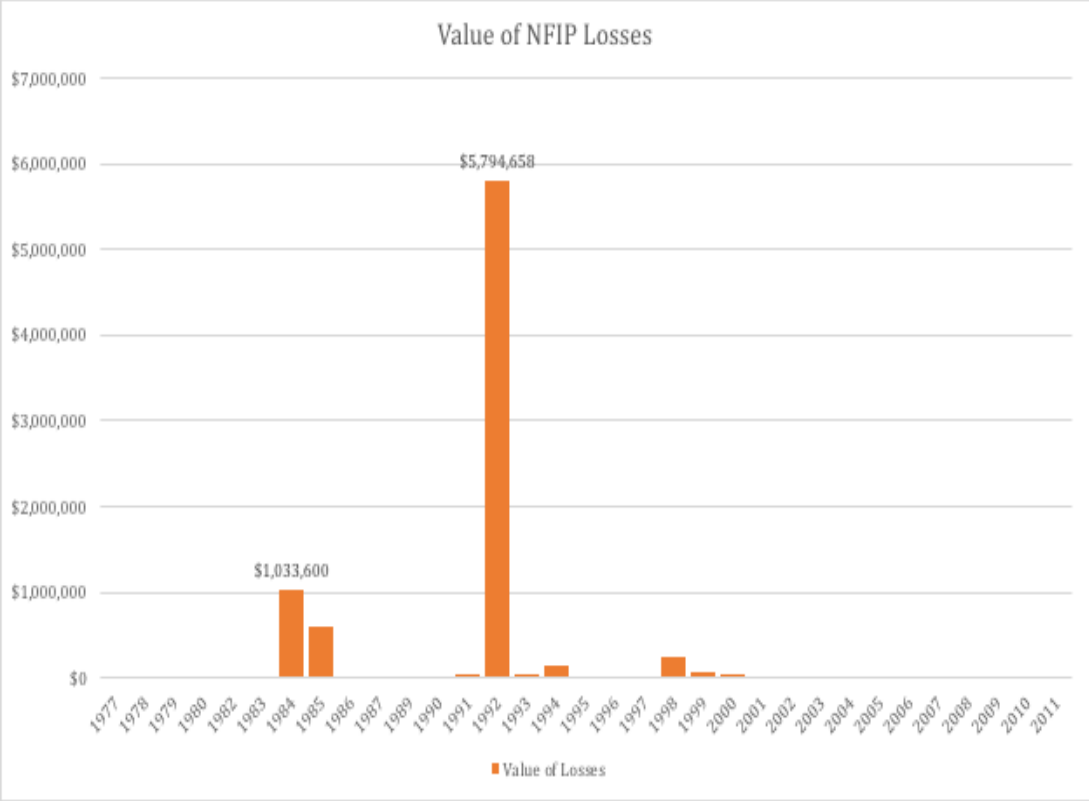
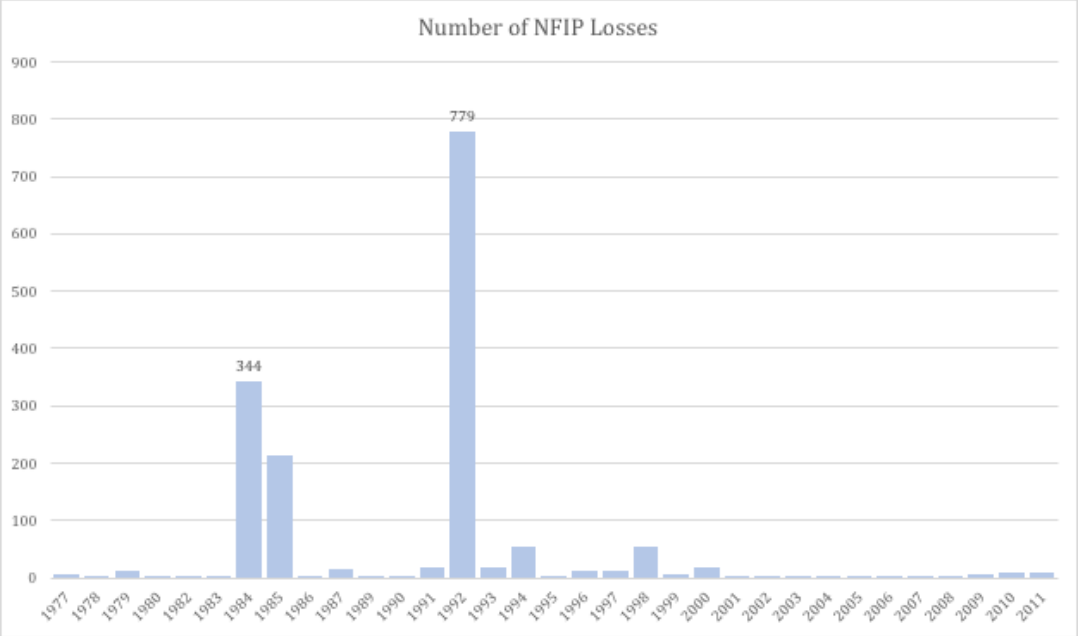


Figure 13: Number of NFIP Losses



Storm events in 1984, 1985, and 1992 caused considerable damage in the City and set a precedent for areas that would be repetitively damaged by future storms. These three storms occurred over an eight-year period, though the astronomical damages from Superstorm Sandy would not be seen for another two decades. Since Superstorm Sandy and the time of this report's drafting in 2019, there have been no major flooding events in Brigantine that have caused significant damage. However, it is recognized that more damaging storms will occur in the future and the damage from which will be compounded by rising sea levels.

According to the Exceedance Probability Levels and Tidal Datums developed by NOAA, a ten-year storm between 1983 and 2001 reached a height of 1.75 meters MSL, or 5.3 feet NAVD88. Based on the heights observed at the Atlantic City tide gauge, the 10-year storm occurred thrice in the eight years between 1984 and 1992.

The four storms that dealt the most significant pre-Sandy storm damage based on NFIP loses are shown in the table below. Each storm saw high water levels that were within less than six inches of each other, even though the damage was variable. This could be due to other local factors such as wind or storm duration. Note that the damages below cover only properties insured through the National Flood Insurance Program.

Figure 14: Pre-Sandy Storm Damages

Event Date	Claims	Damages	High Water Level (ft NAVD 88)*
March 28th-29th, 1984	341	$1,024,893	5.38
September 27th, 1985	212	$590,742	5.5
January 3rd-5th, 1992	64	$221,496	5.15

Event Date	Claims	Damages	High Water Level (ft NAVD 88)*
December 10th-14th, 1992	709	$5,570,048	5.19
* Atlantic City tide gauge https://tidesandcurrents.noaa.gov/est/stickdiagram.shtml?stnid=8534720			

The 1984 storm caused damage that was almost exclusively clustered along the lower-lying, back bay sections of the City. Clusters of damaged sections are prevalent near 24th Street South, 28th Street South, 9th Street South, the area surrounding the Links, and Evans Boulevard. East Shore Drive, East Evans Boulevard, Sheridan Boulevard, and the area immediately eastward of the Schools saw the heaviest damage.

The 1985 storm saw more limited damage similarly clustered to the 1984 storm. The West Shore Drive neighborhood was more significantly impacted. Interior neighborhoods in The Links – particularly along Roosevelt Boulevard and MacDonald Place – were spared, though the neighborhood east of the School saw slightly more damage than it did in the prior year's storm.

The January 1992 storm saw a further shrinkage of the damaged area. In this storm, damages were more limited to the northern section of the island just south of The Links. Significant damages tended to be more concentrated inland, with the section of Sheridan Boulevard between Lafayette Boulevard and Cummings Place continuing to see heavy flood damage. The northern shore of Baremore Quarters saw a larger concentration of damage than it did in previous storms.

The December 1992 storm was the second-most damaging storm in Brigantine of the last half-century in Brigantine. Storm damage was dispersed throughout the City. Like prior storms, damages were more heavily concentrated in The Links section and along Bayshore Drive. However, even a small number of oceanfront and dune-front blocks in the South end also saw significant damage. Damaged clusters echoed those of the 1984 storm.
For example, some structures in the vicinity of East Evans Boulevard east of their school saw damages in 1992 that were three to ten times higher than in 1984. The storm also saw widespread damage to the North Roosevelt Boulevard section of the Links, which had seen lighter damage during the 1992 storm.

Historic and Future Damage Estimates

Brigantine has seen a significant number of flood losses. Since 1977, approximately 3,200 properties in Brigantine have experienced approximately 4,200 losses. Properties experiencing losses equate to about one-third of all Brigantine's housing units, though flood losses include single structures of multi-family buildings as well as commercial properties.

Mapped flood losses in Brigantine show concentrations of areas with historic losses. These areas include:

- Waterfront properties along Ocean Drive West in the South End

- Properties along Atlantic-Brigantine Boulevard
- Beach Cove and Atlantis Cove in St. George's Thorofare
- The residential neighborhood just east of the Circle, with high concentrations in Marc Lane
- Residential areas between Brigantine Boulevard and the Bay
- Residential properties west of Beach Avenue North of 14th Street South
- The entirety of the North End and Links section of the island, particularly north of Roosevelt Boulevard and south of Caverty Drive

NFIP flood loss data was analyzed for nearly 2,000 properties based on data provided by FEMA. Superstorm Sandy was selected as a benchmark storm owing to the accessibility of data for storm impacts and its widespread impact. Superstorm Sandy is estimated to be a 60-year storm event based on water levels experienced in Brigantine.

The estimate's methodology was as follows:

1. Match property addresses with NFIP flood claims and values to Brigantine tax records.
2. Separate and sort data to make a table that shows NFIP payments sorted by year of construction and the number of such claims. Add together all of the claims for each year.
3. For each year, divide the total damage by the number of properties damaged by year built. This yields an average damage by year for each property.
4. Sort data into three categories: properties built before the City's floodplain management ordinance was enacted, properties built after the City's floodplain management ordinance was enacted, and properties built since the reference storm occurred. Exclude buildings for which there is only one built in a given year.
5. Using existing NFIP policy data, determine houses that have a negative elevation difference. Extract the address and elevation difference from this list to create a list of un-elevated properties. Match this list to the Year Built data and adjust for Base Flood Elevation calculations to create a list that sorts these properties by year and by elevation difference.
6. Multiply the average damage figure determined in Step 3 by the number of unelevated structures to determine the anticipated damages from a storm similar to Sandy. This can be repeated for storms at varying flood levels.

This methodology has limitations, including those associated with the use of NFIP and tax data. The numbers generated in this assessment should be used for estimation purposes only.

Properties built after 2013 yielded important data about buildings replacing those damaged by Superstorm Sandy. Structures that were demolished post-Sandy and reconstructed saw an average of $86,538 in damages per property. On the other hand, a Sandy-damaged property built after the enactment of the City's floodplain management ordinance in 1987 saw an average claim payment of approximately $13,000. A property built before this time saw an average NFIP payment of $41,890. More modern buildings saw even smaller losses-

damaged properties built between 2005 and 2012 saw a weighted average of approximately $10,500 in damages in the wake of Sandy.

NFIP-insured properties in Brigantine are typically located at or above the base flood elevation. As seen in the table below, NFIP-insured properties comprise just over a quarter of all policies in the City for which elevation data is available.

Figure 15: NFIP Policies in Brigantine by Elevation

Elevation Difference	Number of Policies	Percent of Policies	Value of Building	Percent of Total Insured Building
Above	2,475	58.5%	$792,938,200	58.1%
At	635	15%	$243,937,400	17.9%
Below	1,123	26.5%	$328,602,000	24%
	4,233		$1,365,477,600	

The following figures are derived from damages to properties with active NFIP policies with Sandy damage as of 2019. Clearly, properties built in the mid-century saw higher average damages than structures built more recently. A storm or flooding event at the same flood level of Superstorm Sandy (approximately eight feed NAVD 88) could thereby be expected to see the following average damages assuming no other mitigation measures are taken for properties.

Figure 16: NFIP Policies by Value and Number of Claims (Sandy)

Decade	# of Buildings	Value of Claims	Average
1900-1909	1	$ 1,891.58	$ 1,891.58
1910-1919	0	$ -	--
1920-1929	20	$ 779,854.23	$ 38,992.71
1930-1939	12	$ 826,572.47	$ 68,881.04
1940-1949	52	$ 2,578,778.78	$ 49,591.90
1950-1959	388	$ 15,329,031.85	$ 39,507.81
1960-1969	301	$ 16,611,348.70	$ 55,187.20
1970-1979	312	$ 14,254,562.90	$ 45,687.70
1980-1989	284	$ 5,185,464.28	$ 18,258.68

Decade	# of Buildings	Value of Claims	Average
1990-1999	103	$ 1,296,502.06	$ 12,587.40
2000-2009	129	$ 1,979,132.54	$ 15,342.11
Source: NJ MOD-IV Data (May 2019)			

Repetitive Loss Areas

Flood losses in Brigantine's Repetitive Loss Areas include approximately 328 properties and more than $6.8 million in losses. 177 structures in the repetitive loss area saw damage during Superstorm Sandy, totaling approximately $6.2 million, or close to seven percent of the value of all NFIP losses during Sandy. Properties in the repetitive loss area saw similar average losses ($35,042) and slightly lower median losses ($16,590) compared to the average and median losses of NFIP policies citywide following Sandy.

Nearly 123 of Brigantine's 178 repetitive loss properties were damaged during Superstorm Sandy. Of those properties, 47 have been mitigated and 75 remain unmitigated. Properties in Brigantine's Repetitive Loss Area, which include all repetitive loss properties, account for approximately $69.3 million in NFIP coverage.

Of the properties in the repetitive loss area for which NFIP coverage data is available, approximately two-thirds (129 properties) are above the BFE, 21 (or 10 percent of) properties are built at the BFE, and about one-quarter (or 51 properties) are below the BFE. The properties that are below the base flood elevation account for approximately 17 percent of the value of building coverage within the entire repetitive loss area.

Figure 17: NFIP Policies in the Repetitive Loss Area by Elevation

Elevation Difference	Number	Percent
Above	129	64.2%
At	21	10.4%
Below	51	25.4%
Total	201	

CHAPTER 9 – FLOOD HAZARD VULNERABILITIES

As described in the Risk Assessment, Brigantine faces four types of flooding with inter-related impacts:

1. Storm surge flooding (hurricanes, nor'easters, and other coastal storms): This entails flooding created by storm events that temporarily increase water levels beyond those anticipated from lunar tides.
2. Stormwater/rain flooding: This type of flooding is created by runoff that is not immediately discharged into adjacent waterways and instead creates temporary flooding impacts on streets and properties.
3. Nuisance flooding ("high tide flooding"): Nuisance flooding, which can occur as a surge or in combination with stormwater flooding, is a type of flooding that causes public inconvenience but is not necessarily connected to storm surge or stormwater events. This results from water levels increasing to the point that flooding impacts are visible and felt, yet water levels are high in relation to land due to relatively routine causes.
4. Future Flooding (Sea Level Change in combination with the prior three flooding types): Future flooding entails the impact of primarily sea level change in exacerbating the prior flooding types. Sea level is historically high and is projected to rise further. Increased water levels on a day-to-day basis will thereby increase flooding impacts for exceptional events as well as nuisance flooding.

For this plan, flooding is treated as a single hazard regardless of its cause.

9.1 Flood Hazard Exposure

The table below shows the risk assessment to buildings throughout the City at various flood levels. Superstorm Sandy surge reached nearly three-quarters of all buildings in the City, even though flood levels from the storm did not reach the base flood elevation. In many parts of the City, the base flood elevation is nine feet. A storm of such levels would inundate 92 percent of all buildings in the City.

Figure 18: Building Exposure to Flood Levels

	Approx. Elevation (Feet NAVD 88-MSL)	# of Buildings (2015)	% of Buildings (2015)
2015 Buildings		6,273	--
Superstorm Sandy *	7.8 (8)	4,697	74.8
Existing SFHA	9*	5,759	91.8
Mean Higher High Water	4.44		
* Sandy Surge was measured at 7.8 feet NAVD 88 at the Brigantine Channel but exposed far more buildings than sea level rise at similar elevations			

Risk Assessment: Building Inventory

The Special Flood Hazard Area includes 7,186 properties with buildings estimated at $1.054 billion. The vast majority of these properties are residential one-to-four-unit buildings, as well as three church properties and 103 commercial properties.

Figure 19: Special Flood Hazard Area, Properties and Values

Land Use	Number of Properties	Building Assessment
Vacant	201	$0
Residential (1-4 Units)	6,433	$972,131,400
Schools	2	$30,386,400
City/Public Property (includes riparian bulkheads)	416	$16,619,700
Churches/Charitable	3	$1,874,000
Exempt	24	$4,987,800
Commercial	103	$27,002,400
Multi-Family	4	1,012,600
	7,186	**$1,054,014,300**
Source: NJ MOD-IV Property Tax Data (2019)		

City structures in the SFHA include the following buildings. All City buildings are protected by its flood insurance policy:

Figure 20: City Structures in the SFHA

Location	Facility
Golf Course	1 Golf Course Drive
100 31st Street South	Recreation Center
100 Bayshore Avenue	Pumping Station
115 38th Street South	Utility Building
1417 W Brigantine Avenue	City Hall/Police/Fire
1425 Sheridan Boulevard	Pumping Station
1600 Ocean Avenue	Parking Lot/Beach
201 14th Street North	Pumping Station
201 15th Street South	County Library
203 Vernon Place	Pumping Station
215 14th Street South	Water Tower
223-231 14th Street South	Parking Lot
2519 Bayshore Avenue	Recreation Center/Boathouse
265 42nd Street South	Recreation Center
3519 Bayshore Avenue	Well
3605 Bayshore Avenue	Utility Building

Location	Facility
3625 Atlantic-Brigantine Boulevard	Museum
37th Street South	Utility Building
38th Street South	Utility Building
4201 Bayshore Avenue	Water Tower
42nd Street South	Recreation Fields
4300 Bayshore Avenue	Playground
530 Casa Drive	Administrative Building
518 Bayshore Avenue	Utility Building
Atlantic-Brigantine Boulevard	Lighthouse
Jenkins Parkway	Pumping Station
Putnam Place	Water Tower

The X Zone sees a much smaller number of properties and an overall smaller value of building improvements that is approximately proportional. The X Zone has less exposure for all property types.

Figure 21: X-Zone Properties and Values

Use	Number	Value
Vacant Properties	14	$0
Residential	2,174	$240,668,500
City Property	10	$358,400
Church/Charitable	2	$1,668,400
Other Exempt	5	$432,900
Commercial	11	$3,497,900
Multi-Family	1	$348,800
	2,217	**$246,974,900**
Source: NJ MOD-IV Property Tax Data (2019)		

Development, Redevelopment, and Ecological Trends

Brigantine is a largely built-out community with limited land availability for development. Between 2000 and 2017, the estimated number of housing units was estimated to increase from 9,304 units to 9,666 units even as the City's population has declined significantly in the same time. Brigantine's developed "footprint" has remained largely the same since the 1970s, when beachfill and landfill patterns were locked in place with shore protection structures and the advent of environmental regulations. Those actions resulted in the significant loss of significant amounts of saline marshes and dune ecosystems and created spillover impacts to surrounding ecosystems and barrier islands.

The South Jersey Transportation Planning Organization has produced estimates for Brigantine's population through 2040. These estimates, last revised in 2016, indicate a

population that grows and shrinks very slightly through 2040 and the number of households increases- indicating a smaller household size moving into the future. The US Census Bureau estimates that Brigantine's population has decreased by 2017 to be 9,164 residents- indicating that so far, the SJTPO estimates overstate the population levels. Employment is also estimated to remain stable moving into the future. It is anticipated that the City's population will further shrink owing to a combination of rising coastal home prices, inundation of low-lying areas, the still-rising seasonal home market, and larger trends indicating a decrease of year-round residents living in coastal areas.

Figure 22: SJTPO Population and Employment Projections (2015-2040)

	2015	2020	2025	2030	2035	2040
Population	9,400	9,500	9,600	9,600	9,600	9,500
Households	4,400	4,600	4,800	4,900	5,000	5,100
Population in Households	9,500	9,600	9,700	9,800	9,800	9,700
Employment	2,800	2,800	2,800	2,800	2,800	2,800
Source: https://www.sjtpo.org/wp-content/uploads/2016/07/Appendix-C-Demographic-Forecast-7-25-2016-Final.pdf						

The creation of the North Brigantine Natural Area and regulations protecting the dunes and wetlands surrounding the City have set strict boundaries for development. Since the 1970s, most of Brigantine's population and development growth have occurred within the existing "built-up" portion of the City.

Any future growth in Brigantine will likely be through redevelopment rather than through outward development. The protection of sensitive lands and lack of availability of larger properties means that existing and vacant properties will be redeveloped. There are virtually no large vacant lands available for development in the City owing to environmental constraints and the lack of large parcels. The City's zoning regulations preserve existing neighborhood character with the intent of reducing density. Though the City saw relatively rampant development in the mid-Twentieth century, much of it has slowed as the island built-out and the City adopted growth management policies. Beginning in the early 2000s, several prominent trends became noticeable:

- Multi-family properties declined in number and were redeveloped into lower-density housing units. Large-scale and multi-family developments do not have favorable zoning.
- Storm damages from Superstorm Sandy accelerated a trend that has been pervasive across the Jersey Shore. This trend is the replacement of older, smaller, and less expensive properties with much larger residential units (many of which are single family). The older homes, which were not built to flood standards, contribute significantly to flood losses experienced in the community.
- Simultaneously, the development of larger properties reflects a trend of increasing rates of second homeownership. Though Brigantine has long been a year-round community, rates of home vacancies have increased as year-round residents

decamped owing to unfavorable economic conditions and rising home prices. This has reduced the number of people living in the floodplain in Brigantine.
- Single properties on oversize lots have subdivided, creating several additional new residential properties where one existed previously.

These recent trends have been facilitated by the City's zoning and changing preferences of homebuyers and developers. Preferences in the direction of larger homes and living spaces and the discouraging of higher density throughout the City have essentially locked in the trends described previously.

According to May 2019 tax records, Brigantine has approximately 215 vacant properties- of which 63 were recently demolished. Approximately 190 of Brigantine's 215 vacant properties are anticipated to be developable. The majority of these parcels are located in the Special Flood Hazard Area. Eighty percent of developable vacant parcels are residentially zoned, whereas 20 percent are zoned for commercial/business use. The R-2, R-2A, and R-3 zones comprise many of the residentially zoned vacant properties and permit almost exclusively single-family dwellings on lots between 3,600 and 5,400 square feet in size. Maximum building and site coverages are 40 percent and 60 percent, respectively. There are few privately-owned, large vacant sites in the City.

Redevelopment will likely occur at existing commercial properties. The City recently completed three redevelopment studies that will facilitate some redevelopment on the island:

1. Waterfront Study Area: This redevelopment designation will facilitate the replacement of private bulkheads throughout the City.
2. Civic Center Study Area: This redevelopment designation will replace the unused Civic Center with housing.
3. North End Study Area: This redevelopment designation will replace the now-demolished Rod & Reel bar with housing.

On the whole, development and redevelopment in the City will likely continue resulting in larger residential properties that are compliant to the City's flood standards (which exceed NFIP requirements). These structures will continue to replace structures built before Brigantine's flood ordinance was adopted and those that generate substantial flood losses. While this will have the impact of providing individual property protection for future homeowners, the value of properties in the SFHA will increase and the number of housing structures in the flood zone will likely stay the same or increase. Residual risk will remain for extreme flooding events and for sea level rise, which will be discussed elsewhere in this plan. However, development and redevelopment will likely have a beneficial impact on reducing flood damage risk by replacing non-compliant structures with safer, elevated, and floodproofed structures that will exhibit fewer flood damages compared to older structures.

Specified Flood Hazard Impact – Life Safety

Flooding has multifarious impacts on life safety. Flooding in of itself poses dangers for drownings and entrapment and injury caused by damaged buildings. As an island community, these impacts are pronounced on Brigantine where discrete geographic vulnerability and limited access through a similarly vulnerable geographic area (Atlantic City) heighten the risk and the ability for first responders and emergency workers to address the threats. Brigantine's vulnerability to flood hazard for evacuation became apparent during Superstorm Sandy, when approximately 70 percent of Brigantine's residents were estimated to remain during the storm despite a mandatory evacuation order. Prior to and during the storm, evacuation was hampered owing to flooding at the bridge heading into the City.

The Brigantine Boulevard flooding vulnerability is a challenge for rescue operations because transporting victims and evacuees from the island may not be possible by ground transportation, thereby resulting in the need for airlifts or boat rescues. There are no designated in heliports in Brigantine, though several are available in Atlantic City. Several large park fields or parking lots in the City may serve as temporary heliport facilities if needed.

Brigantine is in close proximity to the AtlantiCare Regional Medical Center in Atlantic City, which is a Level 2 Trauma Center. The hospital's location in Atlantic City is on high ground surrounded by a Special Flood Hazard Area and faces vulnerabilities for flooding. Additional nearby hospitals are located at Shore Memorial Hospital in Somers Point, Hackensack Meridian Health Southern Ocean Medical Center in Manahawkin, and the AtlantiCare Regional Medical Center in Pomona.

Being the only bridge connecting the City to the mainland, the Haneman Bridge and Atlantic Brigantine-Boulevard leading to the bridge remain the most critical vulnerabilities for evacuation. The elevation at the foot of the bridge upon arriving in Brigantine is approximately seven feet.

Leaving Brigantine, the roads approaching Lighthouse Circle as well as Bayshore Avenue and Harbor Beach Boulevard have heights of four and five feet. Brigantine Boulevard between Lighthouse Circle and the intersection with Harbor Beach Boulevard have elevations of seven and eight feet, though in the vicinity of the intersection with Edgewater Drive the roadbed decreases in elevation to about four to five feet and then increasing to ten feet heading southwest towards Atlantic City.

Brigantine has a full-time police force and fire department. The Police Department and Fire Department are located with City Hall at 1417 West Brigantine Avenue near the center of the inhabited portion of the island. As of 2018, the Fire Department was comprised of 34 firefighters, two engines, two ambulances, an aerial apparatus, a quick attack truck, and two additional vehicles.

Prior to the arrival of Superstorm Sandy, Brigantine officials did not intend to have a shelter on the island. However, the Brigantine Community Center on 42nd Street South eventually did serve as a shelter for nearly 200 people during the storm. The building is located on high ground outside of the designated 100-year and 500-year flood zones. Sandy surge – between five and six feet MHHW - did not reach the building but did reach the parking lot in front of the building. Based on flooding data from the NJ Adapt Flood Mapper, storm surge would have to reach eight feet above MHHW.

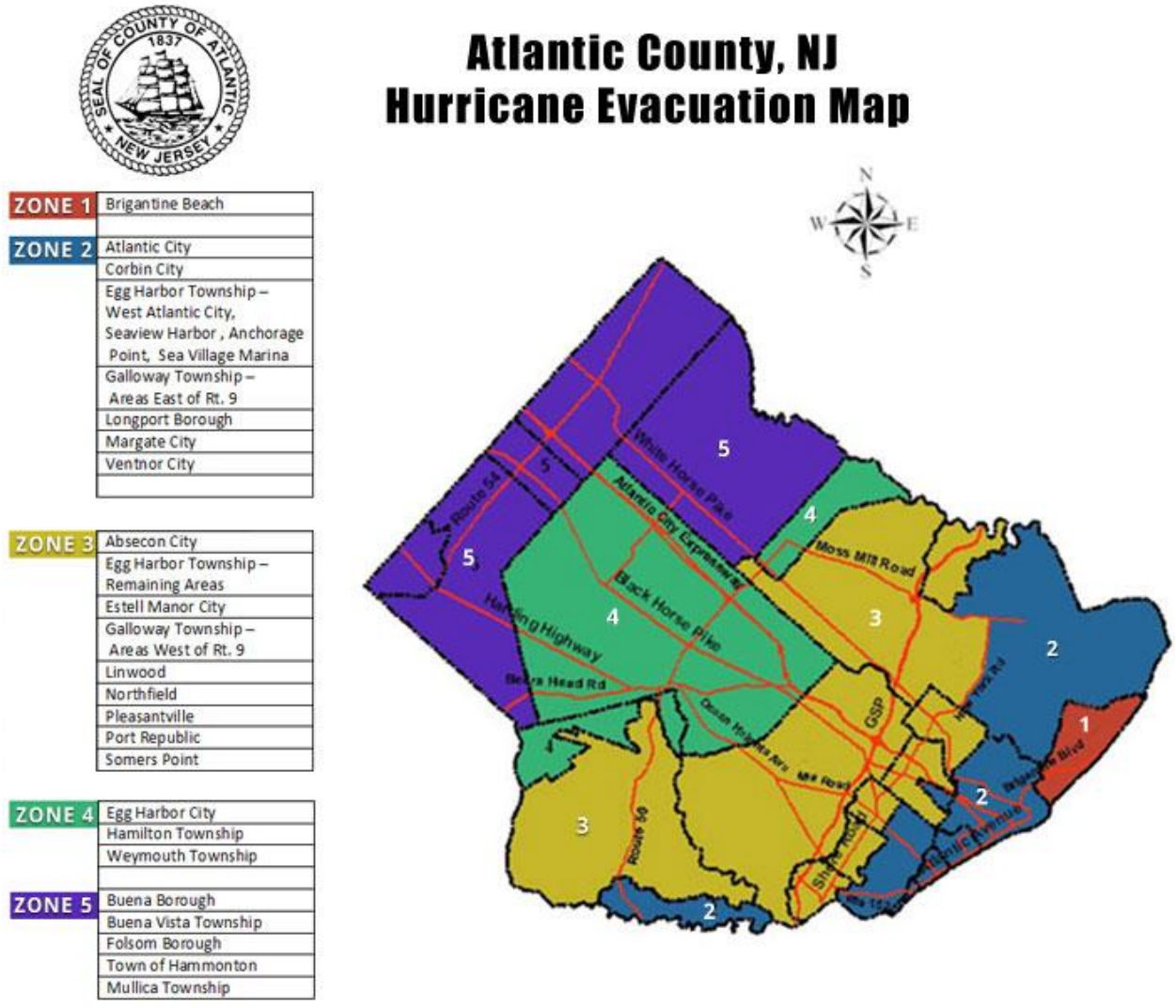
Brigantine's Office of Emergency Management executes the City's Emergency Operations Plan in coordination with partners such as Atlantic County and activates an Emergency Operation Center during major disasters. Additionally, the Office of Emergency Management has posted maps on its website that show flood depth hazard and flood stages. The City also uses a CodeRed reverse 9-1-1 system to inform residents of flooding threats. Visitors can be informed of flood threats through emergency alerts via cell phones, as well as by manual warning through the City's emergency services.

Map 3: Evacuation Routes in Atlantic County

As previously described, Brigantine has a single four-lane road leading on and off the island. This road is State Route 87, which begins at Route 30 in Atlantic City and continues to County

Route 638 on the Atlantic City-Brigantine border nearly 1,250 feet east of the bridge. Though located on higher terrain in some areas, the road is subject to flooding, and will begin shallow flooding at 3 feet MHHW of inundation in the area of Brigantine near Edgewater Drive, where the road makes an eastern curve heading into the City. This flooding will substantially worsen with four and five feet of inundation and will begin impeding access on the Atlantic City side of Route 87.

Map 4: Hurricane Evacuation Map



Unlike Brigantine, Atlantic City has several evacuation routes off of the island. However, Brigantine is fully dependent upon the availability of Atlantic City's evacuation routes for a safe evacuation. Route 30, the closest inland route from Brigantine, is generally free of inundation at 3 feet MHHW from the island to the Delilah Road Overpass. North of the overpass into Absecon, Route 30 begins experiencing inundation. At 4 feet MHHW, Route 30 in Atlantic City is substantially inundated, necessitating the use of the Atlantic City

Expressway out of the City. Though this route is mostly clear of inundation, some low-lying areas near the tunnel and Marina Boulevard may begin seeing shallow flooding. At 5 feet MHHW, the Expressway and access to it are substantially impeded by floodwaters.

Atlantic County has five designated evacuation zones for municipalities within the County. Each municipality is designated by degree of exposure to hurricane impacts, particularly flooding. Brigantine is currently classified as the only "Zone 1" hurricane evacuation area in the County. This designation reflects Brigantine's considerable exposure to flooding impacts, and its single point of egress off the island and into Atlantic City. In Atlantic City, Brigantine's evacuation route to the mainland crosses through the Special Flood Hazard Area in multiple locations. These compounds the difficulty of safely evacuating the City in the case of a hurricane or coastal storm.

Brigantine's evacuation difficulties are further compounded by its second home and visitor population. Though Brigantine's permanent population currently hovers around 9,000 residents, the South Jersey Transportation Planning Organization (SJTPO) estimates that the City's peak summer weekend visitor and household population to be more than 42,000 people, and between 30,000 and 32,000 people on summer weekdays. Based on prior damaging storms, evacuations are more likely to be triggered in the off-season when nor'easters are more likely to occur rather than during the peak of summer. However, the scale of evacuation needs – particularly in the context of Absecon Island's potential evacuee population – is significant. Currently, Route 87/CR638 sees daily traffic between 20,000 and 30,000 vehicles per day depending on the season. Based on the estimated household size (2.2 persons/household) in Brigantine, it is feasible that the island's peak population could be fully evacuated within a one or two-day period. Given the prediction abilities for coastal storms, the existing evacuation capacity would appear to be sufficient for the City.

Specified Hazard Impact – Public Health

Flooding in Brigantine presents major public health impacts for Brigantine residents. While flooding conditions are inherently dangerous for life and safety, the after-effects of flooding can have widespread impacts upon public health. Disruption of access to mental and physical health providers in the wake of flooding can further exacerbate these impacts.

In the aftermath of flooding, life safety is threatened by structural damage caused by flooding as well as impacts to utilities. A lack of heat, electricity, clean water, communication services, and water treatment owing to disrupted utility services can be particularly harmful for those living in properties after a flood has occurred. Medical devices that require electricity will likely stop functioning during a flooding disaster, particularly in properties lacking mitigation.

Mold remaining in properties after a flood also poses a significant risk owing to its transferability and pervasiveness, particularly in wet environments. Mold can wick higher than the waterline and will permeate porous surfaces- including materials with fabric, drywall, carpeting, and even appliances with insulation. Mold poses threats to vulnerable

groups such as infants and children, pregnant women, and those with compromised respiratory systems. Treating mold will often require professional cleaning.

Disasters such as major floods pose major mental health risks such as post-traumatic stress disorder, anxiety, and depression. These conditions can be amplified in the wake of a disaster as a return to pre-disaster living conditions seems unachievable or distant to those that have experienced loss. After Superstorm Sandy, mental health organizations

Sea level rise and chronic inundation will further threaten physical health by resulting in disruption of essential services like roads and utilities. Nuisance flooding will likely render various streets inaccessible at times of high flood levels, which will pose disruptions for residents and first responders.

Specified Hazard Impact – Critical Facilities and Infrastructure

Critical facilities in Brigantine are those that contribute to the basic functions of the community – both infrastructural and social. Seven types of critical facilities are identified in the City. These include:

1. Government- Facilities that house government operations, including postal and emergency services.
2. Marina- Upland facilities that provide dedicated water access for vessels of various sizes. These facilities could be necessary for evacuation or the delivery of supplies in the case of limited road access.
3. Park/Natural Area- Facilities that provide recreational or ecological functions.
4. Retail- Facilities that provide opportunities for the provision of basic goods, including pharmacies, grocery stores, and fuel.
5. School- Educational facilities owned by the local school board.
6. Social- Facilities that provide spaces for assembly, inclusive of religious and fraternal uses.
7. Utility- Facilities that provide utilities functions, inclusive of electricity, natural gas, potable water, telecommunication, and wastewater services.

In 2012, Superstorm Sandy caused damaged to a number of critical facilities. Electrical and hydraulic damage to various City pump stations cost $353,000 to replace, including wholesale equipment replacement and cleaning. Storm sewer repairs cost $51,000, street repairs cost $136,000, and estimated damages to bulkheads reached nearly $400,000.

As a policy, all new and substantially improved, city-owned critical facilities will be elevated or floodproofed to the 500-year flood level. Non-city owned buildings will be elevated or floodproofed pursuant to the City code. Relocation of critical facilities out of the floodplain is not currently feasible owing to lack of land availability. Even though the City has areas of higher elevation, the entire island is vulnerable to the disruption of critical facilities owing to flooding.

Brigantine's marinas will need to continue to be located in high-hazard and special flood hazard areas owing to the need for water access. Retail facilities will continue to be located in lower-elevation areas with lower land values owing to the higher value of property closer to the beach and on high ground. In the future, utility uses may seek higher ground owing to the need to provide continuity of services. However, as evidenced by the recent elevation of various pump stations, the in-situ elevation of existing facilities currently provides the most cost effective and feasible approach to protecting the facilities.

Brigantine's Coastal Vulnerability Assessment completed in 2017 identified the Community Assets and Critical Facilities listed in the table below. The table also shows the lowest elevation nearest to the critical facility to demonstrate vulnerability during a flooding event. Elevation is approximate for the lowest portion of the property near the building. It is approximate and should not be used to substitute the actual building height. Note that just because a water level reaches the height listed here does not mean that the structure floods at that height.

Figure 23: Height of Critical Facilities

Name/Address	Hazard Type	Type	Height NAVD88
Absecon Wildlife Management Area	No development-marshlands and coastal wetlands. Vulnerable to subsidence/drowning. Rate of salt marsh accretion may be superseded by rate of relative sea level rise.	Park/Natural Area	0
Ace Hardware 3116 Atlantic-Brigantine Blvd.	Building not elevated or floodproofed.	Retail-Hardware/Essential goods	6
ACME Market 4236 Harbor Beach Blvd	Building is elevated or on locally higher terrain.	Retail-Groceries/Essential goods	6
American Legion 3218 W Brigantine Ave	Building not elevated or floodproofed.	Social-Organization	6
Bob's Marine 486 W Shore Drive	Building not elevated or floodproofed. Waterfront location subject to wave action and inundation from low topography.	Marina	4
Brigantine Auto and Marine 226 33rd Street South	Building not elevated or floodproofed.	Retail-Automotive	6

Name/Address	Hazard Type	Type	Height NAVD88
Brigantine Beach Patrol 1600 Ocean Avenue	Building elevated near dunes on higher ground.	Government-Emergency Services	11
Brigantine Bible Church 103 Bayshore Avenue	Building not elevated or floodproofed. Located in low area.	Social-Religious	4
Brigantine Community Center 265 42nd Street	Building located on high ground. Served as shelter during and after Sandy.	Government-Amenity/Shelter	9
Brigantine Library 201 15th Street South	First floor located at grade and subject to inundation. Historic building.	Government-Amenity	6.5
Brigantine Elementary School 301 E Evans Blvd	Building may not be elevated to standards and is located in a low area.	School	5
Brigantine Elks Lodge 400 W Shore Drive	Waterfront building in low area and vulnerable to wave action and inundation.	Social-Organization	5.5
Brigantine Lighthouse Block 2910/Lot 1	Landmark property on locally high terrain surrounded by lower roadway area.	Park/Natural Area-Landmark	6
Brigantine North Middle School 301 E Evans Blvd	Newer, elevated school building located in lower area of the City. Access to building is hindered during a flood event.	School	6.3
Brigantine Police, City Hall, Fire Department 1417 W Brigantine Avenue	Unelevated building on slightly higher terrain.	Government-Emergency Services/Administration	7.5
Brigantine Public Works 3605 Bayshore Avenue	Critical operations center for Public Works and water department located in low area of the City.	Government-Essential and Utility- Water Provision	6.5
Brigantine Sewer/Lift Stations 201 14th Street North	Sewer facility located in the lower-elevation	Utility- Sewer	6

Name/Address	Hazard Type	Type	Height NAVD88
	North End. Located near critical erosion area.		
Brigantine Sewer/Lift Stations 1425 Sheridan Blvd	Lift station located near Golf Course I area of low elevation.	Utility- Sewer	4
Brigantine Sewer/Lift Stations Putnam Place	Lift station located near school in area of especially low elevation.	Utility-Sewer	4.5
Brigantine Sewer/Lift Stations 100 Bayshore Avenue	Utility building located in low elevation area.	Utility- Sewer	6
Brigantine Sewer/Lift Stations 215 14th Street South	Utility building located in low elevation area.	Utility- Sewer	6
Brigantine Sewer/Lift Stations 4201 Bayshore Avenue	Utility building located in low elevation area.	Utility- Sewer	6
Brigantine Sewer/Lift Stations 111 38th Street South (ACUA)	Utility building located in low elevation area.	Utility- Sewer	6
Brigantine Sewer/Lift Stations 3519 Bayshore Avenue	Utility building located in low elevation area.	Utility- Sewer	5.5
Brigantine Sewer/Lift Stations 240 Hagen Road	Utility building located in low elevation area.	Utility- Sewer	6
Community Presbyterian Church 1501 W Brigantine Avenue	Religious facility located on slightly higher ground near the center of the island.	Social-Religious	7
CVS 3123 Atlantic-Brigantine Boulevard	Building and parking lot significantly sloped upward to approximately 8.5 feet	Retail-Essential goods	4.3
Deebold Boat Yard 434 W Shore Drive	Waterfront property vulnerable to inundation and wave action.	Marina	4.2
Fish Finder Marine 3645 Atlantic-Brigantine Blvd	Waterfront property vulnerable to inundation and wave action.	Marina	5.2
Harbor Beach Substation 4205 Bayshore Avenue	Substations located in low-lying areas and part of Atlantic City Electric upgrades.	Utility-Electricity	5.1
Harbor Beach Substation 1312 W Beach Avenue	Substations located in low-lying areas and part of Atlantic City Electric upgrades.	Utility-Electricity	5.3

Name/Address	Hazard Type	Type	Height NAVD88
Temple Beth Shalom 4419 W Brigantine Avenue	Religious facility located on higher land	Social-Religious	8.5
Jolly Roger Marina 3101 Bayshore Avenue	Waterfront property vulnerable to inundation and wave action.	Marina	5.3
Marine Mammal Stranding Center 3625 Atlantic Brigantine Blvd	Waterfront marine mammal rehabilitation center located in low-lying Lighthouse District.	Social-Veterinary	5.5
North Brigantine State Natural Area 14th Street North	Preserved natural area with significant recreational use. No structural flooding protection- vulnerable to storm events.	Park/Natural Area-Ecosystem Services	0
North Point Marina 1225 E Shore Drive	Waterfront property vulnerable to inundation and wave action. Street and boat yard are at an especially low elevation.	Marina	3.5
Shark Park 2500 W Brigantine Avenue	Large City park located in area of higher elevation.	Park/Natural Area-Landmark	7
Conoco Gas Station 4012 Atlantic Brigantine Blvd	One of the few gas stations remaining on the island located near low area at high profile intersection.	Retail-Essential goods	5.5
St Thomas the Apostle Church 331 8th Street South	Religious institution located on higher ground and threatened by extreme flooding events.	Social-Religious	9
The Links 1075 N Shore Drive	City-owned golf course with drainage features. Subject to frequent inundation due to low elevation.	Park/Natural Area-Landmark	0
Post Office 4326 Harbor Beach Boulevard	Federal government facility located in area of higher elevation across from St. George's Thorofare.	Government-Essential Services	7

Name/Address	Hazard Type	Type	Height NAVD88
VFW 121 31st Street South	Social facility located in low-lying Lighthouse District.	Social-Organization	5

Map 5: Critical Facilities Heights

Specified Hazard Impact – Economy and Employers

Brigantine's year-round is best characterized as double-edged: providing tourism services and government administration connected to the tourism economy. As of July 2019, approximately 900 residents (or one-fifth of its 2017 labor force) work in Atlantic City's casinos. Many residents also work in the accommodations/food services industry that are influenced by the Atlantic City region's tourist/gaming economy. The public sector looms large in Brigantine's economy through the provision of education and public service professions.

According to 2019-2013 American Community Survey commuter flows, Brigantine is home to approximately 4,700 commuting workers and 2,000 people commuting to Brigantine for work (half of which are commuting within the City). These numbers have likely decreased within the economic downturn in Atlantic County and massive layoffs at the casinos.

Brigantine's economy is tightly related to Atlantic City and its reliance on tourism, including providing for seasonal residents. The plurality of Brigantine workers (about one-third) commute to Atlantic City, and about one-fourth work in the City itself. Other residents commute to nearby communities, and about five percent commute to Philadelphia or Cherry Hill. Local government (including the school district) are responsible for the majority of wages paid in the City and close to one-third of all jobs. The retail trade, health/social industry, and food/accommodations industries also provide a large number of jobs and relatively smaller wages.

Figure 24: Employment in Brigantine

NAICS Sector	Description	Establishments	Jobs	Total	Annual Average Salary
	Federal Government	2	8	$371,252	$45,000
	Local Government	2	336	$22,602,263	$67,285
61	Local Government Education	1	133	$9,491,597	$71,545
23	Construction	27	80	$3,735,077	$46,933
31	Manufacturing	.	.	.	.
42	Wholesale Trade	.	.	.	.
44	Retail Trade	18	244	$5,691,838	$23,367
48	Transp/Warehousing	.	.	.	.
51	Information	.	.	.	.
52	Finance/Insurance	.	.	.	.
53	Real Estate	4	13	$537,441	$40,308
54	Professional/Technical	.	.	.	.
56	Admin/Waste Remediation	.	.	.	.

NAICS Sector	Description	Establishments	Jobs	Total	Annual Average Salary
61	Education	.	.	.	.
62	Health/Social	17	332	$7,789,667	$23,492
71	Arts/Entertainment	10	29	$505,100	$17,171
72	Accommodations/Food	21	331	$5,131,289	$15,499
81	Other Services	25	110	$2,289,492	$20,798
99	Unclassified	.	.	.	.
	PRIVATE SECTOR TOTALS	159	1,302	$29,392,019	$22,572

Source: NJ Division of Labor and Workforce Development. Figures derive from 2018 unemployment tax data. Data reflects economic activity in Brigantine, not residents who live in the City.

The past two decades in Atlantic County have been instructive for understanding the relationship between the regional economy and that of the region's flooding vulnerability. The region suffered with the national economic recession in the late aughts, and then experienced a double-dip recession caused by casino closings in the mid-2010s. By 2010, shore towns such as Brigantine lost significant portions of their population owing to the real estate/second-home boom and bust. When Superstorm Sandy struck in 2012, shore communities had already been experiencing out-migration. When the casino industry took a turn in the following years, Sandy-damaged homes became foreclosed and abandoned. Sandy reconstruction saw a minor building boom as the tourist economy helped to sustain communities that were suffering with casino closings.

Though the impact of chronic and increased flooding remains to be seen, it is clear that Brigantine's natural assets continue to be an economic lifeblood as well as its biggest threat. Chronic and storm flooding will likely be more disruptive to businesses heading into the future. For example, dining establishments and shops located at grade will need to invest in floodproofing to avoid costly damages to equipment and inventory. Impacts to local government and education may be manifest in disruption to commutes and the need to relocate or floodproof existing facilities.

This will highlight the need to mitigate chronic flooding conditions and adapt the City to support a more water-based economy and way of life. Elevations of roadways in business districts, hardening of marinas, and floodproofing of commercial properties will be required to sustain commercial activity on the island. The largest unknown is whether inundation resulting from sea level change will result in either a hardening and preservation of the existing number of homes, residents, and visitors or whether inundation leads to retreat from the island, which would lead to a decrease.

With no large-scale employers in the City besides the City government and schools, the City will likely see its status as a residential community/bedroom suburb retained vis-à-vis its place in the regional economy. For tourists and second homeowners, the expectation to

retain island-based commercial activity such as shopping and dining will likely remain even as the number of year-round residents continues to decline.

9.2 Flood Hazard Vulnerabilities

Brigantine Seawall

The existing Brigantine Seawall was constructed in the early 1990s as a result of a joint shore-protection effort by the City of Brigantine, County of Atlantic and the State of New Jersey. The seawall extends along the easterly right-of-way of Brigantine Avenue from 9th Street North to 15th Street North. It has protected the adjacent properties from coastal storms while the promenade on the seawall provides for passive recreation year-round.

The City requested that the US Army Corps of Engineers consider extending the seawall northward approximately 275 feet. This area was subject to extensive erosion during coastal storms and severely impacted during Superstorm Sandy. In fact, several homes in this area were severely damaged during Superstorm Sandy as waves from the Atlantic Ocean breached the area north of the seawall.

The requested extension of the seawall will serve to protect public infrastructure and 12 single-family homes between 14th Street North and 15th Street North and will also protect nine single-family homes approved for construction on the vacant tract between 14th Street North and 15th Street North west of the existing homes.

Figure 25: Brigantine North End Erosion Photo

Figure 26: North End Flooding Damage

Figure 27: Storm Surge at the Brigantine Seawall

Bulkhead Gaps

Brigantine's bulkheads are crucial flood protection structures along the City's bayfront. Bulkheads are critical for retaining fill, mitigating wave damage, and preventing overtopping storm surge and tidal heights. Bulkheads typically comprise wooden or vinyl pilings driven into the shoreline.

Bulkheads are a necessary and often unwieldy tool in the floodplain management toolkit. Unlike levees and other flood control structures, after initial installation they are replaced and maintained in piecemeal owing to their ownership and regulation. A bulkhead at an individual's property is typically not sufficient to protect property because it is not acting as a floodwall or structural mitigation, but instead functions as part of a patchwork of individual flood control projects. A property owner installing a bulkhead on his or her own property sufficient to exceed wave heights from the design storm is still at risk of inundation owing to lower bulkheads on either side of the property or in the general vicinity.

Though bulkheads in of themselves are not sufficient for mitigating flood risk to individual properties, they are critical for overall flood protection. Gaps in bulkheads are understood to be major threats to inundation and flooding in Brigantine, particularly in areas where individual bulkheads are too low and have not been maintained.

Much of Brigantine's bayfront has some kind of bulkhead. Known gaps exist at the 26th Street South bayfront boat ramp, the aforementioned North End seawall, the 13th Street North bayfront, and in portions of the south end along Lagoon Boulevard.

Stormwater Flooding

Brigantine is prone to stormwater flooding resulting from rainfall events. In conjunction with high tides, stormwater flooding acts as a major nuisance and quality of life issue. Brigantine's drainage system collects runoff from City streets via inlets and discharges it into the bays through check valves and drainage systems built into the bulkhead. Though this system works in typical circumstances, flooding events, debris clogs, and increasingly intense rainfalls inhibit the ability of stormwater to be channeled to the bay. Brigantine has several areas where nuisance stormwater flooding is prevalent and exacerbated owing to a lack of stormwater inlets in some areas, such as those in the vicinity of 20th Street South and 38th Street South. Older drainage systems such as those in the vicinity of The Links golf course may be ill equipped to handle existing development and drainage patterns.

Stormwater flooding is addressed in more detail in the City's Watershed Master Plan, which is being worked on concurrent with this document.

CHAPTER 10 – CLIMATE CHANGE CONSIDERATIONS FOR FLOODPLAIN MANAGEMENT

This chapter presents an overview of current understandings about flooding and its relationship to climate change.

10.1 What is climate change?

Climate, consisting of patterns of temperature, precipitation, humidity, wind and seasons, plays a fundamental role in shaping natural ecosystems and the human economies and cultures that depend on them. "Climate change" refers to changes over a long period of time. Worldwide, average temperatures have increased 1.4ºF since 1880 (NASA, 2015). Although this change may seem small, it can lead to large changes in climate and weather.

The warming trend and its related impacts are caused by increasing concentrations of carbon dioxide and other greenhouse gases in the earth's atmosphere. Greenhouse gases are gases that trap heat in the atmosphere, resulting in a warming effect. Carbon dioxide is the most commonly known greenhouse gas; however, methane, nitrous oxide and fluorinated gases also contribute to warming. Emissions of these gases come from a variety of sources, such as the combustion of fossil fuels, agricultural production and changes in land use. According to the U.S. Environmental Protection Agency (EPA), carbon dioxide concentrations measured about 280 parts per million (ppm) before the industrial era began in the late 1700s and have risen 43 percent since then, reaching 399 ppm in 2014 (see Figure 9-1). The EPA attributes almost all of this increase to human activities (U.S. EPA, 2015).

10.2 How Climate Change Affects Floodplain Management

An essential aspect of floodplain management is predicting the likelihood of flooding in a planning area. Typically, predictions are based on statistical projections from records of past events. This approach assumes that the likelihood of flood events remains essentially unchanged over time. Thus, averages based on the past frequencies of floods are used to estimate future frequencies: if a river has flooded an average of once every five years for the past 100 years, then it can be expected to continue to flood an average of once every five years. But the assumption that future flooding behavior will be equivalent to past behavior is not valid if climate conditions are changing.

Climate involves not only average temperature and precipitation but also the frequency and intensity of extreme weather events. The frequency of flooding will not remain constant if broad precipitation patterns change over time. While predicting changes in flood events under a changing climate is difficult, understanding vulnerabilities to potential changes is a critical part of estimating future climate change impacts on human health, society and the environment. For this reason, an understanding of climate change is pertinent to floodplain management activities. Information about how climate patterns are changing provides insight on the reliability of future flooding projections used in mitigation analysis.

Climate change will affect the people, property, economy and ecosystems of our region in a variety of ways. Its impacts are most frequently associated with negative consequences and increased risk, such as increased flooding or increased heat-related public health concerns. The most important effect for the development of this plan is that climate change will have a measurable impact on the occurrence and severity of flooding. This chapter summarizes current understandings about climate change in order to provide a context for the recommendation and implementation of flood hazard mitigation measures in our region.

10.3 Current Global Indications of Climate Change

The major scientific agencies of the United States—including the National Aeronautics and Space Administration (NASA) and the National Oceanic and Atmospheric Administration (NOAA)—agree that climate change is occurring. Multiple temperature records from all over the world have shown a warming trend, and the Intergovernmental Panel on Climate Change (IPCC) has stated that the warming of the climate system is unequivocal (IPCC, 2014). Of the 10 warmest years in the 134-year record, all but one (1998) occurred since 2000, and 2015 was the warmest year on record (NASA, 2016). Worldwide, average temperatures have increased 1.4ºF since 1880 (NASA, 2016). Rising global temperatures have been accompanied by other changes in weather and climate. Many places have experienced changes in rainfall resulting in more intense rain, as well as more frequent and severe heat waves (IPCC, 2014). The planet's oceans and glaciers have also experienced changes: oceans are warming and becoming more acidic, ice caps are melting, and sea levels are rising (NASA, 2016). Global sea level has risen approximately 6.7 inches, on average, in the last 100 years (NASA, 2016). This has already put some coastal homes, beaches, roads, bridges, and wildlife at risk (USGCRP, 2009).

10.4 Projected Future Impacts

10.4.1 Global Projections

Scientists project that Earth's average surface temperature will continue to rise between 0.5ºF and 8.6ºF by 2100 (IPCC, 2014). Some research has concluded that every increase of 2ºF in average global average temperature can have the following impacts (NRC, 2011b):

- 3 to 10 percent increases in the amount of rain falling during the heaviest precipitation events, which can increase flooding risks
- 5 to 10 percent decreases in stream flow in some river basins.

The amount of sea level rise expected to occur as a result of climate change will increase the risk of coastal flooding for millions to hundreds of millions of people around the world, many of whom would have to permanently leave their homes (IPCC, 2014). By 2100, sea level is expected to rise another 1 to 4 feet, with an uncertainty range of 0.66 to 6.6 feet (Melillo et al., 2014). Rising seas will make coastal storms and the associated storm surges more frequent and destructive. Flooding may also become more intense even in areas where

precipitation is expected to decline (Melillo et al., 2014). What is currently termed a once-in-a-century coastal flooding event could occur more frequently.

10.4.2 Projections for the Jersey Shore

The historical rate of sea level rise along the New Jersey coast over the past half-century was 0.14 inches/year, while predicted future rates are expected to increase to 0.5 inches/year. The 2007 report from the Intergovernmental Panel on Climate Change projects that the world's oceans will rise from 8 inches to 2 feet by the end of the century. This means that by 2050, sea level is expected to rise by approximately 1 foot, and by 2100, sea level is projected to rise about 3 feet along the Jersey Shore (Figure 17).

Sea level rise in New Jersey is attributed to several factors. While global climate change is a key determinant, land subsidence attributes to New Jersey's rate of sea level rise being faster than the global average. Furthermore, sediment compaction in New Jersey's coastal region resulting from groundwater withdrawal and other natural processes added four additional inches of relative rise over the last century to the 12-inch rise experienced at bedrock locations.

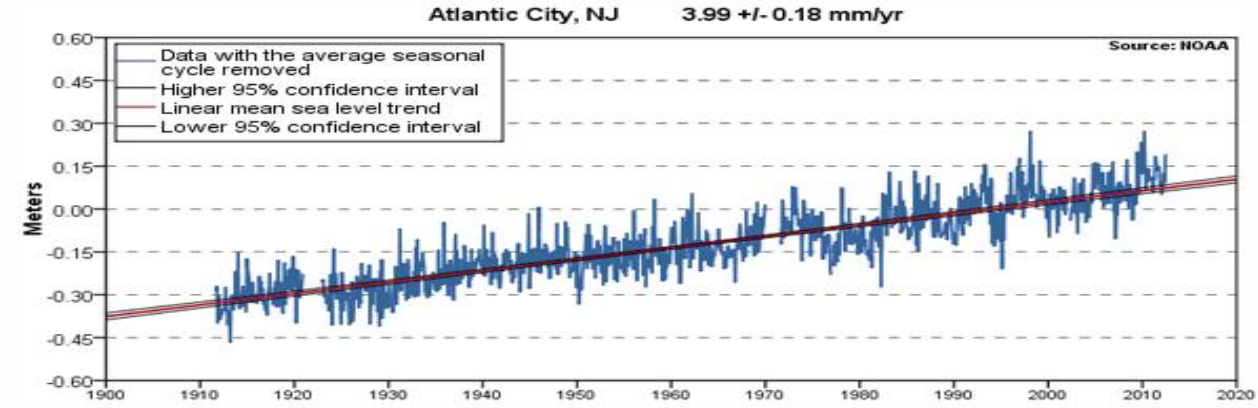
The exact rate of sea level rise in the future is not established. While there are varying degrees of consensus about a range of estimates, those estimates are predicated on geological events (such as glacier collapses) and current trends (such as carbon emissions and global temperature increases) that can change rapidly in the future. The Army Corps, IPCC, and other agencies have developed a range of estimates that encapsulate the various levels of sea level change based on the best available science. As of 2019, sea level change appears to track the intermediate estimates owing to continued emissions but no major climatological or geological changes.

Brigantine's Floodplain Management Plan has elected to use the US Army Corps of Engineers Intermediate estimate for its planning efforts. This is the same sea level change scenario that the Army Corps is using for their Back Bay Coastal Storm Risk Management Interim Feasibility Study. The dynamic nature of sea level change and climate change makes selecting an assumption for floodplain management planning a moving target. These assumptions will likely need to be revised heading into the future. However, the Intermediate projections allow the City to plan for the future with a reasonable degree of confidence. Because flood risk data products such as Flood Insurance Rate Maps (FIRMs) are often "moment in time" pictures of existing flood risk, it will be imperative to keep apprised of the best available predictions and estimates for sea level rise moving into the future.

Figure 28: US Army Corps – Intermediate Sea Level Rise Project

Year	ft., MSL
1992	0.00
2000	0.11
2019	0.42
2030	0.63
2050	1.06
2080	1.84
2100	2.54
2130	3.5
Based on National Tidal Datum Epoch of 1983-2001	

Figure 29: Historic Rate of Sea Level Rise along the New Jersey Coast



Source: www.njfloodmapper.com

In November 2019, the New Jersey Science and Technical Advisory Panel (STAP) published an update to a 2019 report that evaluates the most current science on sea-level rise projections. The findings are shown in the following image:

The STAP estimates generally track the Army Corps Intermediate Scenario through 2050, though the STAP estimates a greater than 50 percent chance of sea level rise being 1.4 feet by that time (as opposed to 1 foot estimated by the Army Corps). The Army Corps' 2100 estimate of 2.5 feet of sea level rise similarly follows the likely range (83 percent chance) of occurring under a high emissions scenario. However, there is a 50 percent chance that a low, medium, or high emissions scenario would result in sea level rise increases that are 0.3, 0.8, and 1.4 feet higher than the Army Corps intermediate scenario.

Sea level rise estimates continue to be a moving target, which complicates the challenge of planning for future flooding. Additionally, unpredicted meteorological events or ice shelf collapses may further accelerate sea level rise in ways that are not yet fully understood or quantified. The City will actively monitor estimates moving forward and use updated projections in future updates.

Figure 30: 2019 NJ STAP Sea Level Rise Projections

Sea-level rise:

Table ES-1: New Jersey Sea-Level Rise above the year 2000 (1991-2009 average) baseline (ft)*

		2030	2050	2070			2100			2150		
				Emissions								
	Chance SLR Exceeds			Low	Mod.	High	Low	Mod.	High	Low	Mod.	High
Low End	> 95% chance	0.3	0.7	0.9	1	1.1	1.0	1.3	1.5	1.3	2.1	2.9
Likely Range	> 83% chance	0.5	0.9	1.3	1.4	1.5	1.7	2.0	2.3	2.4	3.1	3.8
	~50 % chance	0.8	1.4	1.9	2.2	2.4	2.8	3.3	3.9	4.2	5.2	6.2
	<17% chance	1.1	2.1	2.7	3.1	3.5	3.9	5.1	6.3	6.3	8.3	10.3
High End	< 5% chance	1.3	2.6	3.2	3.8	4.4	5.0	6.9	8.8	8.0	13.8	19.6

**2010 (2001-2019 average) Observed = 0.2 ft*

Notes: All values are 19-year means of sea-level measured with respect to a 1991-2009 baseline centered on the year indicated in the top row of the table. Projections are based on Kopp et al. (2014), Rasmussen et al. (2018), and Bamber et al. (2019). Near-term projections (through 2050) exhibit only minor sensitivity to different emissions scenarios (<0.1 feet). Low and high emissions scenarios correspond to global-mean warming by 2100 of 2°C and 5°C above early Industrial (1850-1900) levels, respectively, or equivalently, about 1°C and 4°C above the current global-mean temperature. Moderate (Mod.) emissions are interpolated as the midpoint between the high- and low-emissions scenarios and approximately correspond to the warming expected under current global policies. Rows correspond to different projection probabilities. There is at least a 95% chance of SLR exceeding the values in the 'Low End' row, while there is less than a 5% chance of exceeding the values in the 'High End' row. There is at least a 66% chance that SLR will fall within the values in the 'Likely Range'. Note that alternative methods may yield higher or lower estimates of the chance of low-end and high-end outcomes.

10.4.3 Brigantine-Specific Impacts

Though the range of sea level rise estimates in the near and long-term vary, the City acknowledges the reality of sea level rise and its acceleration. Sea level rise will have a direct impact on the City that must be planned for proactively. As the following table shows, even small levels of sea level rise will have significant impacts to Brigantine residents and properties in the City.

Figure 31: Population and Property Impacts based on Level of SLR

Sea Level Rise (above MHHW)	Population (2010)	# of Buildings (2015)	# of Properties	Building Values (2016)
1 ft (2050)	0	0	--	--
2 ft	400	211	112	$20,966,700
3 ft	1,550	1,104	808	$102,513,600
4 ft	2,892	2,638	2,003	$268,393,400
5 ft	4,864	3,841	3,032	$397,495,900
6 ft	6,375	6,085	3,995	$476,0027,100
Properties do not include riparian properties. The data was created by overlaying GIS files of sea level rise at various elevations on top of Census outlines, building footprints, and parcel data. Properties were geo-located. Note that this data represents an estimation. In some cases, surge areas crossed Census blocks or				

properties without including the entire feature. Building numbers were determined as exposed if their footprint touched the inundation area.

By 2050, the sea level in New Jersey is estimated to be one foot higher than at its level in 2000. The first foot of sea level rise will not have a significant impact to people or property and will likely be experienced as it is currently in the form of nuisance flooding. The second foot of sea level rise will likely occur as soon as 2070, at which point hundreds of buildings will be permanently surrounded by flood waters at high tide. The third foot of sea level rise – likely to occur by 2100 – will see the impact of permanent high tide flooding triple in terms of resident exposure and increase five-fold for building exposure. At higher levels of sea level rise, water levels seen previously only at high tides or at full/new moons will be the norm. Coastal storms and flooding events occurring at similar intensities in past years will have a more pronounced effect with higher sea levels, thereby subjecting properties that previously have not flooded to inundation.

Sea level rise estimates are based on feet above Mean Higher High Water (MHHW). According to the NOAA, this is "the average of the higher high-water height of each tidal day observed over the National Tidal Datum Epoch". In Brigantine, Mean Higher High Water is approximately 1.99 feet NAVD 88. In essence, sea level rise of one foot above MHHW means a water elevation of approximately 2.99 feet NAVD88, or 2.59 feet relative to sea level. Superstorm Sandy reached a height of 7.8 feet NAVD88 in 2012. Under a likely moderate emissions scenario in 2150, the storm surge seen by Sandy could become a typical high tide.

Ecological impacts from sea level rise are also expected. Though salt marshes generally accrete vertically each year, the rate of sea level rise may exceed the rate of salt marsh growth, thereby causing the loss of the salt marsh ecosystem. This would have the effect of decreasing the natural floodplain functions of the ecosystem and increasing the potential for damage from wave action. However, semi-permanent inundation of currently urbanized land may enable the opportunity for the growth of wetlands ecosystems in areas that are currently urbanized uplands. Dune systems will likely be threatened by sea level rise as the water line increases vertically along the beach. Though dunes typically migrate inland, existing urbanized lane creates a backstop against this migration. The maintenance of existing land use patterns behind the dunes will likely cause the dunes and beaches to shrink as sea levels rise.

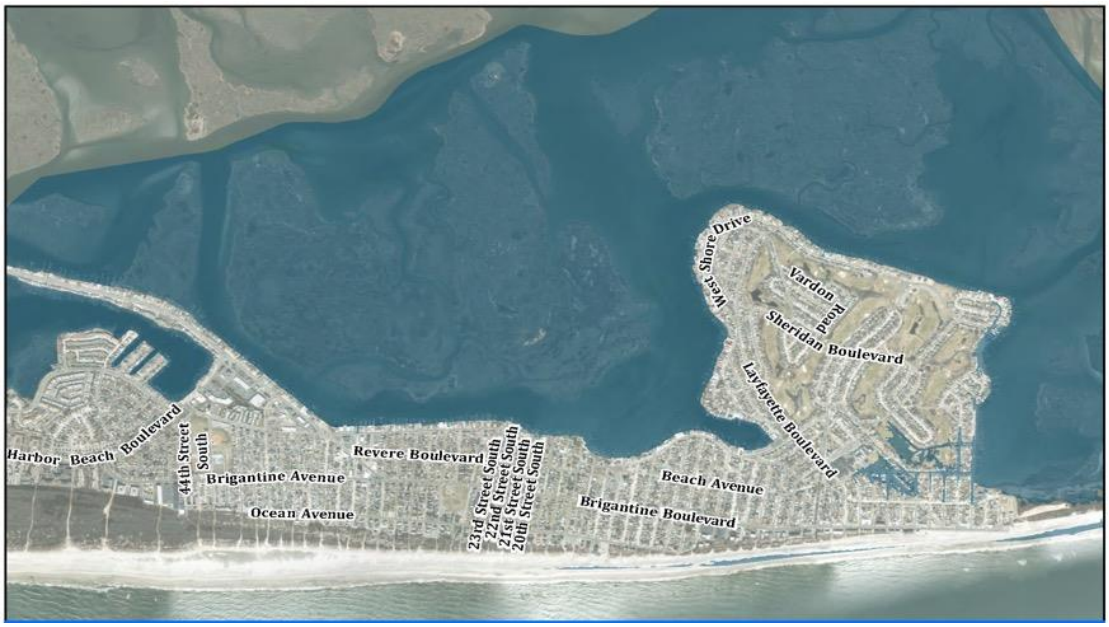
The maps below show estimated inundation impacts during one, two, and three feet of sea level rise at mean higher high water. These maps were developed with sea level rise data procured from the NOAA Digital Coast project.

Note that the maps below are "moment in time" captures based on existing conditions. They do not account for flood mitigation projects such as home elevation, fill, stormwater pumping station, higher bulkheads, and other projects that could alleviate inundation. As such, they should not be used to pinpoint properties that *will* flood, but rather identify general areas of low elevation that should be addressed with future projects.

Figure 32: Sea Level Rise (1 ft)

One foot of sea level rise in relation to Mean Higher High Water does not inundate land but will likely cause more disruptive nuisance flooding, particularly during high tide.

Figure 33: Sea Level Rise (2 ft)



Two feet of sea level rise potentially entails partial inundation at the north end during high tides. Neighborhoods along Bayshore Boulevard may also experience more severe nuisance flooding.

Figure 34: Sea Level Rise (3 ft)

Three feet of sea level rise in Brigantine will likely cause persistent flooding and inundation of the North End and Links Area, creating a continuous body of water between the bays. Bayshore Boulevard will also see more persistent inundation.

PART 3 – MITIGATION STRATEGY

CHAPTER 11 – GUIDING PRICIPLE, GOALS AND OBJECTIVES

This chapter identifies goals for reducing long-term vulnerabilities to flooding (CRS Step 6). After reviewing the goals and objectives identified for the 2010 plan and for other locally relevant planning documents, the Floodplain Management Committee developed updated goals and objectives and a mission statement. This work was completed through facilitated discussions over several meetings. Goals were selected that support the mission statement. Objectives were selected that meet multiple goals.

- Mission statement—Protect life, property, the economy and the environment of Brigantine by identifying and communicating risks and sustainable actions to reduce flood hazards.
- Goals

    1. Protect life, safety, property, and economy.

2. Work with local property owners and watershed management groups so that residents understand the flood hazard of the region based on best available data and science.
3. Increase resilience of infrastructure and critical facilities.
4. Account for flood risk in land use and planning.
5. Preserve, enhance, or restore the natural environment's floodplain functions.
6. Encourage the development and implementation of long-term, cost-effective, and environmentally-sound mitigation projects.

- Objectives
    - Work cooperatively with public agencies with responsibility for flood protection and with stakeholders in planning for flood and inundation hazards.
    - Utilize best available data, science, and technologies to improve understanding of the location and potential impacts of flood hazards.
    - Provide state, county, and local agencies and stakeholders with updated information about flood hazards, vulnerabilities, and mitigation measures.
    - Create a public outreach strategy.
    - Discourage new development in known flood hazard areas or ensure that, if development occurs in those areas, it is done in a way to minimize flood risk.
    - Consider open space land uses within known flood hazard areas.
    - Provide the highest degree of flood hazard protection at the least cost by working with environmentally friendly natural systems and by using prevention as the first priority.
    - Retrofit, purchase, and relocate structures in known flood hazard areas, especially those known to be repetitively damaged.
    - Provide flood protection by maintaining flood control systems.
    - Sustain reliable local emergency operations and facilities during and after a flood event.
    - Consider climate change implications in planning for flood and inundation hazards.

CHAPTER 12 – MITIGATION INITIATIVES

12.1 Alternatives Analysis

This section identifies a comprehensive range of alternatives that the City could consider mitigating the flood issues identified by this plan. It provides a wide range of activities to ensure that all possible measures are explored, beyond the traditional approaches of flood control, acquisition, and regulation of land use. Presenting a complete range of possible alternatives diversifies the Floodplain Management Plan and positions it to be able to respond to changing conditions affecting the food hazard. An action that might not be feasible today could become feasible in the future due to a change in programs, capabilities or available resources. The resources in this section provide options for the County to consider as it implements and maintains this plan, in order to address changing conditions in mapped floodplains.
The planning team prepared a catalog of mitigation alternatives based on the findings of this meeting (CRS Step 7). The Floodplain Management Committee reviewed and updated the catalog based on findings of public outreach efforts, the risk assessment results, and the actions identified in the 2010 plan.

The catalog provides a baseline of mitigation alternatives that are backed by a planning process, are consistent with the goals and objectives, and are within the capabilities of the City of Brigantine to implement. However, not all the alternatives meet all the selection criteria considered by the Floodplain Management Committee. The enhanced catalog was used by the planning team to select flood hazard mitigation actions.

12.1.1 Constraints Impacting Alternative Selection

The City faces several constraints that impact its selection of mitigation options. Floodplain management and mitigation offer scores of best practices and methods that can reduce harm to people and property. The City's planning process identified the unique features of Brigantine and how mitigation can be used to address the unique issues and threats facing the City. Though the constraints facing Brigantine are not unique, stating and recognizing these constraints in this section is intended to rationalize the final recommendations for this process.

Budget

The first and most obvious constraint is funding. Every mitigation initiative entails some kind of cost, whether it is a capital expense for structural projects, deferred tax revenue, or soft costs associated with hiring design professionals and employing workers, or providing contingencies associated with projects. Brigantine's bonding capacity is limited, and as of 2017 has a net debt in excess of $26.8 million for all utilities, municipal, and county general obligations. Its municipal budget is $21.3 million, and its municipal purpose tax is 0.648 percent, or 64 cents per 100 dollars of assessed property. Despite the City's sizeable tax base, its exposure to flooding and mandate to staff and operate a city that quadruples in size three to four months a year entails a tax burden that is borne by both City residents and out-of-

towners who own property in the City. This dynamic complicates the ability of the City to unilaterally fund projects.

Additionally, New Jersey local governments are prohibited from increasing property taxes by more than two percent annually. This essentially caps municipal spending and requires a referendum for increases. Though debt serve and capital expenditures are excluded from this two percent cap, the budget squeeze and mandates to fund other government operations make it difficult for communities like Brigantine to levy additional taxes to fund new mitigation projects. The prospect of acquisitions that would permanently remove properties from the City's tax rolls is also daunting and requires the City to make a careful assessment of the costs and benefits associated with buyouts.

Similarly, large-scale acquisition programs are not feasible. The current taxable value of properties in the City of Brigantine is in excess of $3.2 billion as of 2019, including $2 billion in land value and $1.2 billion in structure value. Though almost all of the City is in the Area of Special Flood Hazard and faces acute vulnerability owing to sea level rise and future flooding conditions, large-scale buy-out programs that permanently remove people and property from flood damages is not currently feasible owing to the sheer amount of funding needed to purchase large, connected swathes of land in the City.

Budgetary constraints are not just faced by the City itself, but also by renters, homeowners, and property owners. Nearly half of all home-owning households in Brigantine earn less than $75,000 per year. Households have an acute sensitivity to cost, particularly for mitigation and home elevation. In the case of bulkheads – most of which are in private ownership – bulkhead replacement projects are dependent upon the financial capacity of the property owner to undertake the projects. For retirees and those with fixed incomes that own properties with a bulkhead, undertaking the repairs necessary to bring a bulkhead into compliance are substantial and potentially beyond the means of those occupying the homes. This underscores the need of the City to cooperate with private owners to ensure that systemically important infrastructural elements are funded and completed.

Brigantine has relied significantly on grants and external financial assistance (whether from the State or Federal government) to assist with mitigation opportunities. Moving forward, the City will continue to pursue projects that leverage or supplement the City's own funds rather than require the City to shoulder the entire cost of the mitigation project.

Staff Time and Expertise

The City employs a number of full-time employees who often wear multiple hats and hold multiple roles. Undertaking new initiatives and programs often requires some degree of external help due to the extent of existing roles and responsibilities assigned to staff members. To this extent, mitigation options are limited by the City's ability to ensure that City employees' existing duties are successfully discharged along with the City's ability to hire in-house staff or consultants to complete mitigation projects.

Regulatory Compliance and Jurisdictional Coordination

Large scale infrastructural projects require substantial permitting, for example, each individual bulkhead requires a waterfront development permit from the NJ Department of Environmental Protection, even if it is a replacement-in-kind. While the Back-Bay projects proposed by the Army Corps will likely entail the Army Corps itself undertaking permitting for whichever mitigation project is selected, the completion of permitting for smaller-scale projects is a significant soft cost and often entails a significant delay between design and approval.

12.2 Completed Initiatives

12.2.1 Completed Initiatives

Installation of Emergency Generators – Completed

The City of Brigantine is served by three sanitary sewer lift stations, three potable wells and two stormwater pumps, which all required emergency generators. In addition, the police/fire/Emergency Management Office did not have an emergency generator. Finally, City Hall is used for emergency purposes during storms, hurricanes, electric outages and other natural disasters, and a generator was required for this building as well. All of these facilities required emergency generators so that service can be provided during emergency situations.

The following emergency generators were recently installed:

1. A Station Sewer Lift Station, 100 Bayshore Avenue
2. Potable Well #9, 4201 Bayshore Avenue
3. Potable Well #7, 203 Vernon Place
4. Caverly Drive Stormwater Pump Station, Sheridan Boulevard at Caverly Drive (shares a portable generator with Lincoln Drive)
5. Lincoln Drive Stormwater Pump Station, Lincoln Drive at Caverly Drive (portable)
6. Police/Fire/Emergency Medical Services, 1417 West Brigantine Avenue

Bulkheads - Completed

This project included replacement of various deteriorated timber bulkheads with vinyl bulkheads or living shorelines to raise the elevation to 9 feet. New vinyl bulkheads or living shorelines were installed at:

1. Cherokee Boulevard
2. Unnamed Street End adjacent to 4104 Atlantic Boulevard
3. Unnamed Street End adjacent to 4200 Atlantic Boulevard
4. 24th Street South

Replacement of Well #9 - Completed

Well #9 is located at 42nd Street and Bayshore Avenue and serves the entire south section of the island of Brigantine. This water-supply system was close to being impacted by Superstorm Sandy, since flood waters reached the top of the well system due to the existing

low elevation. State regulations require that the well head be 18 inches above the flood elevation. The new Well #9 now meets this requirement to ensure that future storms will not jeopardize the City's water system.

Figure 35: South End Well #9 Replacement

Figure 36: 5th Street South During Superstorm Sandy

10/29/12 - 5th Street South in Brigantine, NJ

CLOSE ✕

Pump Station and Flood Gates at Boat Ramp at 5th Street South – Completed

This project was listed as Community Action No. 2 in the 2016 Atlantic County Natural Hazard Mitigation Plan. The Boat Ramp is located at 5th Street South and Bayshore Avenues.

Historically, street flooding lead to damage to surrounding homes, businesses and vehicles. This project included a pump station and emergency generator to service the stormwater needs of this area along with waterproofing the boat ramp by installing floodgates. Also included was the elevation of the boat ramp apron and Bayshore Avenue to reduce flooding.

12.2.2 The following projects are under construction:

Pump Stations at Hackney Place, 34th Street South, Jenkins Parkway - $1,423,050 (Under Construction)

The City installed a stormwater pump station in 1980 and alleviated the flooding in one area. Two additional stormwater pump stations were installed in 2007 with funding support from FEMA.

Three additional stormwater management projects are proposed in this application. Each of the pump stations described below will include an emergency generator to ensure operation during electric power outages:

1. New Lighthouse Circle Stormwater Pump Station – This project was listed as Community Action No. 6 in the 2016 Atlantic County Natural Hazard Mitigation Plan. The new pump station will be located at 34th Street and Bayshore Avenue. This pump will serve a drainage area that includes portions of Brigantine Boulevard, the only access route off of the island.

2. New Hackney Place Stormwater Pump Station – This project was listed as Community Action No. 5 in the 2016 Atlantic County Natural Hazard Mitigation Plan. The new pump station will be located off of West Shore Drive in the Golf Course Section of the City.

3. New Pump Station at Jenkins Parkway, 12th Street North.

12.2.3 Initiative Designed and Under Permit Review

South End Flood Control Improvements - $783,400 (Permitting Underway)

Currently the outlet structure that serves the Ocean Drive and Lagoon Boulevard section of the Inlet area of the City is totally clogged and non-functional. The current 60-inch outfall pipe is buried, and the system no longer functions as designed. It is estimated that the current system operates at or near 25 percent capacity, resulting in localized flooding. This project calls for a new outlet system to be designed that will reroute stormwater within the Seaport Area Drainage Basin to a new outfall.

This project is designed to improve and protect groundwater, as well as provide for a functional stormwater system.

Golf Course Neighborhood Improvements - $688,250 (Permitting Underway)

This project will provide for the removal of accumulated sand from municipal drainage basins in the Golf Course Section of the City of Brigantine. The Golf Course Section of the City was significantly flooded by Superstorm Sandy, and silts and sand washed into the underground drainage system. This project is designed to improve and protect groundwater, as well as provide for a functional stormwater system.

The entire Golf Course Section of the City was under water during and after Superstorm Sandy. More than 32,000 cubic yards of sand and silts washed into the drainage system, making it inoperable. The planned improvements will help to prevent future damage caused by natural disasters. By making these improvements, the need for emergency protective and public-works services in this area will be reduced. Damage to roads and structures in the area will be reduced, and property owners will suffer fewer instances of being denied access/egress to their properties. In addition, this project will provide adequate environmental infrastructure to improve resiliency of Sandy-damaged systems in future natural disasters.

Figure 37: Golf Course Area During Superstorm Sandy

Bulkhead Reconstruction at City Dock located at 26th Street South - $396,000 (Permitting)

The City Dock is located at 26th Street South and provides for kayaking, boating, swimming and other water sports. The City Dock was severely damaged by Superstorm Sandy and has not been operational since the storm.

The project includes replacing the bulkhead that is severely damaged and raising it from 7 feet to 9 feet along the park water frontage. The entire project will occur on public property. The public benefits of this project are to protect critical public infrastructure, namely the City Dock and Bayshore Avenue, reduce flooding in this low-lying area and improve access for emergency services to residents and visitors.

Figure 38: City Dock Damage Caused by Superstorm Sandy

Bulkheads

Bulkheads provide a crucial aspect of the City's flood protection infrastructure. Bulkheads keep sediment and fill in place and help to attenuate wave action from water bodies. Bulkheads are found along nearly the entirety of Brigantine's back bay area. Some bulkheads owned by the City, though most are owned by private property owners with a home or marina upland of the Boardwalk. Over the years, these bulkheads fell into varying states of disrepair and were constructed to various heights, resulting in inconsistent protection.

Since Superstorm Sandy, the City has strived to replace existing bulkheads with those that comply with its standards. In 2018, the City took another step by designating the back-bay

waterfront area as an "Area in Need of Redevelopment". The Redevelopment Area designation will allow the City to enter into redevelopment agreements with waterfront property owners to fix and elevate bulkheads. This enables financial arrangements, such as the City fixing bulkheads and placing a special assessment on waterfront properties.

Chapter 127 of the City Code addresses bulkheads, setting the minimum height and construction/design standards. Currently oceanfront properties are required to have a bulkhead of 11 feet above Mean Sea level and nine feet above Mean Sea Level in all other areas (including the back-bay waterfront). The 14th Street South bulkhead is being permitted and is fully funded. The City has identified bulkhead replacement as a priority and will continue to advocate and facilitate bulkhead replacements.

12.1.1 Alternatives to Mitigate the Flood Hazard

a. Preventive Activities/Regulations

- Adopt land development criteria such as planned unit developments, density transfers, clustering. **Brigantine's existing system is robust, and existing build-out and the preponderance of small lots makes this recommendation not feasible at this time. In the future, should large-scale redevelopment take place and property assemblage takes place, this activity should be reconsidered.**
- Perform regular inspections and assessments of locally owned or maintained flood control infrastructure. **The City already maintains and inspects flood control infrastructure in conjunction with state and federal officials, as needed.**
- Locate or re-locate critical facilities outside of hazard areas, provide permanent protection for pump stations at risk of flooding, and support redundancy for critical functions. **Emergency Generators have installed and are planned to be installed at various City critical facilities, including at pump stations. Emergency generators – in combination with other floodproofing measures – are cost effective mitigation projects that enhance the services of critical facilities.**
- Identify and mitigate drainage issues resulting in ponding. **This activity is underway and planned owing to the need to maintain bulkhead and drainage infrastructure.**
- Identify sources of nuisance flooding. **The planning process identified low-lying areas where flooding takes place. Existing and underway stormwater pumping stations will help to mitigate nuisance flooding from stormwater and high tides.**
- Maintain existing data and gather new data needed to define risks and vulnerability. **A repetitive loss area analysis and Green Infrastructure**

Plan is recommended to better understand and address localized neighborhood flooding and opportunities for green infrastructure.

- Provide training for staff and decision-makers in floodplain management. **The City employs certified floodplain managers who receive regular training.**
- Review and update floodplain damage prevention ordinances such as cumulative substantial improvement/damage, freeboard, lower substantial damage threshold, compensatory storage and include future conditions standards. **This mitigation action was selected owing to the findings of this Floodplain Management Plan, the need to keep ordinances updated and prospective, and the ability to achieve other mitigation actions (e.g. NFIP standing, CRS class enhancements) through this activity.**
- Stormwater management regulations and master planning. **This mitigation action is described in more detail in the City's Watershed Management Plan.**
- Integrate floodplain management policies into other local planning mechanisms. **This recommendation will be included owing to the need to integrate land use planning with floodplain management in the City.**
- Retain good standing in National Flood Insurance Program. **NFIP participation is a priority and the City will continue to participate in the program and administrate its floodplain with NFIP compliance.**
- Integrate flood mitigation opportunities into capital improvement programs. **The development of a capital improvement plan is recognized as a need in this plan. The development of such a plan will prioritize projects that mitigate flooding.**

b. Property Protection

- Encourage mitigation of private property. **Brigantine has encouraged home elevations, and a number of such projects (as well as demolitions and reconstructions to flood standards) have taken place or are underway in the City. This mitigation measure has been proven to be both cost effective and technically feasible.**
- Close bulkhead gaps. **Bulkhead gaps have been documented in this report as a hazard that threatens life and property. The City has taken steps to close existing bulkhead gaps and is working with private property owners to close gaps on private property. Bulkheads are both technically feasible and cost effective.**

- Elevate and/or floodproof structures throughout the City. **This mitigation action will be selected because it will protect both life and property and is technically feasible. The maintenance of quality of life and promotion of commercial activity in the business zones are major goals and objectives in the City's Master Plan.**

c. Natural resource protection

- Promote/retain natural vegetation in areas with significant erosion concerns. **The City has installed a natural shoreline and supports the development of additional living shorelines throughout the City.**
- Promote open space uses in identified high hazard areas via techniques such as easements, setbacks, greenways, sensitive area tracks. **Due to the extent of development, these techniques are not necessary. The City has proactively acquired the golf course property, thereby preventing future development. No other large-scale open space uses beyond those that already exist are planned.**
- Map and create an inventory of open spaces with potential for beneficial functions. **The City already maintains an inventory of its open spaces, which are owned and managed by the City itself or by the State of New Jersey.**
- Clear stormwater drains and culverts. **This activity is undertaken as part of normal Public Works operations and should continue.**

d. Emergency services

- Develop and maintain emergency warning systems. **The City will implement a city-wide IPAWS notification system using cell powers in 2020.**
- Develop and update evacuation routes. **Given Brigantine's vulnerability and access issues, the City has chosen to prioritize the elevation of evacuation routes in low-lying areas. This will enhance the safety of those living and visiting the island.**
- Increase emergency services capabilities and public awareness of preparedness. **The City's Office of Emergency Management is capable and undertakes public outreach events throughout the year to raise awareness about hazards and encourages the public to take steps to prepare for emergencies.**

e. Structural projects

- Harden and/or protect areas with significant erosion concerns. **The plan has identified the need to close the structural protection gap at the north end with an extended bulkhead. The project currently requires permitting and funding negotiations. A back-passing operation to**

transport sand from the south end to the north end is also recommended. The feasibility and cost effectiveness of these projects should be explored.

- Develop road elevation and drainage programs. **The City has identified the need to elevate certain streets and install drainage in several locations. Elevated streets could double as berms or floodwalls, thereby providing both an elevated evacuation route as well as a property protection feature.**
- Close public bulkhead gaps. **A flood wall/bulkhead is recommended for installation at the City dock near 26th Street South.**

f. Public information activities

- Develop and implement a public information strategy. **Brigantine currently maintains a Program for Public Information that develops its own recommendations and programming for public information.**
- Develop a flood task force. **The Floodplain Management Planning Committee that developed this plan represents a "flood task force" consisting of both members of the public and City staff to focus on flooding issues.**
- Support and implement hazard disclosure for the sale of property in identified risk zones and increase enforcement of disclosure provisions. **The need to provide better disclosure of flood hazards was identified in the planning process. This action has been selected as a recommended strategy owing to the need to enact such a program in the short term.**
- Provide technical information and guidance. **The City provides advisory services to residents who are building in the floodplain. More technical guidance and outreach should be considered through the Program for Public Information.**
- Provide enhanced flood mapping. **The mapping of elevation certificates and Brigantine-specific flood hazard and sea level rise data was a need identified in the planning process. This project is recommended for further consideration.**

12.2.1 Mitigation and Adaptation

Communities and governments worldwide are working to address, evaluate and prepare for climate changes that are likely to impact communities in coming decades. Generally, climate change discussions encompass two separate but inter-related considerations: mitigation and adaptation. The term "mitigation" can be confusing, because its meaning changes across disciplines:

- Mitigation in restoration ecology and related fields generally refers to policies, programs or actions that are intended to reduce or to offset the negative impacts of human activities on natural systems. Generally, mitigation can be understood as

avoiding, minimizing, rectifying, reducing or eliminating, or compensating for known impacts (CEQ, 1978).

- Mitigation in climate change discussions is defined as "a human intervention to reduce the impact on the climate system." It includes strategies to reduce greenhouse gas sources and emissions and enhance greenhouse gas sinks (U.S. EPA, 2013g).

- Mitigation in emergency management is typically defined as the effort to reduce loss of life and property by lessening the impact of disasters (FEMA, 2013).

In this chapter, mitigation is used as defined by the climate change community. In the other chapters of this floodplain management plan, mitigation is primarily used in an emergency management context.

Adaptation refers to adjustments in natural or human systems in response to the actual or anticipated effects of climate change and associated impacts. These adjustments may moderate harm or exploit beneficial opportunities (U.S. EPA, 2013g).

Mitigation and adaptation are related, as the world's ability to reduce greenhouse gas emissions will affect the degree of adaptation that will be necessary. Some initiatives and actions can both reduce greenhouse gas emissions and support adaptation to likely future conditions. One subset of this type of strategy is known as ecosystem-based adaptation. Ecosystem-based adaptation is the use of biodiversity and ecosystem services as part of an overall strategy to help people adapt to the adverse effects of climate change. This includes the sustainable management, conservation and restoration of specific ecosystems that provide key services. In terms of floodplain management, many such actions are related to preserving or enhancing the natural beneficial functions of floodplain systems. Floodplains can absorb large volumes of water during peak flows. Coastal ecosystems can hold out against storms, attenuating waves and reducing erosion.

Chapter 13: ACTION PLAN AND PLANNED INITIATVES

13.1 Prioritized Actions

ID	Priority	Goals	Action and Description	Lead Agency and Partners	Schedule	Potential Funding Sources
Preventative Activities						
A-1	4	4	A (1) Targeted Open Space Acquisition Atlantic-Brigantine Boulevard Harbor Beach Boulevard East Evans Avenue	City of Brigantine NJDEP-Blue Acres FEMA	2020-2025: Identify and secure funding sources and clusters of potential properties	Blue Acres (NJDEP) FEMA- Flood Mitigation Assistance City Capital Funds
A-2	3	2, 4	A (2) Strengthen Floodplain Management Ordinance: Critical facilities standards, higher freeboard	City of Brigantine	2020: Identify feasible changes and protection benchmarks	City Funds
A-3	4	2, 4	A (3) Future Conditions Standards for New Developments: adjust bulkhead ordinance to increase heights in vulnerable areas, freeboard, and other regulations to account for sea level change	City of Brigantine	2023: Identify and adopt future conditions standards based on tracked emissions scenarios and standards used for Army Corps/DEP Projects	City Funds
A-4	2	4	A (4) Emergency Generator Installation- City Hall, South End Sewer Lift Station, Jenkins Parkway Sewer Lift	City (Lead); Brigantine Public Schools; Non-profits	2020-2025: Identify and secure funding sources for generators. Prioritize critical generators and those at lowest elevations	FEMA Pre-Disaster Mitigation; City Funds; NJEIT

ID	Priority	Goals	Action and Description	Lead Agency and Partners	Schedule	Potential Funding Sources
			Station, Potable Well #5, Evans Boulevard Stormwater Lift Station, Harbor Beach Boulevard Stormwater Lift Station, Public Works/SCADA Control Center, 12th Street Stormwater Pumping Station			
A-5	2	4	A (5) Check Valve Inspections/Replace- 80	City of Brigantine	Ongoing	City Funds; NJEIT
A-6	4	2, 4	Draft a Capital Improvement Plan	City of Brigantine	2020- Begin reserve for comprehensive, flood-informed capital improvement plan	City Funds; NJEIT; NJDEP; FEMA; Army Corps
A-7	2	2, 4, 5, 6	Complete a Repetitive Loss Area Analysis and Green Infrastructure/Natural Resources Plan	City of Brigantine FEMA	2020- Develop scope of work and draft HMA grant application 2022- Develop planning documents 2023- Begin implementation of recommendations	City Funds; Hazard Mitigation Assistance Grants
Property Protection						
B-1	1	1, 6	B (1) Home Elevations- accelerate remaining home elevations and develop gap financing to support homeowners who have received grants	Private property owners (lead); City/state/federal government	2020: Develop framework for gap financing	FEMA NJDCA City

ID	Priority	Goals	Action and Description	Lead Agency and Partners	Schedule	Potential Funding Sources
B-2	1	1, 6	B (2) Close bulkhead gaps Elevate bulkheads (Public and Private) Poinsettia Way, Lilac Way, Golf Course, Pepper Cove, 13th Street North to 14th Street North-Bayside Gabion, 9th Street North to 5th Street North-Oceanside	City (Lead); Waterfront property owners (lead); NJDEP (Permitting)	Ongoing	City capital funds; Hazard Mitigation Assistance grants; Private owner contributions; Army Corps appropriations (if tied to Back Bay Study); NJDEP Shore Protection Fund; Army Corps
B-3	2	1, 6	B (3) Support floodproofing for commercial buildings in business districts	Private property owners	2020-2021 Begin developing guidance for commercial floodproofing to retain business uses	City funds (standards/guidance) Private funds (construction); CDBG-DR
Natural Resource Protection						
C-1	3	5	C (1) Install and maintain inlet grates and debris collectors. Identify debris hotspots	Brigantine Public Works	Ongoing	City funds
C-2	4	5	C (2) Living Shoreline Improvements to Back Bay Areas	NJDEP, City of Brigantine	2020-2025 2025-2030 Implement living shorelines projects	The Nature Conservancy, City Funds, Private property owners
C-3	3	5	C (3) Maintain golf course drainage area	City of Brigantine	2020-2025	City of Brigantine
Emergency Services						
D-1	2	1, 3	D (1) Install City-Wide Warning System/Implement IPAWS notifications using cell towers	Atlantic County OEM, Brigantine OEM/Police/Fire	2020- Implement system	Brigantine OEM, Brigantine Police Department, Brigantine Fire Department

ID	Priority	Goals	Action and Description	Lead Agency and Partners	Schedule	Potential Funding Sources
D-2	2	1, 3	D (2) Elevate Evacuation Routes	NJDOT City of Brigantine Atlantic County	2020-2022 Develop schedule and specifications for roadway elevations and drainage improvements	NJ Transportation Trust Fund; Capital funds; FEMA
Structural Protections						
E-1	4		E (1) Selected Road Elevations and Drainage Projects: Atlantic-Brigantine Boulevard by Edgewater; Harbor Beach Boulevard; Sarazen Road, Evans Boulevard, Lafayette Boulevard	City of Brigantine; Atlantic County; NJ Department of Transportation; FEMA	2020-2022 Develop schedule and specifications for roadway elevations and drainage improvements	NJ Transportation Trust Fund; Capital funds; FEMA
E-2	1	1, 3, 6	E (2) North End Seawall- Extend by 275 feet northward and to bayside; Create vehicle crossover. Implement beachfill from 15th Street North to 4WD entrance	US Army Corps, NJDEP, City of Brigantine	2020-2021 Finalize negotiations for funding and permitting of seawall extension 2022-2025 Construct seawall extension	US Army Corps, Shore Protection Fund, City Capital Fund, FEMA Hazard Mitigation Assistance
E-3	4	1, 3, 6	E (3) Back Passing Operation for Beach Replenishment- North End	US Army Corps, NJDEP, City of Brigantine	2020-2021 Finalize negotiations for funding and permitting of backpassing 2022-2024 Implement backpassing	US Army Corps, Shore Protection Fund, City Capital Fund
E-4	3	3, 6	E (4) Drainage Improvements and Inlet	City of Brigantine Atlantic County (for drainage	2020-2021 Map storm inlets and outfall locations	City Funds

ID	Priority	Goals	Action and Description	Lead Agency and Partners	Schedule	Potential Funding Sources
			Installations, for example 32nd – 40th Street South	along County Roads)	2022-2023 Develop plan and seek financing to address stormwater flooding hotspots 2024-2028 Install drainage improvements	
E-5	1	1, 6	E (5) Install flood wall at City dock (2519-2601 Bayshore Ave)	City of Brigantine, NJDEP	2020-2021 Draft design and permit for boat ramp floodgate 2022-2023 Install flood gate	City Funds; Hazard Mitigation Assistance
E-6	4	1, 6	E (6) Road Elevations/Berm Transformation- identify and construct streets that can also function as berms or floodwalls	NJDOT City of Brigantine Atlantic County Private property Owners	2020-2022 Develop inventory of roads that require elevation	NJ Transportation Trust Fund; Capital funds; FEMA
Public Information						
F-1	2	1, 2	F (1) Require real estate disclosure of flood hazard	City of Brigantine	2020-2021 Draft legislation for flood hazard disclosure	City Funds
F-2	2	1, 2	F (2) Elevation Certificates mapping	City of Brigantine – Construction Department	2020-2021 Collect and digitize existing elevation certificates on file 2022 Post elevation certificates on a map on the city website	City Funds
F-3	4	1, 2, 4	F (3) Integrated flood hazard/sea level rise mapping for Brigantine	City of Brigantine	2020-2025 Identify map host and data for	City Funds; FEMA; NJOEM
	Goals					

ID	Priority	Goals	Action and Description	Lead Agency and Partners	Schedule	Potential Funding Sources
	1. Protect life, safety, property, and economy. 2. Work with local citizens and watershed management groups so that residents understand the flood hazard of the region based on best available data and science. 3. Increase resilience of infrastructure and critical facilities. 4. Account for flood risk in land use and planning. 5. Preserve, enhance, or restore the natural environment's floodplain functions. 6. Encourage the development and implementation of long-term, cost-effective, and environmentally-sound mitigation projects. Priorities Priority 1: Critical need/imminent vulnerability- This designates projects that should be prioritized immediately due to the provision of essential protection services and immediate health/public safety. Priority 2: Contributing action to critical function Priority 3: Addresses nuisance/quality of life issue Priority 4: Aspirational projects/prospective mitigation					

Map 6: Proposed Mitigation Projects

13.2 Post-Disaster Mitigation Policies and Procedures

Post-Disaster Mitigation Policies

Damaging flood events are not a regular occurrence in Brigantine. The City has had approximately five independent flood events that resulted in NFIP claims since 1977 over a period of 42 years. However, as the City's experience with Superstorm Sandy has indicated, the City remains quite vulnerable to coastal storms and hurricanes as well as more regularly occurring nuisance flooding. These impacts will be more pronounced in the future as sea levels increase.

Brigantine's post-disaster recovery policy is to rebuild, not retreat. The City recognizes its continued vulnerability to flooding and the profound impacts of climate change upon future flooding. However, it resolves to mitigate and adapt in the face of this threat rather than to withdraw from the island. This priority is evident in the City's post-Sandy Strategic Recovery Planning Report, completed in 2014.

Though a storm at Sandy's intensity was particularly damaging, it did not experience the widespread devastation observed in other parts of New Jersey and New York, where entire blocks of buildings were rendered inhabitable or otherwise destroyed. A storm such as Superstorm Sandy that leaves Brigantine's built form intact while causing significant damage to structures will follow the same procedures that were followed through during Sandy of cleanup and debris removal followed by incremental mitigation and redevelopment.

In the case of a truly cataclysmic storm or flooding event that results in the widespread devastation of sections of the community, the City will consider wide-reaching post-disaster actions. This could potentially include a large-scale redevelopment designation to facilitate debris clearance, utility reconnections, and tax abatements. There are currently no policies in place in the case of an avulsion.

Post-Disaster Procedures

Responsibilities for post-disaster procedures are set forth in the City's Emergency Operations Plan and with plans adopted by the Atlantic County Office of Emergency Preparedness with the cooperation of the City of Brigantine.

CHAPTER 14 – PLAN ADOPTION

This chapter documents formal adoption of the Brigantine Floodplain Management Plan by City Council (CRS Step 9). This Plan was submitted for a pre-adoption review to the Insurance Services Office (ISO) prior to adoption. Once pre-adoption approval was provided, the City of Brigantine formally adopted the Plan. A copy of the resolution is provided in the appendix.

CHAPTER 15 – PLAN MAINTENANCE STRATEGY

This chapter presents a plan maintenance process (CRS Step 10) that includes the following:

- Implementing the recommended action plan
- Monitoring, evaluating and updating the floodplain management plan over a 5-year cycle
- Maintaining public participation in the plan maintenance process
- Incorporating the requirements of the floodplain management plan into other local government planning mechanisms, such as comprehensive, capital improvement or all-hazard mitigation plans, when appropriate

The plan maintenance strategy is the formal process that will ensure that the floodplain management plan remains active and relevant and that the City of Brigantine maintains its eligibility for applicable funding. The Brigantine Repetitive Loss Area Analysis, prepared in conjunction with this plan, also outlines procedures for maintaining its recommendations into the future.

15.1 Implementing the Plan

The effectiveness of the floodplain management plan depends on its implementation and incorporation of its action items into existing local plans, policies and programs. The action items provide a framework for activities that the City can implement over the next five years. The planning team and the Floodplain Management Committee have established goals and objectives and have prioritized mitigation initiatives that will be implemented through existing plans, policies, and programs. The City Manager's Office will have lead responsibility for overseeing the plan implementation and maintenance. Plan implementation and evaluation will be a shared responsibility among all agencies identified as lead agencies in the mitigation action plan. Some action items do not need to be implemented through regulation. Instead, these items can be implemented through the creation of new educational programs, continued interagency coordination, or improved public participation.

15.2 Monitoring, Evaluating and Updating the Plan

15.2.1 Floodplain Management Committee

The Floodplain Management Committee is a total volunteer body that oversaw the development of the plan and made recommendations on key elements of it, including this maintenance strategy. It was the Committee's position that an oversight committee with representation congruent to that of the Floodplain Management Committee should have an active role in the plan maintenance strategy. Therefore, it is recommended that a committee remain a viable body involved in key elements of the plan maintenance strategy. The Committee should continue to include representation from stakeholders in the planning area. The principal role of a Floodplain Management Committee in this plan maintenance strategy will be to review the annual progress report and provide input to the City on possible enhancements to be considered at the next update.

Future plan updates will be overseen by a Floodplain Management Committee. It will be the Committee's role to review the progress report in an effort to identify issues needing to be addressed by future plan updates. The Floodplain Management Committee's membership shall reflect the same membership of the initial committee, whereby at least one-half of the membership is from members of the public. Meetings shall be convened twice a year and be open to the public.

15.2.2 Annual Progress Report

The minimum task of the ongoing annual Floodplain Management Committee meeting will be the evaluation of the progress of its individual action plan during a 12-month performance period. This review will include the following:

- Summary of any flood hazard events that occurred during the performance period and the impact these events had on the planning area
- Review of mitigation success stories
- Review of continuing public involvement
- Brief discussion about why targeted strategies were not completed
- Re-evaluation of the action plan to determine if the timeline for identified projects needs to be amended (such as changing a long-term project to a short-term one because of new funding)
- Recommendations for new projects
- Changes in or potential for new funding options (grant opportunities)
- Impact of any other planning programs or initiatives that involve hazard mitigation.

The planning team has created a template for preparing a progress report. The Floodplain Management Committee will provide feedback to the planning team on items included in the template. The planning team will then prepare a formal annual report on the progress of the plan. This report should be used as follows:

- Posted on the City's website page dedicated to the floodplain management plan
- Provided to the local media through a press release
- Presented to the County OEM to inform them of the progress of mitigation initiatives implemented during the reporting period
- Provided as part of the CRS annual re-certification package. The CRS requires an annual recertification to be submitted by October 1 of every calendar year for which the community has not received a formal audit. To meet this recertification timeline, the planning team will strive to complete progress reports between June and September each year.

Annual progress reporting is credited under CRS Step 10.

15.2.3 Plan Update

The information on flood hazard, risk, vulnerability, and mitigation contained in this floodplain management plan is based on the best science and technology available at the time this plan was prepared. The plan's format allows sections to be reviewed and updated when new data become available, resulting in a plan that will remain current and relevant. The City of Brigantine intends to update the floodplain management plan on a 5-year cycle from the date of initial plan adoption (CRS Step 10). This cycle may be accelerated to less than 5 years based on the following triggers:

- A federal disaster declaration that impacts the planning area
- A flood event that causes loss of life
- A comprehensive update of the City Master Plan, which is considered to be an integral part of this plan.

It will not be the intent of future updates to develop a completely new floodplain management plan for the City. The update will, at a minimum, include the following elements:

- The update process will be convened through a Floodplain Management committee.
- The flood hazard risk assessment will be reviewed and, if necessary, updated using best available information and technologies.
- The action plan will be reviewed and revised to account for any initiatives completed, dropped, or changed and to account for changes in the risk assessment or new policies identified under other planning mechanisms (such as the general plan).
- The draft update will be sent to appropriate agencies and organizations for comment.
- The public will be given an opportunity to comment on the update prior to adoption.
- The City will adopt the updated plan. It is the City's intention to fully integrate this floodplain management plan into the All-Hazards Mitigation Plan for Atlantic County.

15.3 Maintaining Public Involvement

The public will continue to be informed of the plan's progress through the City's website and by copies of annual progress reports provided to the media. The website will not only house the final plan, it will become the one-stop shop for information regarding the plan and plan implementation. Copies of the plan will be distributed to the County library system. Upon initiation of future update processes, a new public involvement strategy will be initiated based on guidance from a new Floodplain Management committee. This strategy will be based on the needs and capabilities of the City at the time of the update. At a minimum, this strategy will include the use of local media outlets within the planning area.

15.4 Incorporating the Plan into other Mechanisms

The City of Brigantine, through adoption of a general plan and zoning ordinance, has planned for the impacts of flooding. The floodplain management plan development process provided

the opportunity to review and expand on policies in these planning mechanisms. The Master Plan and the floodplain management plan are complementary documents that work together to achieve the goal of reducing risk exposure. The City has created a linkage between the floodplain management plan and the master plan by identifying a mitigation initiative as such and giving that initiative a high priority. Other planning processes and programs to be coordinated with the recommendations of the floodplain management plan include the following:

- Local all-hazards mitigation plan
- Emergency response plans
- Capital improvement programs
- Municipal codes
- Community design guidelines
- Water-efficient landscape design guidelines
- Stormwater management programs
- Water system vulnerability assessments

As information becomes available from other planning mechanisms that can enhance this plan, that information will be incorporated via the update process.

15.5 Funding Options

U.S. Department of Interior

The U.S. Department of Interior is investing $100 million in grant funding under the Hurricane Sandy Coastal Resiliency Competitive Grant Program. The grants are provided to better protect Atlantic Coast communities from future powerful storms by restoring marshes, wetlands and beaches, rebuilding shorelines, and researching the impacts and modeling mitigation of storm surge impacts.

With more than 47,000 acres of wetlands spanning from Brick Township to Brigantine, the Forsythe National Wildlife Refuge absorbed much of Sandy's energy and storm surge, protecting some of the local communities in the path of the storm.

The Forsythe Wildlife Refuge is a resiliency hub, which is a priority use for this funding. Resiliency hubs are coastal or inland areas characterized by preserved public or private open lands that contain an intact complex of ecosystems, habitats and "nature-based infrastructure," and that are in close proximity or connected to population centers or communities.

The City has applied for this funding for a back-passing operation and a living shoreline along the bay side of the island. A letter of support from NJDEP is provided in Attachment D.

Alternative Funding Sources for Elevating Structures

Given the fact that more than 1,000 homeowners have provided the City with letters of intent to elevate their homes, it is important to summarize the various funding sources for elevating structures.

National Flood Insurance Program – Increased Cost of Compliance (ICC) Coverage

ICC funding is not a loan and does not have to be repaid. It is managed by the National Flood Insurance Program and is available to property owners who carry new and renewed standard flood insurance policies. It helps homeowners meet the costs of repairing or rebuilding their property in order to comply with building requirements of their community and reduce future flood damage. The maximum amount a homeowner can receive is $30,000 and is based on a proof of loss, a detailed repair estimate and a substantial damage declaration from the community. ICC funding can be used to pay for:

- The elevation of a home above the flood elevation level adopted by the community
- The relocation of a home out of harm's way
- The demolition and removal of a damaged home

Eligibility requirements include:

- Location in a flood plain
- Property has suffered substantial damage from a flood
- Property has had repeated damage by floods

A single-family dwelling is available for a maximum combined amount of $250,000 from both the ICC and flood insurance.

Reconstruction, Rehabilitation, Elevation and Mitigation (RREM) Program

The RREM program was offered through the State of New Jersey and provided up to $150,000 for eligible homeowners to repair, elevate or rebuild their primary residences in the affected communities. Based on information provided by the NJDCA as of January 20, 2014, 511 homeowners in the City of Brigantine applied for RREM funding. At that time, 132 were found to be eligible and 276 were on the waiting list.

Hazard Mitigation Grant Program (HMGP)

HMGP is only offered during a presidentially declared disaster. This reimbursement program provides up to $30,000 to assist homeowners with the elevation of their primary single-family residences in line with the Flood Insurance Risk Maps in affected communities. The HMGP provides grants to states and local governments to implement long-term hazard mitigation measures after a major disaster declaration. The purpose of the HMGP is to reduce the loss of life and property due to natural disasters and to enable mitigation measures to be implemented during the immediate recovery from a disaster. The HMGP is authorized under Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act.

Additional FEMA Programs

In addition to the Hazard Mitigation Grant Program, FEMA provided four additional programs that can be used to elevate structures, including: the Pre-Disaster Mitigation (PDM) Program; Flood Mitigation Assistance (FMA) Program; Severe Repetitive Loss (SRL) Program and Repetitive Flood Claims (RFC) Program. In 2013, the annual grants were trimmed down to just the PDM and FMA Programs. Any municipal applicant must submit to the NJOEM during the application period, and they are put into one state-wide application and submitted to FEMA. The PDM and FMA grants are offered each year, and each applicant competes nationally.

Flood Mitigation Assistance (FMA) Program - The Flood Mitigation Assistance (FMA) program was created as part of the National Flood Insurance Reform Act (NFIRA) of 1994 (42 U.S.C. 4101) with the goal of reducing or eliminating claims under the National Flood Insurance Program. FEMA provides FMA funds to help states and communities implement measures that reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes and other structures insured under NFIP. Eligible properties must maintain flood insurance for the life of the structure. In order to receive an increased federal cost share, properties must be a severe repetitive-loss property or a repetitive-loss property.

Cost-share availability under the FMA program depends on the type of properties included in the grant. For example, severe repetitive-loss properties may receive up to 100 percent federal funding and repetitive-loss properties may receive up to 90 percent.

- In the case of mitigation activities to severe repetitive-loss structures:
    - FEMA may contribute up to 100 percent federal funding of all eligible costs, if the activities are technically feasible and cost-effective; or
    - FEMA may contribute an amount equaling the expected savings to the NFIP from expected avoided damages through acquisition or relocation activities, if the activities will eliminate future payments from the NFIP for severe repetitive-loss structures through an acquisition or relocation activity.
- In the case of mitigation activities to repetitive-loss structures, FEMA may contribute up to 90 percent federal funding of all eligible costs.
- In the case of all other mitigation activities, FEMA may contribute up to 75 percent federal funding of all eligible costs.

Structures with varying cost-share requirements can be submitted in one application. Applicants must provide documentation in the project application showing how the final cost share was derived.

FEMA will identify applications for further review based on a number of criteria, including but not limited to: savings to the NFIP, applicant rank and property status (e.g., repetitive-loss property, severe repetitive-loss property). FEMA also may identify an application for further review out of rank order based on considerations such as program priorities, available funds, and other factors.

Severe Repetitive Loss (SRL) Grants - The SRL grant program was authorized by the Bunning-Bereuter-Blumenauer Flood Insurance Reform Act of 2004, which amended the National Flood Insurance Act of 1968 to provide funding to reduce or eliminate the long-term risk of flood damage to severe repetitive-loss structures insured under the National Flood Insurance Program. Proposed projects must be cost effective with a benefit-cost ratio greater than 1.0. The homeowner's application must include an elevation certificate and signed, detailed contractor's estimate.

Pre-Disaster Mitigation (PDM**) Grants -** The PDM program used to provide funds to states, territories, Indian tribal governments, communities and universities for hazard-mitigation planning and the implementation of mitigation projects prior to a disaster event. This program should be restored. Funding these plans and projects reduces overall risks to the population and structures, while also reducing reliance on funding from actual disaster declarations. PDM grants are to be awarded on a competitive basis and without reference to state allocations, quotas or other formula-based allocation of funds.

Historic Preservation Funding

Municipalities that have RREM recipients who have homes that are considered historic will be receiving funding from the state for historic presentation. The state is putting aside $3,000 to $6,000 per property to mitigate any adverse impacts of the RREM Program on potential historic structures. These mitigation funds will be used to complete projects in the communities that document the historic significance of these properties or provide for public interpretation. The specific scope of these mitigation treatments will be developed through additional consultation between the DCA, DEP and Historic Preservation Office (HPO).

It appears that the Programmatic Agreement covers how to complete Section 106 (SHPO review) for Sandy-impacted properties. It is suggested that this funding be used for:

- updated historic property inventories
- documentation of any structures if slated for demolition
- public interpretation plans of historic structures and their fragility
- mapping of historic areas, both current and historical.

United States Army Corps of Engineers

In September 2019, the US Army Corps of Engineers and the New Jersey Department of Environmental Protection held a public meeting announcing that they're exploring options for flood and storm mitigation such as flood walls, levees, and barriers in Monmouth, Atlantic, Ocean, Burlington and Cape May counties, which encompasses about 3,500 miles of the Jersey Shore. These were the areas most severely damaged by the storm, so it makes sense that they are first in line for hazard mitigation infrastructure improvement. The study will consider past, current, and future coastal storm risk management and resilience planning initiatives and projects underway by the USACE and other Federal, State, and local agencies. Three overarching efforts will be performed:

- Assess the study area's problems, opportunities and future without project conditions;
- Assess the feasibility of implementing system-wide coastal storm risk management solutions such as policy/programmatic strategies, storm surge barriers at selected inlet entrances, or tidal gates at selected lagoon entrances;
- Assess the feasibility of implementing site-specific perimeter solutions such as a combination of structural, non-structural, and natural and nature-based features;
- Assess the impacts of back bay strategies and solutions on the Atlantic Coast Coastal Storm Risk Management Program towards developing recommendations within a systems context given likely future scenarios.

The Army Corps and DEP stated that any sort of construction project would not begin until 2026.

The City has requested assistance from the USACE under the Continuing Authorities Program (CAP). The USACE will evaluate various projects to determine if there is a Federal Interest. If a Federal interest exists, the USACE will complete engineering and construction with a non-Federal sponsor who agrees to cost share the feasibility study and construction. The City has requested that the USACE elevate the following projects:

- Northward extension of the Brigantine Seawall
- Bulkhead reconstruction between 9th Street North and 5th Street North along the Oceanside
- Bulkhead reconstruction at various street ends

References

American Planning Association. PAS Report NO. 483/484: Policies for Guiding Planning for Post-Disaster Recovery and Reconstruction, September 2005.

American Rivers, Washington, D.C. "Water infrastructure: Green investments create jobs, save money." 2008-12-17.

Anna Harwood. "The Trauma after the Storm." Scientific American. November 2017.

Atlantic County. "Atlantic County Flood Control Study: Flood Hazard Mitigation Presentation of Finding," October 5, 2007.

Atlantic County Office of Emergency Preparedness. "Multi-Jurisdictional Hazard Mitigation Plan Update, Atlantic County, New Jersey," Final Plan – February 2016.

Baxter, J., et al. Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards. FEMA (January 2013).

BrigantineNOW. Brigantine Island Shut Down. October 2012.

Broccoli, Anthony J., and Coauthors, State of the Climate: New Jersey 2013, Rutgers Climate Institute.

Central Vermont Regional Planning Commission. "The Vermont Green Infrastructure Initiative: Strategic Plan: 2011-2013".

Federal Emergency Management Agency. "Answers to Questions About Substantially Damaged Buildings," March 1991.

Federal Emergency Management Agency. "Coastal Community Resilience – Custom: Building Resilience from the Inside Out," May 2013.

Federal Emergency Management Agency. "Mold Can Be a Danger After Flooding." September 2010.

Federal Emergency Management Agency. National Flood Insurance Program Community Rating System Coordinator's Manual. OMB No. 1660-0022. 2017.

Federal Emergency Management Agency. "National Flood Insurance Community Rating System: A Local Official's Guide to Saving Lives, Preventing Property Damage, and Reducing the Cost of Flood Insurance," FEMA 573.

Healy, Andrew & Neil Malhotra (2009). Citizen Competence and Government Accountability: Voter Responses to Natural Disaster Relief and Preparedness Spending. Loyola Marymount University.

Heyer, Gruel & Associates. Atlantic County Strategic Recovery Planning Report. 2014.

Jacques Cousteau National Estuarine Research Reserve. Getting to Resilience: A Community Planning Evaluation Tool.

Ken Miller. Sea-level Rise in New Jersey Fact Sheet. Rutgers University. 2014.

Kopp, R.E., C. Andrews, A. Broccoli, A. Garner, D. Kreeger, R. Leichenko, N. Lin, C. Little, J.A. Miller, J.K. Miller, K.G. Miller, R. Moss, P. Orton, A. Parris, D. Robinson, W. Sweet, J. Walker, C.P. Weaver, K. White, M. Campo, M. Kaplan, J. Herb, and L. Auermuller. New Jersey's Rising Seas and Changing Coastal Storms: Report of the 2019 Science and Technical Advisory Panel. Rutgers, The State University of New Jersey. Prepared for the New Jersey Department of Environmental Protection. Trenton, New Jersey.

National Flood Insurance Program. Floodplain Management Bulletin – Historic Structures. FEMA P-467-2, May 2008.

National Flood Insurance Program. City of Brigantine: Verification Report. November 16, 2017.

National Flood Insurance Program. City of Brigantine: Verification Report. October 28, 2014.

National Oceanic and Atmospheric Administration (NOAA). "Adapting to Climate Change: A Planning Guide for State Coastal Managers," 2010.

National Oceanic and Atmospheric Administration (NOAA). Global and Regional Sea Level Rise Scenarios for the United States. NOS CO-OPS 083. 2017

New Jersey Department of Community Affairs. "Action Plan Amendment Number 7: Substantial Amendment for the Second Allocation of CDBG-DR Funds," February 2014.

National Oceanic and Atmospheric Administration (NOAA). Hurricane Sandy- NOAA Water Level and Meteorological Data Report. January 2013.

National Oceanic and Atmospheric Administration (NOAA). Tropical Cyclone Report: Hurricane Sandy. February 2013.

Neria, Y et al. "Post-traumatic stress disorder following disasters: a systematic review." Psychol Med. September 2007.

New Jersey Department of Environmental Protection. Coastal Vulnerability Assessment: Brigantine City, NJ. May 2017.

New Jersey Department of Environmental Protection. New Jersey Coastal Resilience Plan. September 2019.

New Jersey Department of Environmental Protection – New Jersey Geological Survey. New Jersey Tidal Benchmark Network. October 2008.

New Jersey Department of Environmental Protection. Water Level Proposals for NJ FRAMES Project Team Deliberation. February 2017.

New Jersey Division of Gaming Enforcement. Employment by Atlantic City Casino Licenses by Zip Code and Casino. July 2019.

New Jersey Office of Emergency Management. New Jersey State Hazard Mitigation Plan 2019. Michael Baker International, Inc.

Palmer, Roxanne. "One Year after Sandy, Many Ideas for Building More Resilient Coastal Communities". International Business Times (October 25, 2013). http://www.ibtimes.com

Philadelphia Water Department. "Green Stormwater Infrastructure." Accessed 2010-04-27.
Pötz, Hiltrud & Pierre Bleuze (2012). Urban green-blue grids for sustainable and dynamic cities. Delft: Coop for life.

Rutala Associates. City of Brigantine: Strategic Recovery Planning Report. April 2014

Rutgers University, Grant F. Walton Center for Remote Sensing and Spatial Analysis. http://www.njfloodmapper.org/.

Strauss, B., C. Tebaldi, S. Kulp, S. Cutter, C. Emrich, D. Rizza, and D. Yawitz (2013). "New Jersey and the Surging Sea: A Vulnerability Assessment with Projections for Sea Level Rise and Coastal Flood Risk." Climate Central Research Report. pp 1-43.

Unemployment Rate in Atlantic City-Hammonton, NJ Metropolitan Statistical Area, U.S. Department of Labor, Bureau of Labor Statistics.

United States Army Corps of Engineers. New Jersey Back Bay Coastal Storm Risk Management Feasibility Study. Interim Report, May 8, 2019

United States Environmental Protection Agency. "How Does Green Infrastructure Benefit the Environment?" December 15, 2008.

United States Census Bureau. American Factfinder. September 2019.

Appendices

A. Acronyms and Definitions

B. CRS Guidelines for Flood Planning

C. Floodplain Management Committee Ground Rules

D. Public Outreach Materials

E. Critical Facilities and Infrastructure Maps

F. FEMA Flood Zone Maps

G. City of Brigantine Floodway Maps

H. Example Progress Report I

I. City Council Resolution Adopting Plan