RESILIENT JERSEY CITY

A SUMMARY OF CITY-WIDE RESILIENCY AND CLIMATE CHANGE ADAPTATION PLANS

OCTOBER 2019

Jersey City
City Planning Division

RESILIENT JERSEY CITY

A SUMMARY OF CITY-WIDE RESILIENCY AND
CLIMATE CHANGE ADAPTATION PLANS

CONTENTS

Prepared by :

Jersey City
City Planning Division

October, 2019

EXECUTIVE SUMMARY

A resilient community can be characterized as one that is well-prepared for changing conditions and can recover quickly in the event of a significant flood. Due to the history of destructive storms and the prevalence of repetitive flooding in the region, Jersey City has facilitated the creation of various plans to strengthen resiliency through thorough preparation for future storms and reduction of overall flood risk.

EXECUTIVE SUMMARY

With forty percent (40%) of the City's land area lying in the FEMA Special Flood Hazard Area (SFHA), there are residents, businesses, community facilities, infrastructure, and historic landmarks at risk. Superstorm Sandy demonstrated this risk by inundating over thirty-nine percent (39%) of the city's land area, and forcing many low-lying properties to evacuate. This led to environmental and economic losses and amplification of social stressors. With over $11.5 million in housing related claims and over $12 million in lost tax ratables, financial impacts of Sandy were severe. In addition to damage to residences and businesses - critical transit lines such as the PATH and the Hudson-Bergen Light Rail, PSE&G electrical substations, City Hall, the Jersey City Medical Center saw significant damage and disruption of operations as a result of the storm. Based on historic flooding and projections of a changing climate and subsequent sea level rise, the need to act on this knowledge to better prepare Jersey City is increasingly necessary. To guide its direction for resiliency planning, Jersey City has established the following vision for the future:

Jersey City seeks to protect its valuable social, historic, and economic assets against the changing environment and increased risk of storm events through innovative design and infrastructure solutions. By identifying vulnerable populations, neighborhoods, and gaps in the City's preparedness, Jersey City resolves to implement strategies that will ensure that it remains a desirable and dependable place to live, work, and invest for generations to come.

This document serves to frame the reality of Jersey City's social, economic, and geographic vulnerabilities as related to climate change. This report also summarizes the Resiliency Planning Documents completed to date to strengthen the City's resiliency in future events. This summary of Resiliency Planning Documents should be used in conjunction with the full reports, which can be found of Jersey City's Open Data site, in addition to the City's **Resilient Design Handbook**, created as part of the Jersey City Make It Green Initiative. The Handbook is a useful tool for residents, business owners, and other stakeholders seeking information about flooding in Jersey City.

100-Year Flood Zone – an area that is expected to be inundated by a flood event with a one percent annual chance of being equaled or exceeded in any given year

500-Year Storm – an area that is expected to be inundated by a flood event with a 0.2 percent annual chance of being equaled or exceeded in any given year

A/AE Flood Zone – areas that have a 1% probability of flooding every year (also known as the 100-year flood zone); Properties in Zone AE are considered to be at high risk of flooding

Combined Sewer Operating (CSO) system – designed to convey both sanitary sewerage and stormwater, with outfalls into watercourses

Combined Sewer Overflow (CSO) flooding – results in combined sewers receiving higher than normal flows, with both sanitary sewerage and stormwater being discharged into watercourses

Flood Insurance Rate Map (FIRM) – the official map on which the Federal Insurance Administration has delineated both the areas of special flood hazards and the risk premium zones applicable to the community

Levee – a man-made structure that helps contain or control the flow of water during a flood (FEMA, 2016)

National Flood Insurance Program (NFIP) – aims to reduce the impact of flooding on private and public structures by providing affordable insurance to property owners, renters and businesses and by encouraging communities to adopt and enforce floodplain management regulations (FEMA)

Pluvial Flooding – surface water flood caused by heavy rainfall

Resilience - is the ability to prepare and plan for, absorb, recover from and more successfully adapt to adverse events

Risk - the scope of consequences (loss of life, damage to property or the environment)

Watershed – an area of any size that drains into a lake, stream, or other body of water; also known as "basin" or "catchment area (FEMA, 2005)

VE Flood Zone – considered to be lower than the Base Flood Elevation. V zones are the most hazardous of the Special Flood Hazard Areas.

Vulnerability – threat of exposure, the capacity to suffer harm, and the degree to which different social groups are at risk (Cutter, 1996)

X Flood Zone – Areas subject to flooding by the 0.2-percent-annual-chance flood event


NO STANDING ANY TIME

EXISTING + FUTURE CONDITIONS

A summary of Jersey City's physical, demographic, and operational conditions today. This chapter also explores lessons learned from Superstorm Sandy and how recent flooding experiences are informing how the City prioritizes resiliency efforts in conjunction with increased development moving forward.

EXISTING + FUTURE CONDITIONS

The City of Jersey City is located in Hudson County, New Jersey between the Hackensack River and Newark Bay to the west, and the Hudson River and Upper New York Bay to the east. The 14.79 square mile city has 21.7 miles of waterfront along these rivers and bays. Beginning in the 1980s, with freight rail in decline, waterfronts increasingly desirable for residential and recreational uses, and increased appreciation for historic preservation, Jersey City began to transform from an industrial city into the modern, prosperous city that it is today. Waterfront Redevelopment plans were adopted, Historic Districts were established, brownstones were reclaimed, rail yards turned into parks and residential neighborhoods, light rail transit spurred development, and high rise development along the waterfront and in Exchange Place earned the nickname “Wall Street West”.

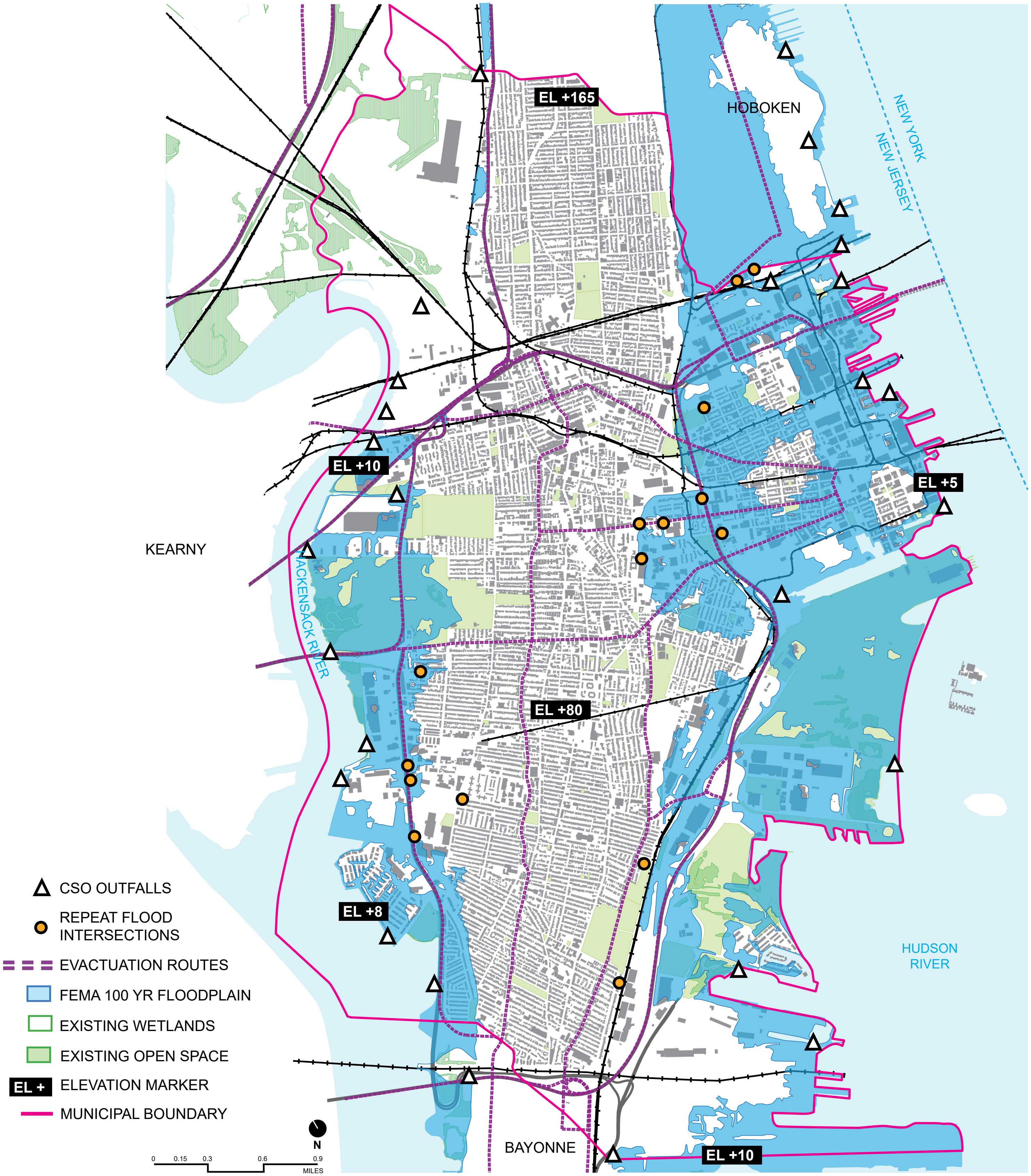
Today, Jersey City is the second most populated city in the state of New Jersey with 264,290 residents as of 2015 and its population is projected to grow in the coming years. Dense urban development makes up the fabric of the city’s building stock, which includes residential, mixed-use, commercial, and industrial buildings. A large, densely populated city coupled with proximity to tidal waterways and areas of low-lying elevation poses risks. In light of these risks, the need to be prepared for flooding events is the purpose of identifying existing conditions, which include social, environmental, and economic vulnerabilities. These resiliency planning documents recently developed by the City of Jersey City not only identify vulnerabilities, but provide recommendations for mitigating flooding under said existing conditions.

Throughout the years, Jersey City has found itself coping with flooding issues and recovering from storms. Between 1954 and 2014, FEMA issued a disaster or emergency declaration for Hudson County for Four coastal storm-related events, classified as one or a combination of the following disaster types: hurricane, tropical storm, severe storm, flooding, Nor’easter, tropical depression, coastal storm, high tides, and heavy rain.

With these parameters in mind, Jersey City’s Municipal Utilities Authority (MUA) identified repeat flooding intersections. These areas were mapped with Combined Sewer Overflows in Figure. Jersey City has a combined sewer system, meaning there is a system of pipes that collect sewage in addition to surface water. When the system is overwhelmed in the event of a rain event, these two sources are combined and discharged into waterways. This has a negative impact on the health of the City’s waterways and poses risks to public health. Repeat flooding intersections can be found below:

1) 9th Street & Brunswick Avenue
2) Linden Avenue & Princeton Avenue
3) Kellogg Street & Route 440 (DOT Drainage)
4) Westside Avenue & Audubon Avenue
5) Fisk Street & Route 440 (DOT Drainage)
6) Culver Avenue & Route 440 (DOT Drainage)
7) Grove Street Between Jersey City & Hoboken
8) Marin Blvd Between Jersey City & Hoboken
9) Merseles Street & Wayne Street
10) Center Street & Bright Street
11) Clendenny Avenue & Marcy Avenue
12) Richard Street just East of Garfield Avenue
13) Manholes on Montgomery Street (Florence St to Mill Rd)
14) Cornelison Avenue

Map 2.1


EL +165
HOBOKEN
NEW YORK
NEW JERSEY
EL +10
EL +5
KEARNY
HACKENSACK RIVER
EL +80
EL +8
HUDSON RIVER
BAYONNE
EL +10
CSO OUTFALLS
REPEAT FLOOD INTERSECTIONS
EVACUATION ROUTES
FEMA 100 YR FLOODPLAIN
EXISTING WETLANDS
EXISTING OPEN SPACE
EL + ELEVATION MARKER
MUNICIPAL BOUNDARY
N
0 0.15 0.3 0.6 0.9
MILES

EXISTING + FUTURE CONDITIONS

As was previously stated, Jersey City is continuously developing and subsequently its total population is growing. Historically, cities developed along waterways for transport and connectivity purposes, but now coastal communities often cope with frequent and increased flooding events. Residents, businesses and infrastructure located in low-lying areas face unique challenges when planning for the future. A changing climate and rising sea levels pose additional risks; if sea levels rise, the base flood elevation will rise as well, increasing the number of properties located in the floodplain.

The geographic location of Jersey City puts it at greater risk of climatic changes; its bi-coastal geography makes the City particularly vulnerable to future sea level rise and coastal storms. Additionally, areas along tidal waterways in New Jersey are already experiencing higher than average rates of sea level rise. This is due to the fact that New Jersey sits in a location that was once elevated by ice sheets during the Last Glacial Maximum. Since those ice sheets have melted away, New Jersey is sinking to its pre- glacial position (Miller et al., 2013). These sinking effects exacerbate risks to homeowners, businesses, and other facilities that lie in the floodplain. Based on this knowledge, not only will Jersey City have to do its part in mitigating current climatic conditions, the City will have to adapt to these foreseen changes in order to thrive in future conditions. This means reevaluating where and how future development will occur, and updating and expanding the City's infrastructure to better suit its proximity to tidal waterways. Additionally, when pairing sea level rise with increased development and subsequent population growth, there are greater risks to integrate with planning. When planning for resiliency we must use projections of development patterns, inside and around the City, in addition to future sea level rise projections to guide the assessment of proposed adaptation measures.

Map 2.2

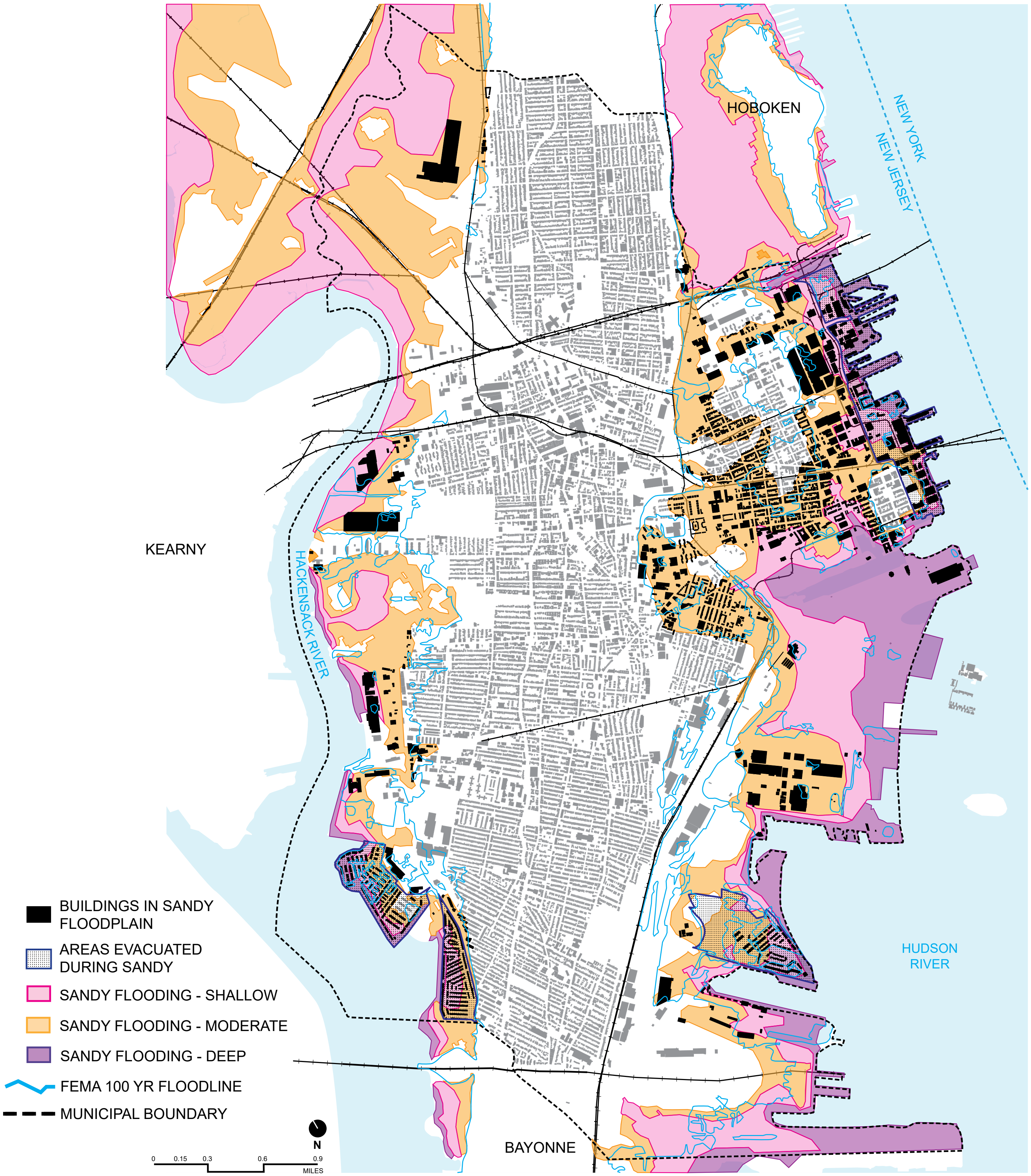
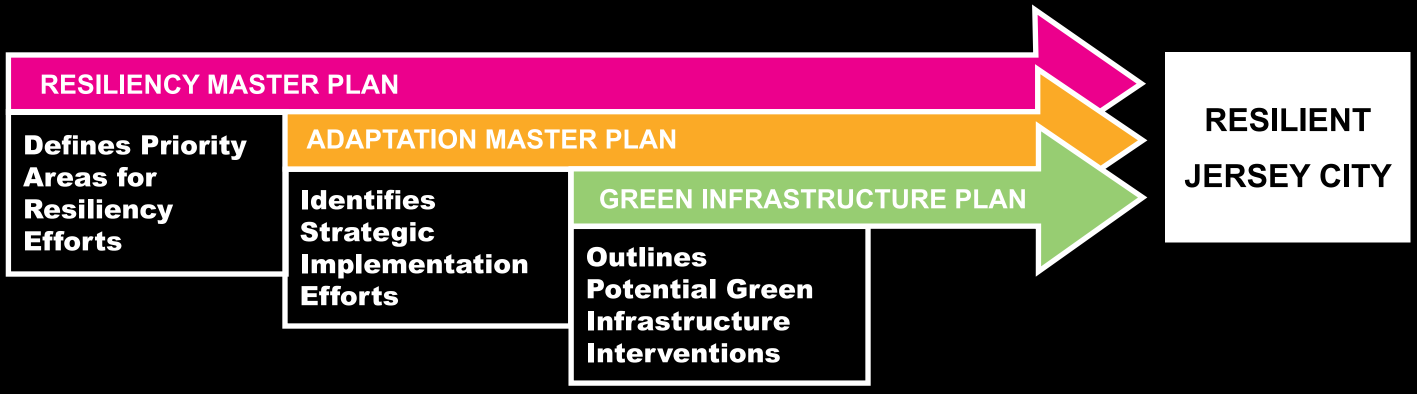

HOBOKEN
NEW YORK
NEW JERSEY
KEARNY
HACKENSACK RIVER
HUDSON RIVER
BAYONNE
BUILDINGS IN SANDY FLOODPLAIN
AREAS EVACUATED DURING SANDY
SANDY FLOODING - SHALLOW
SANDY FLOODING - MODERATE
SANDY FLOODING - DEEP
FEMA 100 YR FLOODLINE
MUNICIPAL BOUNDARY
N
0
0.15
0.3
0.6
0.9
MILES

PHOTO BY LUCIO SANTOSOF JERSEY CITY, OCTOBER 2012

THE PLANS

In order to develop sound recommendations for resiliency as specific to the social, physical, and economic conditions in Jersey City, the City worked with the consultant team to capture and further analyze the collective of information and evaluations that have already been undertaken on the issue of resiliency.

As part of the NJ Department of Community Affairs Post Sandy Planning Assistance Grant program, a Resiliency Master Plan, an Adaptation Master Plan, and an Urban Environmental Green Infrastructure Plan were developed by Maser Consulting to address the various vulnerabilities throughout the city. These documents helped streamline prior efforts and identified ways in which Jersey City can mitigate recurring flooding and prepare for future storms.



The impact of Hurricane Sandy revealed a region-wide exposure to multiple hazards and risks. Power blackouts, severely contaminated storm waters, evacuation of residential communities and massive disruptions to public transport are just a few examples of the systemic nature of risk. The Resiliency Master Plan overlays these many urban systems to determine where an intervention could address the largest portfolio of risks and hazards. This assessment was conducted to identify areas in the city that are at greatest risk in order to guide next steps and future planning efforts.

To develop the Resiliency Master Plan, a citywide analysis evaluated a spectrum of risks and vulnerabilities, combining flood risk with pollution risks, social vulnerability, critical infrastructure vulnerability and economic development vulnerability.

RISK

Risk can be defined as the scope of consequences that result from present and future weather-related conditions such as loss of life, damage to property and environment, and disruption of economic operations. Risk is often described as related to climate change, or changes in global and regional climate patterns. NJ has experienced an increase in average annual temperatures and an increase in rainfall. Globally, an increase in greenhouse gases has increased the rate at which ice is melting. This means that there is more water flowing into the oceans, which are projected to maintain higher water levels and temperatures throughout the year.

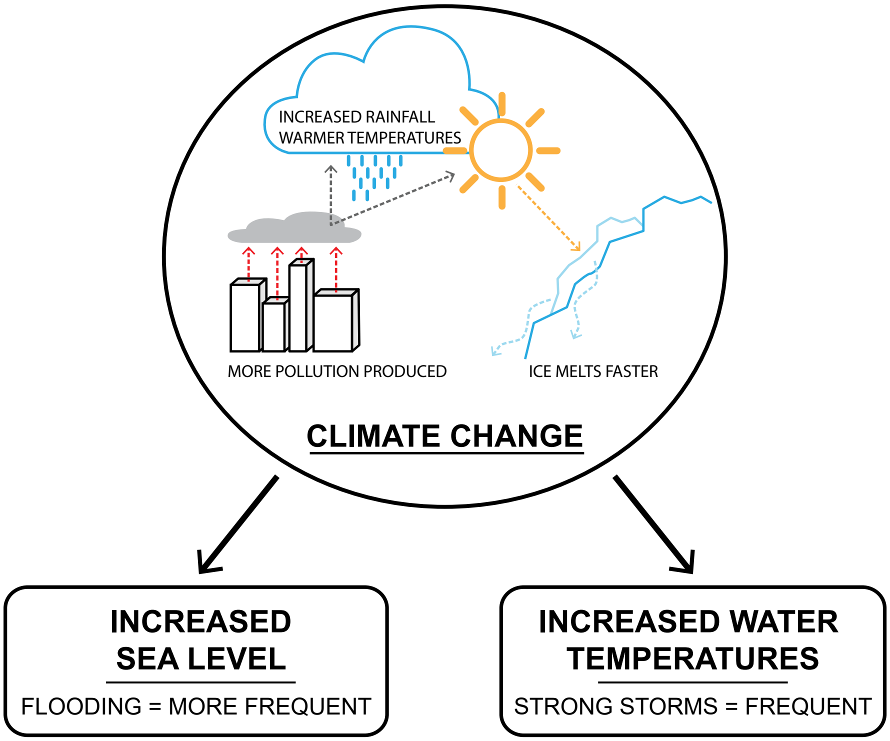


Figure 3.1

All of these factors combined have the potential to influence the way we experience weather on a regular basis. Jersey City's present geographical conditions, when paired with shifts in weather patterns (climate change), create a heightened risk to two types of flooding:

• **TIDAL INUNDATION**: Projections of a changing climate, specifically sea level rise, increase the risk of daily flooding within the urban fabric. Tidal flooding not only threatens to inundate parts of the built environment that are not designed to be regularly flooded, but will result in an increased volume of water entering stormwater infrastructure on a regular basis. This can have significant implications for Jersey City, which is bordered by the Hackensack River to the west and the Hudson River to the east.

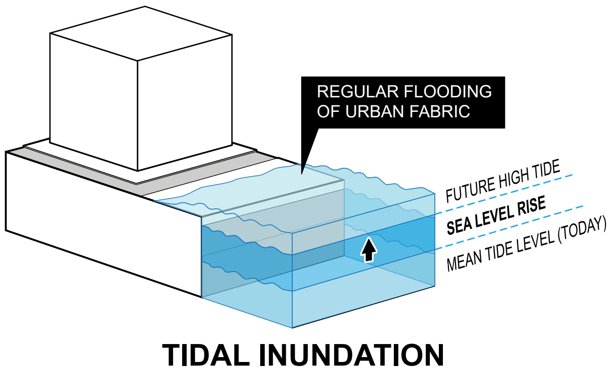


Figure 3.2a

• **STORM SURGE**: Climate change factors such as warmer ocean temperatures create ideal conditions for regularly occurring hurricanes to maintain dangerous winds and surge levels as they hit the shoreline. While storm surge effects the built environment less frequently than tidal inundation, it brings a much larger volume of water into the city at a much higher force. This results in significant damage to structures and urban infrastructure, and can disrupt urban operations for extended periods of time. Recovery from surge damage also tends to require significant financial and manpower resources to restore pre-storm conditions.

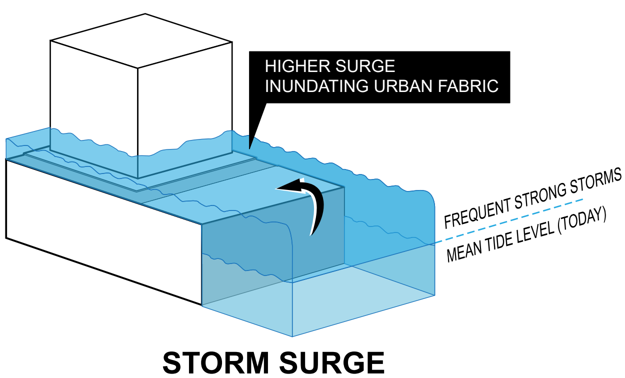


Figure 3.2b

VULNERABILITIES

Vulnerabilities are defined as components of the city and community that face short or long term effects as a result of a storm event. These components pertain to everything from the economic viability of the city, the actual built environment, and the people that inhabit and utilize that built environment on a daily basis. These three main categories of vulnerabilities (social, economic, and physical) which were analyzed and overlaid as part of the Resiliency Master Plan, are further defined below;

• **SOCIAL**: Social vulnerabilities help to identify micro-communities that face greater difficulty in the event of a natural disaster. The Social Vulnerability Index (SOVI), which was developed for NOAA, includes 32 variables and is the broadest multi-variate assessment available. The Resiliency Master Plan mapped these variables against population and census data in order to understand which areas of the city face greater challenges in mitigating risk. This identifies existing vulnerable communities while also helping to streamline future development and location of civic facilities and resources. Below are examples of variables considered in the Social Vulnerability Index;

AGE

Certain age populations, such as the elderly, may face increased challenges in trying to evacuate before or during a storm event. Areas with higher elderly and child populations are considered more vulnerable in the SOVI.

INCOME

Families with a lower income may struggle to afford the resources to evacuate before a storm, or recover from substantial damage to their property after a storm. Low income populations are considered more vulnerable in the SOVI.

LANGUAGE

Communities that have significant non-English speaking populations may struggle to communicate danger or evacuation procedures during a storm event, or to coordinate help in an emergency. Areas with higher non-English speaking populations are considered more vulnerable in the SOVI.

• **ECONOMIC**: Employment centers were identified through land use mapping and recent development patterns. Identifying employment hubs (or commercial and industrial land uses in general) is critical to maintain economic operations during storm events. Should these centers face significant damages during a storm, implications of recovery could impact the city financially or cause associated jobs to relocate outside of Jersey City permanently. Similarly, anchor institutions such as local universities or large single-company employers may suffer long-term if structures and operations are disrupted for an extended period of time. Aside from risk as an isolated factor, oversized properties hosting large tenants can offer great opportunities to accommodate flood protection interventions. Economic risks and vulnerabilities were mapped in the Resiliency Master Plan in order to understand the relationship between communal and economic hubs and flood risk, as well as to identify the potential for coordination in future resiliency efforts.

- **PHYSICAL (CRITICAL INFRASTRUCTURE)**: Infrastructure such as transit lines and stations, evacuation routes, power (sub)stations, gas pipelines, hospitals, police and fire stations, hospitals, shelters, and municipal offices were mapped. These facilities and networks are crucial to everyday operations of the city, and tend require inordinate financial resources to recover from damage after a storm event. Damage to these facilities can have radiating effects, such as downed transit lines preventing people from getting to work after a storm has passed. 95 critical facilities throughout the city were analyzed in the Resiliency Master Plan. It was discovered that 42.1% fall within the SFHA while an additional 31.5% have a 1% annual chance of flooding.

IMPLEMENTATION

With the hazards and vulnerabilities identified, the next step is to determine what areas of the city will receive the greatest impact if and when resiliency measures are implemented. Those identified areas should be seen as general target areas for further analysis and design development to establish cost efficiency and feasibility of resiliency projects.

A preliminary hydrological analysis of the City and its immediate surroundings was conducted as a first means of classifying the City into discrete locations with contained tidal inundation vulnerabilities. FEMA and NOAA data sets for both storm surge (Hurricane Flood Zones) and sea level rise scenarios (up to 6 feet) were compiled. High-resolution topographical data were mapped to understand what portions of the City are subject to these risks, and distinct areas were then delineated by common risk levels, herein referred to as Watershed Districts. These Watershed Districts allow for localized intervention to address their own coastal inundation risks, with the expectation that providing flood resiliency along critical points within the District will protect the District as a whole. These Watershed Districts were then overlaid with social, infrastructure, and economic development vulnerabilities in order to identify where the combined vulnerability is the greatest. The result is six areas where combined vulnerability is higher than in other watershed districts. These areas, termed as Priority Areas and labeled Areas A through F, are found in Map 3.1.

PRIORITY AREAS

A. COUNTRY VILLAGE: Includes the Westside neighborhood south of Society Hill, which is in a one-percent flood zone, comprises block groups that equal or exceed the regional poverty threshold, has a combined sewer overflow, and includes Route 440. This Priority Area includes southern portion of Watershed District 6.

B. SOCIETY HILL: Located in a one-percent flood zone and includes several contaminated sites and ground water contamination. Includes Watershed District 6 and 7.

C. WESTSIDE / RIVERBEND: Centered on the boundary of Watershed Districts 7 and 8, this area includes critical infrastructure such as New Jersey Route 139 and US Route 1 & 9, and environmental concerns such as contaminated sites, combined sewer overflows, and surface water discharge.

D. MILL CREEK/BERGEN -LAFAYETTE/VAN VORST PARK/HAMILTON PARK: Includes portions of Watershed Districts 1, 2, and 3. The Mill Creek Redevelopment Area and Jersey City Medical Center are in this area, which is characterized by a one-percent flood zone and critical infrastructure. Western portions of the Van Vorst Park and Hamilton Park Historic Districts are in this Area. There is also a CSO in Area D. This area extends the length of the New Jersey Turnpike Newark Bay Extension from Morris Canal to the Hoboken border.

E. DOWNTOWN/EXCHANGE PLACE: Comprises several neighborhoods, four of which are historic districts, plus numerous historic structures, bounded by the Hudson River, Jersey Avenue, the Tidewater Basin, and 10th Street.

F. NEWPORT: Located in the northern portion of Watershed District 1, Area F includes the Newport and the Holland Tunnel approach.

In addition to the identification of Priority areas based on risks and vulnerabilities, a number of Resiliency Goals and Objectives were created:

1. Create a Jersey City that is resilient against flooding

2. Protect Jersey City's critical infrastructure

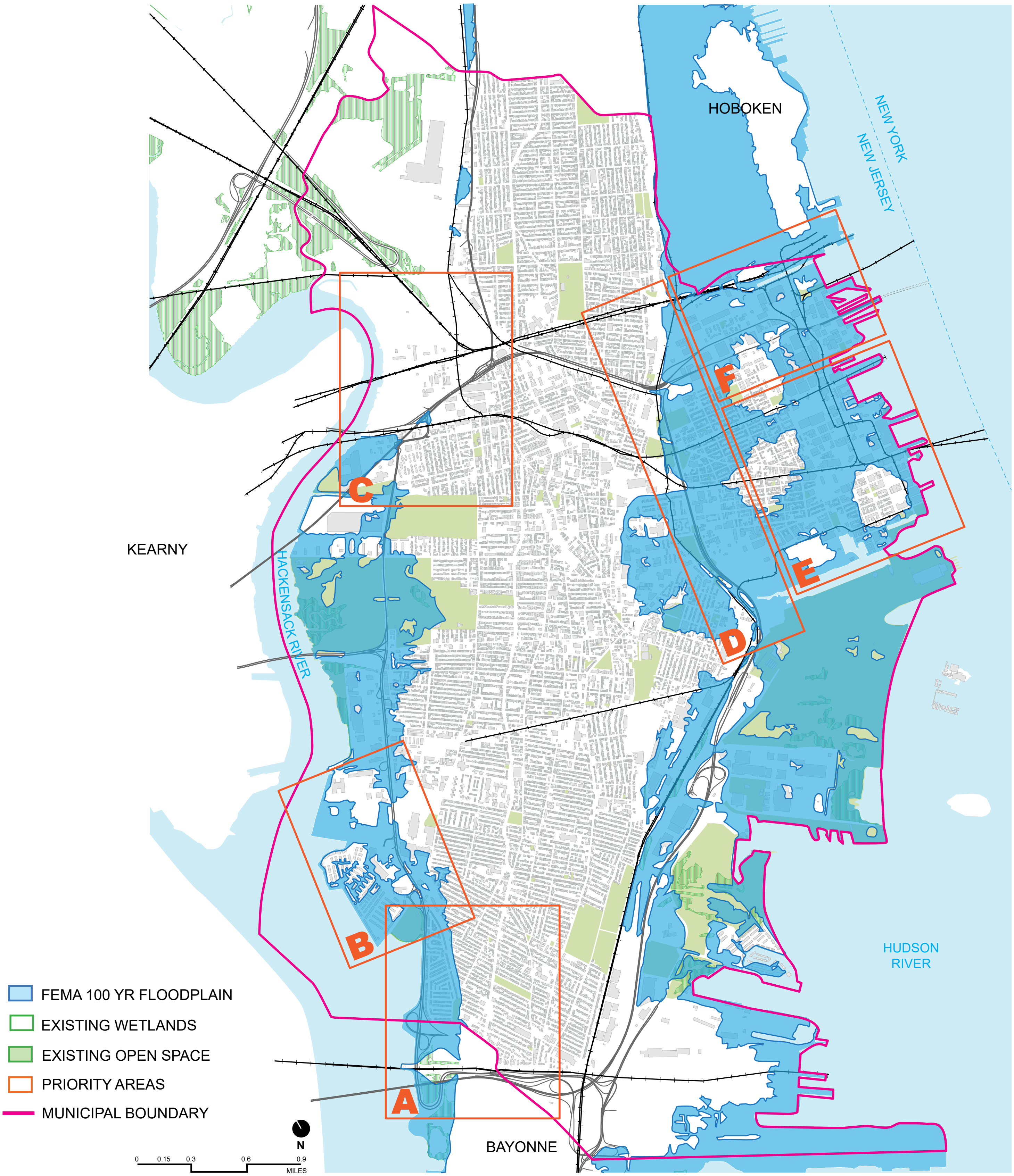
3. Improve emergency preparedness city-wide

4. Create a socially resilient community

5. Ensure economic stability against the threat of flooding

These goals are meant to guide planning efforts throughout the city. The priority areas were used for the Adaptation Master Plan to identify effective place- and vulnerability-specific adaptation measures.

Map 3.1

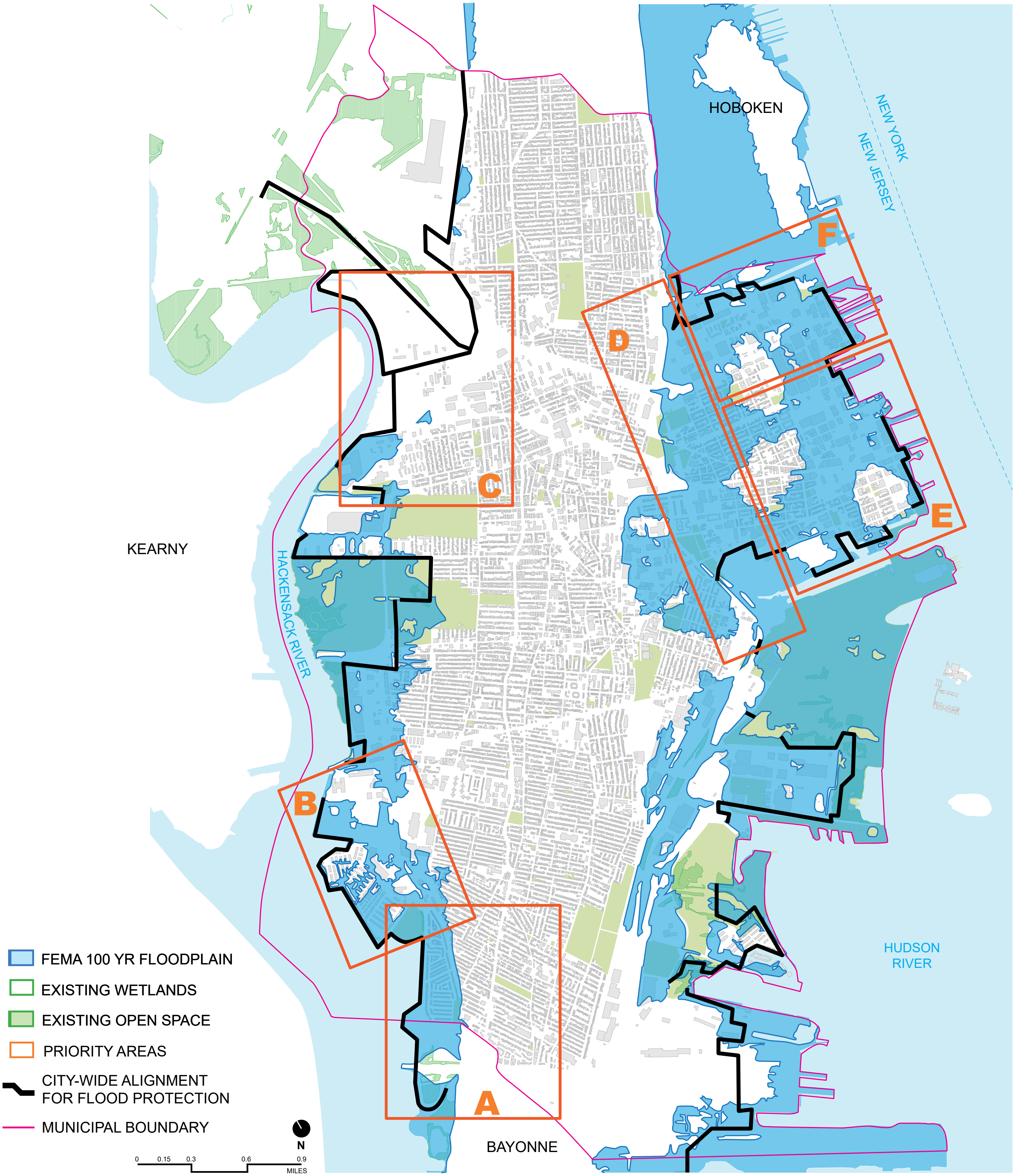

HOBOKEN
NEW YORK
NEW JERSEY
KEARNY
HACKENSACK RIVER
HUDSON RIVER
BAYONNE
A
B
C
D
E
F
FEMA 100 YR FLOODPLAIN
EXISTING WETLANDS
EXISTING OPEN SPACE
PRIORITY AREAS
MUNICIPAL BOUNDARY
N
0 0.15 0.3 0.6 0.9
MILES

The approach for adaptation in Jersey City is multi-layered, as it is clear that no one approach will address all of the City's vulnerabilities. Priority Areas A-F were identified through the Resiliency Plan by analyzing physical, environmental, social, and economic vulnerabilities in relation to the floodplain. These Priority Areas have been targeted as initial phases for implementation efforts for improving flood resiliency as specified in the Adaptation Plan. Using these areas, prior implementation recommendations were evaluated on the basis of a cost-benefit analysis to determine overall feasibility. This Adaptation Master Plan focuses on more substantial physical and infrastructure measures not captured in the Green Infrastructure plan, such as levees and raising at grade elevation in strategic locations so as to protect key infrastructure, neighborhoods, and the City as a whole.

Throughout the post-Sandy recovery process, the City has committed to identifying flood reduction strategies, which includes taking account of potential sea level rise in addition to the existing vulnerabilities from storms and flood inundation. Using both State and Federal grant funding, the City of Jersey City worked on two separate but interrelated studies that assessed the City's vulnerability to flooding and outlined potential strategies for becoming more resilient. The first of these, the Collaborative Climate Adaptation Planning for Urban Coastal Flooding (CCAPUCF) study, a partnership between the City and Stevens Institute of Technology, mapped the effect of projected sea level rise and storm surge on one percent annual chance flood hazard areas and identified 27 potential coastal protection measures that would mitigate storm surge. The second study, the Visualizations of Adaptation Scenarios and Next Steps White Paper ("The Baker Report"), prepared by Michael Baker International, attempted to make the measures identified in the CCAPUCF report understandable to the public through graphic illustrations and conceptual renderings.

Until the creation of an Adaptation Plan, there had not been a comprehensive review to determine if any of the adaptation measures discussed in CCAPUCF or the Visualizations white paper were feasible. The Adaptation plan creates its recommendations by eliminating infeasible measures and putting forth cost effective solutions to conceptualize a city-wide alignment for flood protection. The Plan also seeks to fill in the gaps that prior studies have left. The approach of the plan functions under the notion that each neighborhood and area of the city is unique, therefore there is no "one-size-fits-all" approach for resiliency planning, but rather a toolkit of infrastructure solutions that will weave together to form a continuous line of protection.

Map 3.2


HOBOKEN
NEW YORK
NEW JERSEY
KEARNY
HACKENSACK RIVER
HUDSON RIVER
BAYONNE
A
B
C
D
E
F
FEMA 100 YR FLOODPLAIN
EXISTING WETLANDS
EXISTING OPEN SPACE
PRIORITY AREAS
CITY-WIDE ALIGNMENT FOR FLOOD PROTECTION
MUNICIPAL BOUNDARY
N
0
0.15
0.3
0.6
0.9
MILES

As discussed in the Resiliency Master Plan, the identification and prioritization of vulnerable districts citywide is a necessary first step in understanding where protection measures will be most effective. An Implementation Action Plan identifies strategies and timelines for effectively implementing projects. There are several strategic efforts, many of which overlap, which together create an Implementation Action Plan. These strategies are outlined below, and are paired with recommended actions for the City to consider.

1. PREPAREDNESS– With the expectation that there will be future storm events in Jersey City, a team of government officials and first responders need to be trained to organize and control the response before, during, and after the event. This includes the evacuation of residents, the staffing of safe shelters, command-control, debris removal and clean-up efforts, and the dissemination of information on numerous platforms in several languages. Additionally, other actions to be taken include informing the public prior to any crisis where they can go in case of a storm emergency, how to provide adequate protection for their pets, and where information will be made available.

2. PUBLIC SAFETY – The safety of those who live, work, and travel through Jersey City is of paramount importance when determining what and how adaptation measures are implemented. This strategy includes both safety during and after a storm event, as well as the resiliency and preparedness of local hospitals, emergency services, and first responders.

3. CRITICAL INFRASTRUCTURE– When responding to a crisis, it is also important that communications systems, power, roadways and transportation, and ports are operational during and after storm events. Streets must be passable to evacuate or bring in responders, power must be restored quickly, and all critical infrastructure brought online swiftly. Infrastructure needs to be protected from wind and water inundation to the greatest extent possible. It is essential to draft plans for adapting to circumstances where segments of services are not immediately available.

4. RESILIENT REDEVELOPMENT– As Jersey City continues to grow, future development and redevelopment needs to be undertaken with an eye on the future, informed by the past. With the expectation that sea level rise and flooding will be a continued threat, modifying zoning and building codes to require construction techniques that will reduce or eliminate damage becomes a greater priority.

5. STORMWATER MANAGEMENT – Jersey City can tackle the effects of stormwater retention for major storm and flooding events, as well as for typical heavy rains and pluvial flooding that occur several times annually. Stormwater absorption and retention requirements can be imposed on new development. Existing sewer system improvements are part of the overall management plan.

6. PROPERTY ACQUISITION – In some cases, it is becoming clear that certain properties are suffering repeat flooding events. There is an incredible burden on the property owners as well as the City when this happens. Prioritizing City acquisition of chronically flood prone properties would limit this burden on the property owners. Moreover, such properties have potential to be designed as open spaces or other such uses that will absorb or hold water during future events.

To determine the value of adaptation implementation, costs, both fiscal and otherwise, were measured against any potential benefits. GIS data was used to determine the assessed value of flood areas, which were measured against the determined amount of linear feet per adaptation improvement in each Priority Area. Each proposal considered a number of factors including: historic value, economic impact, business impact, transportation infrastructure, impact on vulnerable populations, technical feasibility, political feasibility, administrative feasibility, environmental feasibility, urban design impact, and implementation issues.

The solutions for each Priority Area utilize a customized combination of multiple flood protection measures. See Figure 3.3 below for the resiliency infrastructure toolkit for protection measures recommended throughout the city-wide alignment.

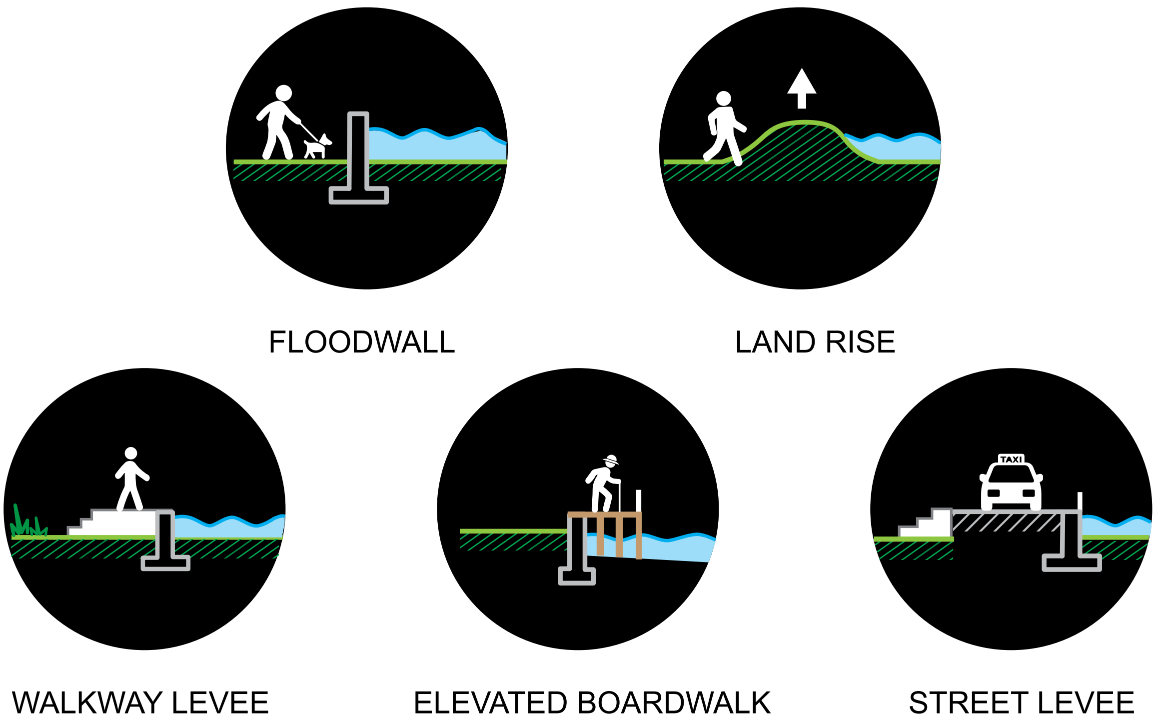


Figure 3.3

Prior studies also did not consider political vulnerability or municipal budgeting. While some solutions may have high effectiveness, cost in both dollars and political capital can be prohibitive. To fill this analytical gap, the Adaptation Master Plan sets forth new Project Recommendations, considering the character of the given area, political constraints, economic impacts to businesses, cost, and other real-world effects of the implementation of any given infrastructure recommendation as identified in the Cost-Benefit analysis.

A Summary Matrix, outlining synergies and conflicts between planning considerations and proposed projects can be found in the full Adaptation Master Plan on Jersey City's Open Data Portal.

The Adaptation Plan worked to refine recommendations provided in the Visualizations of Adaptation Scenarios and Next Steps White Paper by Michael Baker International in 2015. By further studying these recommendations for feasibility and compatibility with best practices, the Adaptation Plan takes the city-wide alignment and specifically the Priority Areas closer to engineering design and implementation.

Area A: Street Levee (Country Village)

Located on the east side of Route 440, Area A is generally bounded by the Bayonne municipal boundary to the south, Newark Bay to the west, Society Hill to the north, and Kennedy Boulevard to the east. It is recommended that a street levee be built along the west side of Route 440. This will involve raising the roadway by three to four feet. This will ensure that not only Country Village is protected, but ensures that Route 440 itself remains a safe, dry evacuation route. The street should be raised for the entirety of Area A, but should continue north to the extent determined necessary by engineers in order to control floodwater inundation. Generally speaking, the challenges to implementing this recommendation are more short-term, primarily circulation disruption during the construction period. The preferred approach is to raise the highway, whether as part of an overall redesign of Route 440 or as a standalone project specific to this neighborhood.

Any potential adverse impacts of this project fall under the potential and/or short-term category. This street levee could be incorporated into the existing 440 Boulevard State of New Jersey project, or as a standalone project specific to this neighborhood. The total number of residents benefited by this measure would be over 2,000.

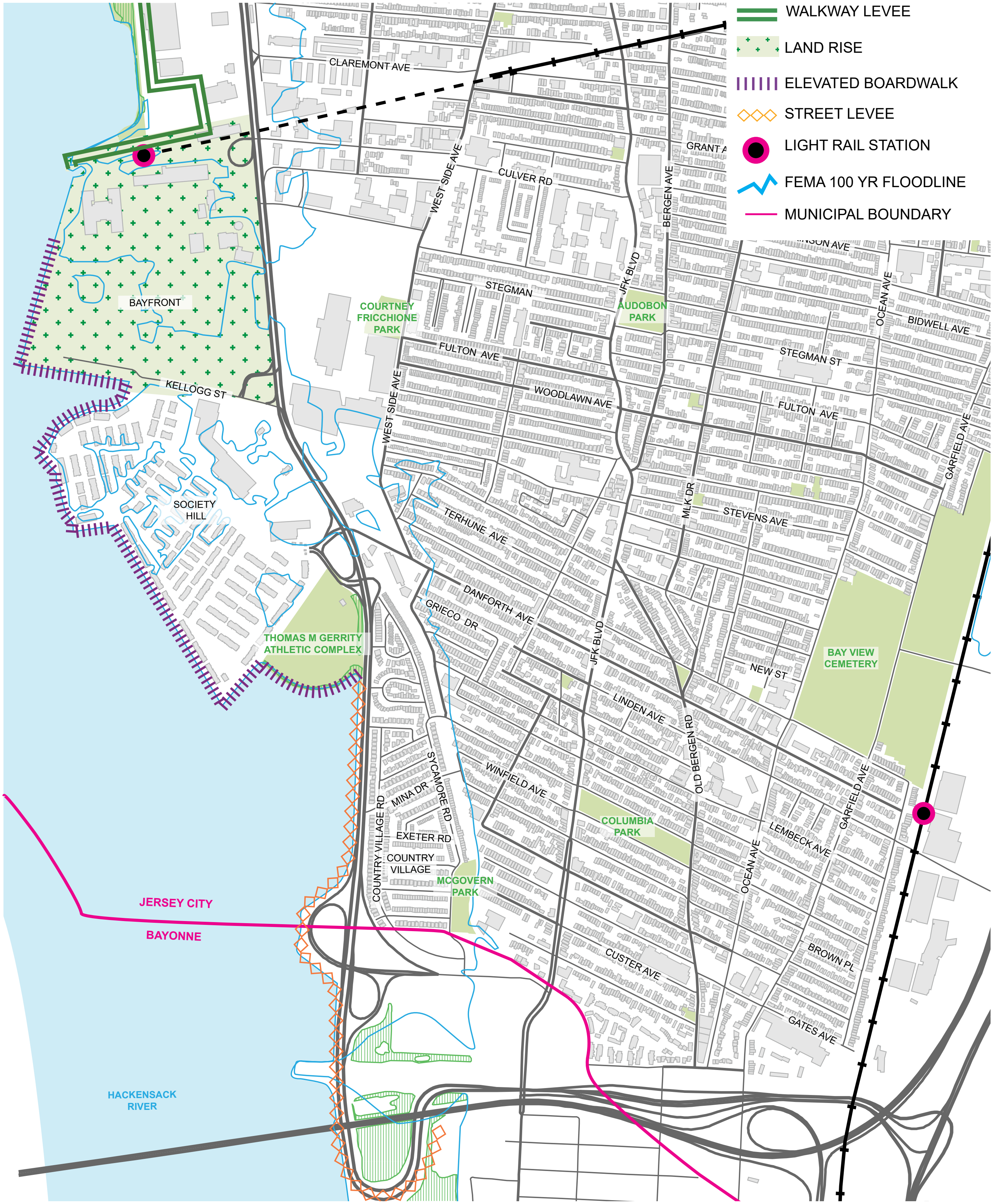
Area B: Elevated Boardwalk (Society Hill + Bayfront)

Located on the west side of Route 440, Society Hill is a multi-family residential development that has an existing walkway along its riverfront. It is recommended that the existing Hackensack RiverWalk be raised five to six feet from its current grade. The walkway distance affected is approximately one mile in length.

The boardwalk levee project will be most successfully undertaken after the recommended street levee at Country Village is complete. If the boardwalk levee were done first, water which would have naturally affected Society Hill may be diverted south to Country Village where the flooding threat is already high, thereby exacerbating the flood impact.

Rather than continue raising Route 440 and adjacent land within Area B2 up until Communipaw Avenue, it is recommended to create a walkway levee along the Morris Canal Greenway in this area. While the idea of a street levee Area B2 proves to have significant short- and long-term challenges, a walkway levee along the Morris Canal Greenway is a similar, though less complicated and less costly approach. Because there are very significant needs to protect the commercial businesses in this area as well as pending residential and mixed-use development, such as Bayfront, making the walkway levee a recommended project in conjunction with Route 440 Boulevard State project is an ideal solution. The raised walkway has fewer negative effects on future site access and visibility than raising the entire street and adjacent land.

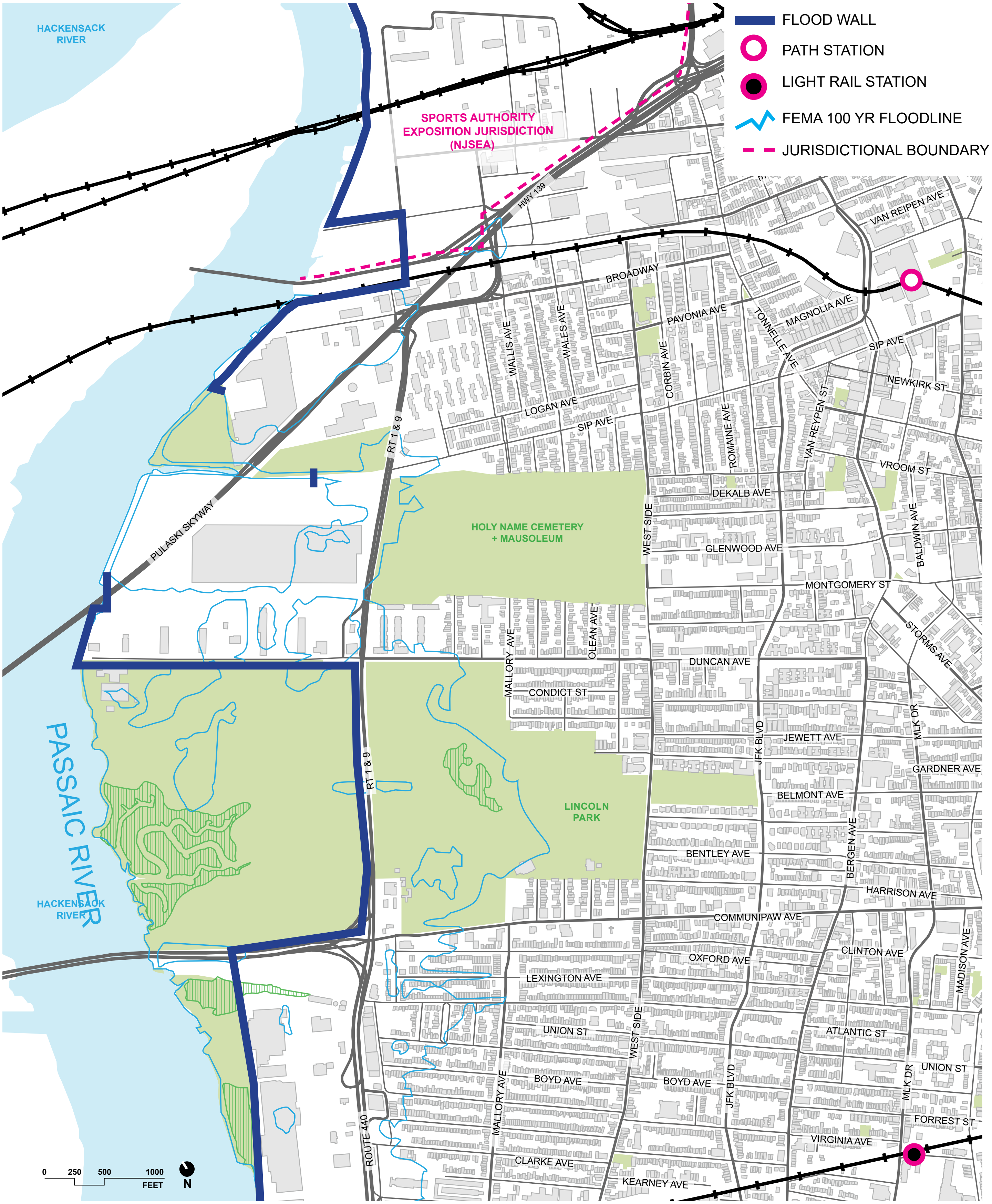
Map 3.3


WALKWAY LEVEE
LAND RISE
ELEVATED BOARDWALK
STREET LEVEE
LIGHT RAIL STATION
FEMA 100 YR FLOODLINE
MUNICIPAL BOUNDARY
CLAREMONT AVE
CULVER RD
WEST SIDE AVE
BERGEN AVE
JFK BLVD
STEGMAN
COURTNEY FRICCHIONE PARK
AUDOBON PARK
BAYFRONT
FULTON AVE
WOODLAWN AVE
KELLOGG ST
BIDWELL AVE
OCEAN AVE
STEGMAN ST
GARFIELD AVE
SOCIETY HILL
MLK DR
STEVENS AVE
TERHUNE AVE
DANFORTH AVE
GRIECO DR
THOMAS M GERRITY ATHLETIC COMPLEX
NEW ST
BAY VIEW CEMETERY
LINDEN AVE
OLD BERGEN RD
WINFIELD AVE
SYCAMORE RD
MINA DR
COUNTRY VILLAGE RD
EXETER RD
COUNTRY VILLAGE
COLUMBIA PARK
LEMBECK AVE
MCGOVERN PARK
JERSEY CITY
BAYONNE
CUSTER AVE
BROWN PL
GATES AVE
HACKENSACK RIVER

Area C: Flood Walls (Marion + Lincoln Park)

Area C is unique, in that its priority is based primarily on infrastructure rather than residences or businesses. This area includes PSE&G facilities, rail yards, and scattered industrial uses. As such, protecting the entire area would not be cost effective. Rather, flood walls can be used to keep water away from specific areas and buildings. These barriers would be composed of flood-damage-resistant materials and appropriate for site-specific protection. Wet and dry floodproofing of buildings is also recommended. Wet floodproofing allows a building to anticipate flooding and not be destroyed by water entering the structure. Dry floodproofing creates a watertight structure with all elements substantially impermeable to the entrance of floodwater and with structural components having the capacity to resist flood loads.

Map 3.3


FLOOD WALL
PATH STATION
LIGHT RAIL STATION
FEMA 100 YR FLOODLINE
JURISDICTIONAL BOUNDARY
HACKENSACK RIVER
SPORTS AUTHORITY EXPOSITION JURISDICTION (NJSEA)
HWY 139
PULASKI SKYWAY
RT 1 & 9
HOLY NAME CEMETERY + MAUSOLEUM
LINCOLN PARK
PASSAIC RIVER
HACKENSACK RIVER
ROUTE 440
BROADWAY
PAVONIA AVE
MAGNOLIA AVE
VAN REIPEN AVE
TONNELLE AVE
SIP AVE
NEWKIRK ST
WALLIS AVE
WALES AVE
CORBIN AVE
LOGAN AVE
ROMAINE AVE
VAN REYPEN ST
VROOM ST
DEKALB AVE
BALDWIN AVE
WEST SIDE
GLENWOOD AVE
MONTGOMERY ST
STORMS AVE
DUNCAN AVE
MALLORY AVE
OLEAN AVE
CONDICT ST
JFK BLVD
MLK DR
JEWETT AVE
GARDNER AVE
BELMONT AVE
BERGEN AVE
BENTLEY AVE
HARRISON AVE
COMMUNIPAW AVE
CLINTON AVE
MADISON AVE
OXFORD AVE
LEXINGTON AVE
UNION ST
ATLANTIC ST
BOYD AVE
FORREST ST
VIRGINIA AVE
CLARKE AVE
KEARNEY AVE
0 250 500 1000
FEET
N

Area D: Land Rise (Mill Creek, Bergen-Lafayette, Western Downtown)

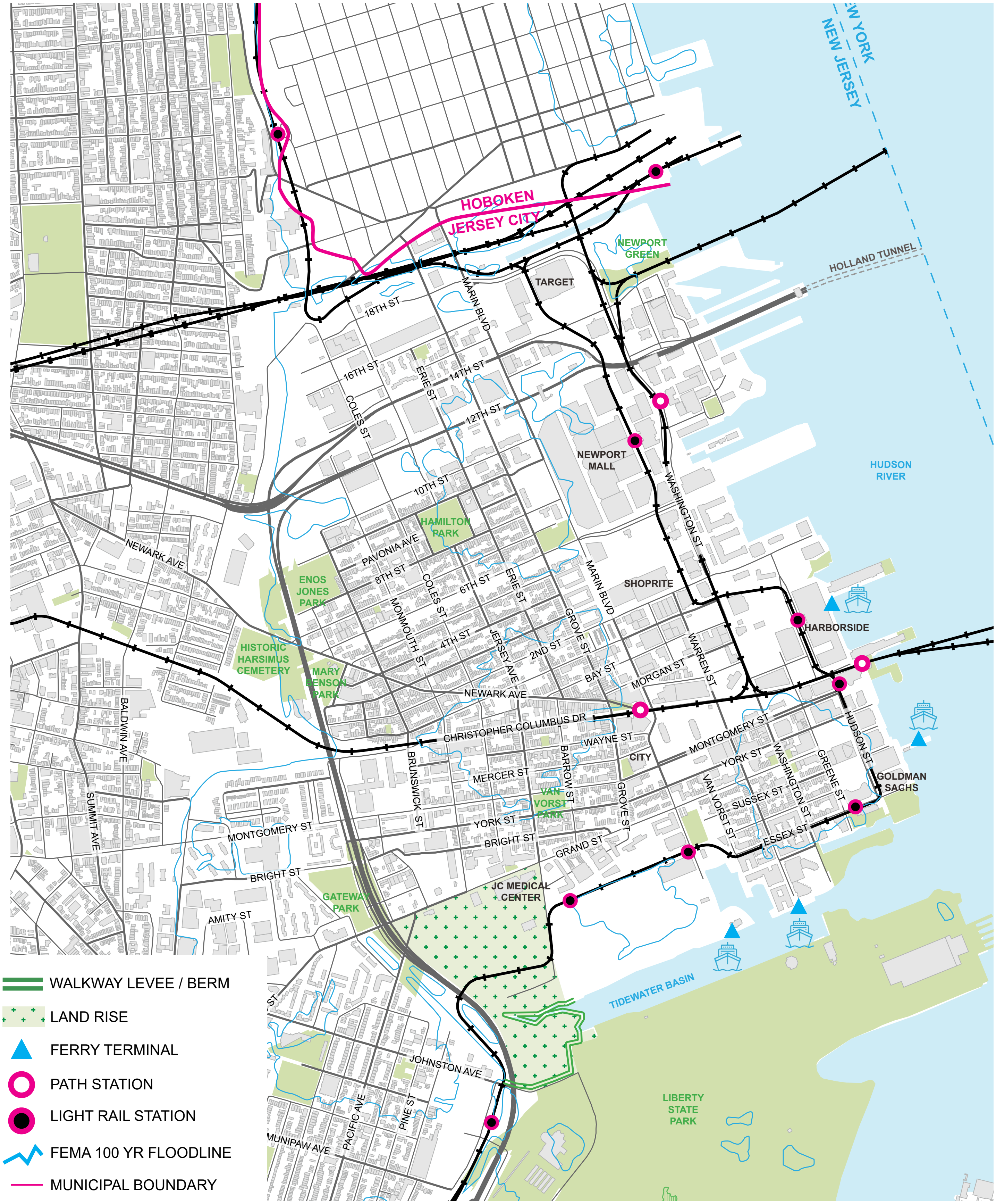
These proposed adaptation measures for Area D focus on raising existing elevations in land around Mill Creek, focusing largely on the Grand Jersey Redevelopment Area. Of note, Area D also includes the Morris Canal Redevelopment Area and extends north to include the western extents of Van Vorst Park and Hamilton Park Historic Districts and the Jersey Avenue Park and Jersey Avenue Tenth Street Redevelopment Plans near the northern boundary of Downtown. The proposed measures, however, deal primarily with the Grand Jersey/Mill Creek area. The land around Mill Creek has an elevation as low as three feet NAVD88.

West of Grand Jersey is the Communipaw neighborhood (also referred to as Morris Canal), which in addition to being part of a one-percent flood zone includes vulnerable populations with public housing projects and senior housing. The Grand Jersey Redevelopment Plan Area incorporates Jersey City Medical Center and the PSE&G Substation at its north end. In addition, the western portion of Downtown is included, specifically the area between the New Jersey Turnpike Newark Bay Extension to the west and Areas E and F to the east. Recommendations for Area D include the following:

1. Berms / Levees: In the short term, it is recommended that targeted levees and berms be implemented in Area D, rather than large-scale land rise like that recommended by the CCAPUCF and Visualizations reports. During flood events, Area D is significantly impacted by water entering from the south through the Tidewater Basin and into Mill Creek and from the north through the Long Slip Canal at the Hoboken border. These two flood entry points must be addressed in order to prevent flooding in the back end of town which was historically a marshy area. This area also has vulnerable populations and pockets of poverty which merit special attention. To protect the area in the short term, it is recommended that in coordination with the land and street rise proposed with the Crescent Park project, additional berms be strategically located at vulnerable points just north of Jersey Avenue to compensate for any residual flooding that is not deterred by the raised street. The Crescent Park project is discussed in the Ongoing Efforts section of this report.

2. Extensive Engineering Study: It is recommended that a comprehensive engineering study be undertaken to address Area D, including the CSO (which has already been studied to some extent in the Mill Creek Initial Design + Finance Analysis and Recommendations prepared by Build it Green) as well as the threat of storm surge. The complexity of this area merits special attention in order to develop a long-term, cost-effective solution that will thoroughly protect all of the residents, businesses, and infrastructure located therein.

Map 3.3



NEW YORK
NEW JERSEY
HOBOKEN
JERSEY CITY
NEWPORT GREEN
TARGET
HOLLAND TUNNEL
18TH ST
MARIN BLVD
16TH ST
14TH ST
ERIE ST
COLES ST
12TH ST
NEWPORT MALL
HUDSON RIVER
10TH ST
WASHINGTON ST
HAMILTON PARK
PAVONIA AVE
NEWARK AVE
ENOS JONES PARK
8TH ST
6TH ST
SHOPRITE
HARBORSIDE
HISTORIC HARSIMUS CEMETERY
MONMOUTH ST
4TH ST
JERSEY AVE
2ND ST
GROVE ST
BAY ST
WARREN ST
MORGAN ST
MARY BENSON PARK
BALDWIN AVE
CHRISTOPHER COLUMBUS DR
WAYNE ST
CITY
MONTGOMERY ST
HUDSON ST
BRUNSWICK ST
BARROW ST
YORK ST
GREENE ST
GOLDMAN SACHS
SUMMIT AVE
MERCER ST
VAN VORST PARK
VAN VORST ST
SUSSEX ST
MONTGOMERY ST
YORK ST
BRIGHT ST
GRAND ST
ESSEX ST
BRIGHT ST
JC MEDICAL CENTER
GATEWAY PARK
AMITY ST
TIDEWATER BASIN
JOHNSTON AVE
LIBERTY STATE PARK
PINE ST
PACIFIC AVE
MUNIPAW AVE
WALKWAY LEVEE / BERM
LAND RISE
FERRY TERMINAL
PATH STATION
LIGHT RAIL STATION
FEMA 100 YR FLOODLINE
MUNICIPAL BOUNDARY

Area E: Various Adaptation Measures (Downtown South)

Area E includes all or parts of historic, long-established neighborhoods such as Paulus Hook, Van Vorst Park, Harsimus Cove, Exchange Place, the Powerhouse Arts District, and Hamilton Park.

1. Dudley/Washington Street Levee. It is recommended that Dudley and Washington Streets be raised three to four feet above grade. This effort should have no impact on the historic character or eastern views that the area is so well known for. It is also one of the most affordable physical adaptation recommendations in this report.

2. Hudson River Waterfront Boardwalk Levee. It is recommended that the Hudson River Waterfront Walkway in Area E be converted into a Boardwalk levee with a height of up to 14 feet above mean sea level. Because the Hudson River Waterfront Walkway is already in place, modifications to it may be acceptable to the public. The Waterfront Walkway would sit atop the levee, and additional space for outdoor recreation should be encouraged.

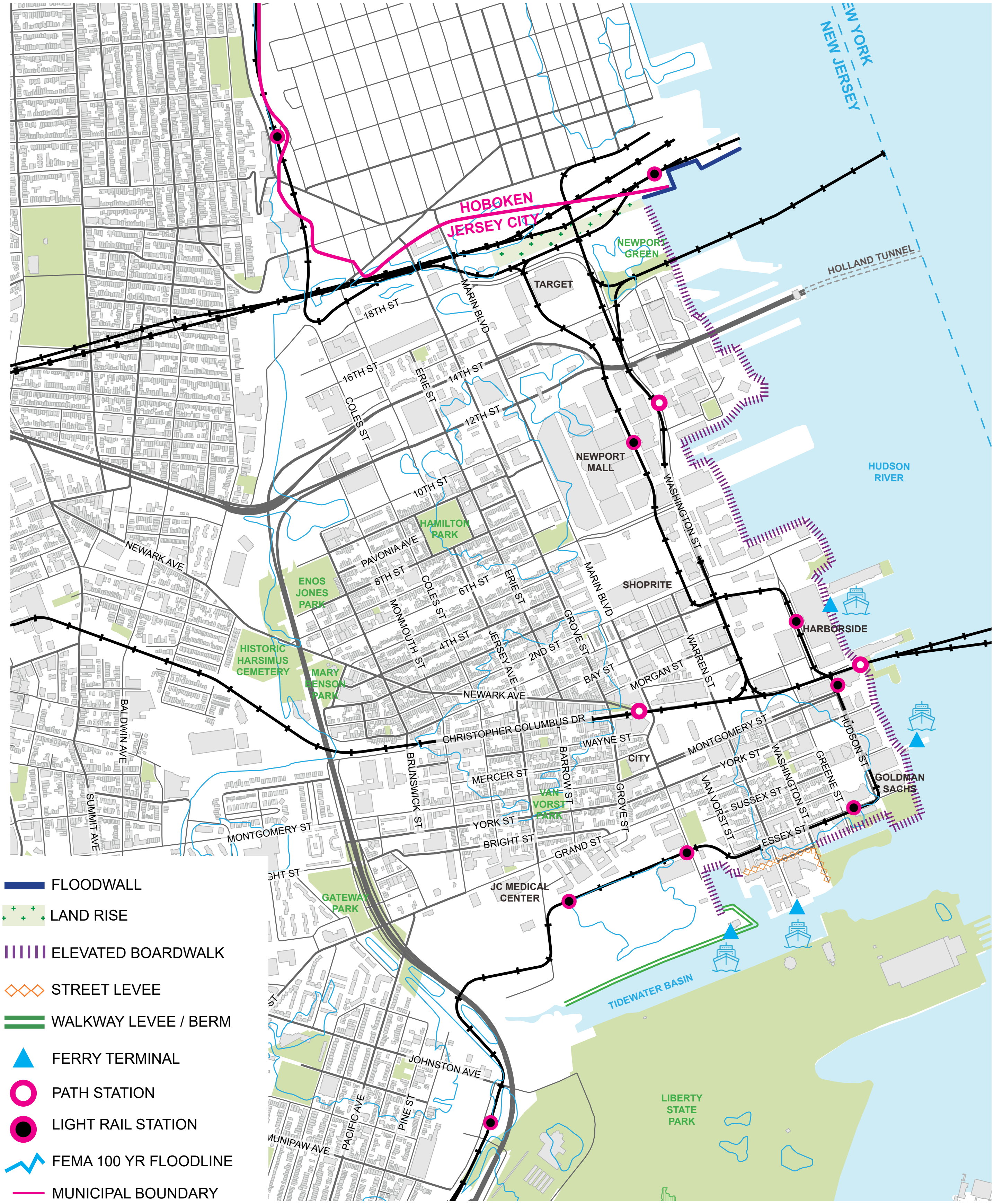
Area F: Various Adaptation measures (Downtown North)

Area F includes the northern portion of Downtown, including Newport and the Holland Tunnel access. A key difference between Area F and Area E is that most of Area F has only limited historic district properties or long established neighborhoods except for a northern portion of the Hamilton Park Historic District. The changing neighborhood and new development is highlighted by the number of redevelopment plans that have been adopted in this area, the most prominent being the Newport Redevelopment Plan which covers the eastern portion of Area F and the Jersey Avenue Redevelopment Plans to the north and west. Area F includes a one-percent flood zone, block groups that equal or exceed the regional poverty threshold, critical facilities including the Holland Tunnel, PATH stations, ferry docks, Hudson-Bergen Light Rail, contaminated sites and surface water discharge areas, and three combined sewer overflows.

1. Rail Yard Flood Protection Barrier It is recommended that a flood protection barrier be developed along the south side of the NJ Transit rail yards. This could be done either by using the rail's right of way and building a wall along its edge, or by building a wall/berm along the northern side of 18th Street which would extend to the face of the Palisades. To resolve current road crossings, which are very low in elevation, a combination of regrading and deployables should be part of the solution. Ideally, the area should be regraded two to three feet and then deployables used. (Using only deployables will not resolve more frequent high tides and sea level rise induced events.)

2. Wet Weather Pumping Stations When the combined sewer system reaches capacity during heavy rainfall, water can be treated at a wet weather treatment facility before it is discharged to local water bodies. This method helps protect human health and the environment by reducing the amount of untreated combined sewage that overflows into the Hudson River by preventing storm water from flooding the sewer lines and coming back up into the streets.

Map 3.3


NEW YORK
NEW JERSEY
HOBOKEN
JERSEY CITY
NEWPORT GREEN
HOLLAND TUNNEL
TARGET
18TH ST
MARIN BLVD
16TH ST
ERIE ST
14TH ST
12TH ST
COLES ST
NEWPORT MALL
HUDSON RIVER
WASHINGTON ST
10TH ST
HAMILTON PARK
PAVONIA AVE
NEWARK AVE
ENOS JONES PARK
8TH ST
6TH ST
SHOPRITE
HARBORSIDE
MONMOUTH ST
4TH ST
JERSEY AVE
2ND ST
GROVE ST
WARREN ST
HISTORIC HARSIMUS CEMETERY
MARY BENSON PARK
BAY ST
MORGAN ST
NEWARK AVE
CHRISTOPHER COLUMBUS DR
WAYNE ST
CITY
MONTGOMERY ST
BALDWIN AVE
BRUNSWICK ST
BARROW ST
YORK ST
HUDSON ST
GREENE ST
GOLDMAN SACHS
MERCER ST
VAN VORST PARK
VAN VORST ST
SUSSEX ST
WASHINGTON ST
SUMMIT AVE
MONTGOMERY ST
YORK ST
BRIGHT ST
GRAND ST
GROVE ST
ESSEX ST
JC MEDICAL CENTER
GATEWAY PARK
TIDEWATER BASIN
JOHNSTON AVE
PACIFIC AVE
PINE ST
MUNIPAW AVE
LIBERTY STATE PARK
FLOODWALL
LAND RISE
ELEVATED BOARDWALK
STREET LEVEE
WALKWAY LEVEE / BERM
FERRY TERMINAL
PATH STATION
LIGHT RAIL STATION
FEMA 100 YR FLOODLINE
MUNICIPAL BOUNDARY

ADDITIONAL RECOMMENDATIONS

There are several options which would be better described as “ongoing maintenance” measures that apply citywide. In other words, short-term actions that build on efforts that have been engaged by the City and other agencies to address flooding and other vulnerability concerns. These actions include:

1. Downspout Disconnection: Disconnecting downspouts helps reduce the amount of stormwater sent through the sewer system. Less stormwater can help prevent wastewater from backing up and thus reduce the risk of basement flooding.

2. Mandatory Backwater Valves: Backwater valves prevent contaminated sewer water from backing-up into homes and businesses.

3. Enhance Sewer Maintenance & Camera Inspection of Sewers: Allows prioritization of sewer repairs/replacement and identifies problems before the required repairs become very costly and disruptive to residents and businesses.

4. Green Infrastructure: Green Infrastructure opportunities are discussed in depth in Jersey City 2017 Urban Environmental Green Infrastructure Master Plan and the Resilient Design Handbook.

5. Wet Flood Proofing: Includes permanent or contingent measures applied to a structure or its contents that prevent or provide resistance to damage from flooding while allowing floodwaters to enter the structure or area. More information on Wet Flood Proofing can be found in the Resilient Design Handbook.

6. Dry Flood Proofing: Includes any combination of structural and non-structural additions, changes, or adjustments to structures which reduce or eliminate flood damage to real estate or improved real property, water and sanitary facilities, structures and their contents. More information on Dry Flood Proofing can be found in the Resilient Design Handbook.

FLOOD PROTECTION MEASURES SUMMARY

	AMOUNT OF PROTECTION RECOMMENDED						
INFRASTRUCTURE TYPE	**AREA A**	**AREA B**	**AREA C**	**AREA D**	**AREA E**	**AREA F**	**TOTAL**
FLOOD WALL	-	-	15,500 LF	-	-	1,200 LF	16,700 LF
STREET LEVEE	2,000 LF	-	-	-	1,500 LF	-	3,500 LF
ELEVATED BOARDWALK	-	5,280 LF	-	-	8,300 LF	6,500 LF	20,080 LF
WALKWAY LEVEE / BERM	-	5,800	-	2,300 LF	1,700 LF	-	9,800 LF
LAND RISE	-	100 AC	-	31 AC	-	7.5 AC	138.5 AC

*Quantities of protection recommended are based on crude assumptions. Exact amounts per infrastructure type will be refined through further feasibility and engineering study. Quantities recommended do not currently account for intermittent deployable floodgates to maintain access and connectivity in blue sky conditions.

THE PLANS | URBAN ENVIRONMENTAL GREEN INFRASTRUCTURE DESIGN PLAN

As was previously stated, the City of Jersey City is experiencing unprecedented growth in population and development with a trajectory toward soon becoming the largest city in the state. Growth and development in an area vulnerable to flooding poses unique challenges. The existing CSO also presents particular challenges due to tidal flows, large areas within flood zones and development near sea levels.

The Urban Environmental Green Infrastructure Design Plan evaluates the present condition of these systems in the city, the expected impact of proposed improvements such as first flush storage areas, the separation of combined flows in areas of recent development, and potential locations for green stormwater management practices going forward. The recommendations made in this Plan are intended to reduce localized flood conditions through green infrastructure site modifications, including within rights-of-way, and open spaces, as well as supplemental measures such as rooftop gardens, and green roofs and walls.

A methodology for determining the appropriateness of various green measures is provided in the Plan, along with examples of treatments with quantifiable goals and a Green Infrastructure Map identifying locations where the recommended green infrastructure application would be most effective and appropriate.
Green infrastructure can be simple or complex, ranging from gardens to man-made wetlands, from green roofs to living shorelines. Green infrastructure can be employed by governments, as is often the case when significant infrastructure is required, or undertaken by the average resident who wishes to capture rain in a barrel or sponsor a street tree.

As a nearly built-out environment, Jersey City has limited pervious surface – pavement and rooftops in an abundance of information and recommendations. abound and there is little vegetated cover. Contamination from past industry and land disturbance from development also “mobilizes sediment and releases nutrients to lakes, streams and wetlands - fundamentally changing aquatic habitats and their potential uses. This change in the landscape decreases groundwater recharge and increases the pollutant load, frequency and volume of surface stormwater runoff”. It is important not to encourage the spread of contaminants through the effort to increase permeability. Increasing pervious coverage or reducing surface runoff in other ways will help water follow its normal course of infiltration or delay infiltration such that the water table can handle the volume which is otherwise limited by the impervious coverage.

Numerous studies and reports have been conducted over the years, some pre-dating Hurricane Sandy, which have investigated and made recommendations for a variety of Stormwater Management approaches, including Tree Canopy Assessment and the introduction of green infrastructure. Each of these studies approached resiliency and green development from a differing vantage point, resulting in an abundance of information and recommendations.

EXAMPLES OF GREEN INFRASTRUCTURE

“Green infrastructure refers to the natural and constructed stormwater controls that mimic the natural hydrological cycle by capturing, treating, and/or using stormwater runoff from public and private properties. These practices are incorporated into the planning, site design and construction phases of development projects.” Said another way, “green infrastructure is an interconnected network of natural areas and other open spaces that conserves natural ecosystem values and functions, sustains clean air and water, and provides a wide array of benefits to people and wildlife.”

Stormwater Trenches: Capture an initial one-inch concentration of stormwater prior to entrance to a combined sewer system. This involves the introduction of green inlets upstream to redirect stormwater to a series of underground stone or structured storage trenches for infiltration or storage with slow release.

Individual Infiltration Units: Provide point diversion of curb line runoff and to provide a means of collection and infiltration of rainwater. Each unit is placed along the curb in relation to an adjacent street tree and planting area, and the runoff is captured and fed to the root system below.

Native Basin Plantings: Capture runoff and provide an effective means of infiltration. In most cases this involves the use of native wetland seeding and plantings that are particularly adapted to promoting infiltration.

Rain Gardens: Divert water, usually from a paved corridor, to a planted low area that allows for a volume of storage and infiltration

Bioswales: Direct water through a graded and planted swale, usually adjacent to a roadway, to attenuate runoff and promote infiltration. The plantings are designed to promote evapotranspiration and are usually wet-tolerant native species, requiring less maintenance

Pervious Surfacing: Used in a range of applications, notably for surfacing of basketball courts and walking trails within recreation sites. The idea is now being developed in gutter collection systems and for crosswalk areas that can infiltrate and redirect surface runoff

Figure 4.1

GREEN DESIGN STANDARDS

It has been the intent of the majority of green stormwater systems to evaluate the possibility of intercepting the initial one inch to one and a half inches of rainfall, and divert it to an alternative drain system that can infiltrate and/or store the potential runoff. One of the major goals of the developing stormwater management concepts throughout the City, therefore, is to do just that, and retain and/or infiltrate the first one inch of rainfall in the immediate area where this water falls or, if possible, to divert water at higher elevations prior to it entering the combined sewer. This goal of capturing at least one inch is applied to all analyses and recommendations herein.

The City's goal of capturing the first one inch could have a significant impact not only on major storms, but on "typical" rain events throughout the year. There are numerous methods by which to achieve this goal, such as integrating green streets concepts into the redesign of urban corridors and spaces, improving infrastructure sustainability, and assisting the regional utility authority in their efforts to reduce peak stormwater flows into the system. Also, green roof systems, combined with porous and pervious surface systems including rain garden areas, shade trees and landscaping to mitigate stormwater prior to it reaching the existing inlets and storm systems are common approaches. The first step in analyzing green infrastructure solutions is to investigate the ability of a given area to support stormwater management initiatives and techniques in conjunction with any anticipated development improvements. The main design criteria for green infrastructure are area, volume, and drainage requirements.

- **Area:** when determining if a green infrastructure project is practical and feasible, a key consideration is if there is adequate space to accommodate the physical infrastructure itself
- **Volume:** most green infrastructure systems must be sized to capture and manage the required storage volume (V) equal to a minimum of one inch of runoff from the contributing impervious drainage area
- **Drainage:** soil infiltration testing must be completed prior to design

RECOMMENDATIONS

Based on bedrock geology, surface geology, soils, and proximity to the upward side of gravity fed drainage lines, specific green infrastructure recommendations have been identified. Three specific geographic areas identified as the Upland, Terrace, and River Frontage were evaluated based on these parameters.

Upland: The Upland area is a localized high point within the city and is an ideal location to remove as much stormwater as possible at the highest point in the Stormwater/Sewer (Combined Sewer Operating) System. In other words, this area can serve the City by removing water from the system before it flows downhill. The following specific locations have the potential for significant net improvement in stormwater reduction by introducing green infrastructure. Each analysis is based upon actual volume of stormwater that falls in that corridor, and serves as a guide for the evaluation of potential sites and a methodology for determining volumes and sizing:

- **Upland Area No. 1:** Bergen Avenue and Vroom Street;
- **Upland Area No. 2:** John F. Kennedy Commercial Corridor;
- **Upland Area No. 3:** Sip Avenue at Garrison Avenue;
- **Upland Area No. 4:** Brett Triangle.

Terrace: The Terrace lies between the Upland and the River Frontage, and has been the subject of repeated inundation due to its location at the lower end of a gravity system. Attempts to mitigate the stormwater will contribute to alleviating the total effects of storm events. With the general slope and the stormwater sewer (CSO) flowing down to a collector pipe on the Hackensack, this is an ideal location to introduce green infrastructure and seek opportunities to keep stormwater out of the system. The Terrace area overall can serve the city best capturing water and slowly releasing it into open spaces in the area. The logical locations that will be investigated are:

- **Terraces Area No. 1:** Bartholdi Avenue at Sullivan Drive;
- **Terraces Area No. 2:** Mina Drive at Sayles Street;
- **Terraces No. 3:** McGovern Park at Sycamore Road;
- **Terraces No. 4:** Turnpike.

River Frontage: The River Frontage includes the low-lying areas along the banks of the Hudson and Hackensack Rivers with soils that are not conducive to water storage. Despite being the closest to the waterfront and the lowest in elevation, has the most limited impact in terms of green infrastructure. The River Frontage areas overall can serve the city best through levees, revetments, and embankments. Figure summarizes a variety of green and grey infrastructure techniques for the River Frontage areas. A benefit to these approaches is that each offers a dual opportunity of providing open space or walkways along or beside the structure, as well as the potential to allow people the opportunity to approach the water's edge, connecting them to nature. The following River Frontage areas in the are scattered throughout the waterfront along both rivers. These areas include:

- **River Frontage Area No. 1:** Country Village;
- **River Frontage Area No. 2:** Society Hill;
- **River Frontage Area No. 3:** Lincoln Park;
- **River Frontage Area No. 4:** Communipaw;
- **River Frontage Area No. 5:** Downtown;
- **River Frontage Area No. 6:** Newport.

MAINTENANCE

All forms of infrastructure require regular maintenance, and green infrastructure is no exception. The suggested systems in the Urban Environmental Green Infrastructure Plan are designed to last 50 years with proper maintenance. To ensure long-term success of green infrastructure projects, a maintenance program is a necessity. Due to its urban environment, Jersey City's green infrastructure is susceptible to extreme temperatures, pollution, sediment and trash accumulation, and an aggressive weed community. Removing competitive plant species, sediment, and trash can help ensure the longevity green infrastructure. Other maintenance activities include repairing small erosion problems, pruning trees, removing graffiti, and replanting or reseeding areas. A full maintenance table and additional citywide recommendations can be found in the full report.

Together, all of these efforts can not only contribute to the resiliency of Jersey City, but will make it a safe, protected, and beautiful place.

Map 4.1


HOBOKEN
NEW YORK
NEW JERSEY
KEARNY
HACKENSACK RIVER
HUDSON RIVER
BAYONNE
UPLAND AREA
TERRACE AREA
RIVER FRONTAGE AREA
MUNICIPAL BOUNDARY
N
0
0.15
0.3
0.6
0.9
MILES

ONGOING EFFORTS

As the threats of climate change, future storms, and rapid development wield pressure on Jersey City, we will continue to collaborate with stakeholders and regional partners to identify opportunities to improve the City's resiliency to flooding. This final section highlights a number of ongoing efforts the City is pursuing.

ONGOING EFFORTS

LONG SLIP

This project will allow NJ Transit to improve resiliency by filling in the Long Slip Canal, a former freight barge channel located within NJ Transit's Hoboken Yard in Jersey City. By raising this area above flood elevation and adding six elevated tracks, NJ Transit will be able to operate train service longer and recover more quickly from storm events.

CRESCENT PARK

Crescent Park is a proposed mixed-use development project within the Grand Jersey Redevelopment Area. The project includes raising the majority of the southern portion of the Redevelopment Area by approximately 6-9 feet above existing elevations. Current concept plans call for filling in Mill Creek, which is a major conduit for floodwaters entering Jersey City. In its place, the project is proposing a park with a tidal marsh, which will be surrounded by a road network that will be elevated above the flood elevation to provide a barrier against tidal surges.

ZONING CHANGES

Green infrastructure plays an important role in mitigating the effects of stormwater runoff. As recommended in the Adaptation Master Plan, adopting a Flood Overlay Zone with green infrastructure requirements would achieve a multitude of goals identified in the Resiliency Planning Documents. These goals include improving stormwater system capacity, reducing impacts of flooding events, and reducing combined sewer overflows. These changes are being proposed to the Jersey City Planning Board and City Council in the Fall of 2019.

LONG TERM CONTROL PLAN

The Long Term Control Plan (LTCP) is an evaluation of a community's sewer infrastructure which serves to identify ways to regulate CSOs and improve water quality. Jersey City's Municipal Utilities Authority (MUA) is tasked with the creation of this plan and is committed to incorporating green infrastructure as means to achieve improved water quality and reduced flooding. City Planning will continue to collaborate with MUA and other city entities on identifying green solutions to mitigate stormwater issues.

MASTER PLAN UPDATE

The Municipal Land Use Law (MLUL) establishes the legal framework for municipal planning. The law requires that municipalities conduct a re-examination of their Master Plans at least every ten years. Through the Reexamination process, City Planning can incorporate resiliency in Master Plan elements relevant to reducing flood risks. For example, the Open Space Master Plan provides a unique opportunity to incorporate green infrastructure into public spaces while providing additional recreational opportunities and promoting public health. The Reexamination of our Land Use Element and Open Space Element will begin in January of 2020.

WANT TO KNOW MORE?

For more information on active City climate and resiliency initiatives or for access to the full Resiliency Planning Documents, please see the Jersey City website or the Jersey City Data Portal online at data.jerseycitynj.gov

PRIOR RESILIENCY PLANNING EFFORTS + DOCUMENTS

- Sandy Recovery Strategic Planning Report | 2014
- Collaborative Design and Dynamic Modeling for Urban Coastal Flood Adaptation | 2015
- Michael Baker Visualizations of Adaptation Scenarios and Next Steps White Paper | 2015
- Hudson County Hazard Mitigation Plan | 2015
- Maser Consulting Resiliency Documents | 2017
  - Resiliency Master Plan
  - Adaptation Plan
  - Green Infrastructure Plan

Document Prepared by :

Jersey City
City Planning Division