

Resilient Neighborhoods

Gerritsen Beach





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Gerritsen Beach

THE CITY OF NEW YORK
MAYOR BILL DE BLASIO

DEPARTMENT OF CITY PLANNING
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www.nyc.gov/resilientneighborhoods

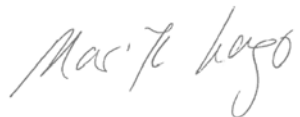
FOREWORD

Once a summer bungalow resort, today Gerritsen Beach is a tight-knit maritime community along Jamaica Bay in Brooklyn. The neighborhood has weathered many coastal storms, but when Hurricane Sandy hit in 2012, the storm surge flooded the entire neighborhood, severely damaging most homes in Gerritsen Beach.

The Resilient Neighborhoods initiative was launched by the Department of City Planning (DCP) shortly after Hurricane Sandy. This report is the culmination of over three years of research, outreach, and hard work by DCP, working closely with floodplain residents, businesses, and local leaders to identify strategies to reduce flood risk and build a more resilient and vibrant neighborhood.

This report includes recommendations for updating specific zoning and land use regulations, as well as investments in coastal infrastructure and other programs. The conclusions of this report will guide updates to the citywide flood resiliency text amendment that DCP is currently developing.

This plan is the beginning of a conversation and a commitment to work with Gerritsen Beach to ensure the community's ongoing vibrancy and resiliency.

A handwritten signature in cursive script that reads "Marisa Lago".

Marisa Lago, Director

Department of City Planning

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EXECUTIVE SUMMARY

Hurricane Sandy's devastating impacts on New York City in October 2012 served as a vivid reminder of how vulnerable the city is to coastal storms and flooding. With climate change, storms like Sandy are expected to increase in frequency and severity in the future, putting New Yorkers living and working on the waterfront at even greater risk. Yet, as Sandy also demonstrated, resilient building design can significantly reduce the damage caused by flooding and enable homes and businesses to be reoccupied sooner. By combining resilient building design with careful land use planning and strategic investment in infrastructure, the city can adapt to challenging environmental conditions over time and shape neighborhoods that are both vibrant and able to withstand and recover quickly from future flood events.

Resilient Neighborhoods is a place-based planning initiative, led by the New York City Department of City Planning in collaboration with communities and other agencies to identify strategies to support the ongoing vitality and resiliency of ten communities located in the city's floodplain. Gerritsen Beach, a peninsula in Southern Brooklyn along Jamaica Bay, was selected for this study not only because it is highly vulnerable to coastal flooding, but also because of the neighborhood's distinct built character resulting from the unique lot size and bungalow building types that define the area.

This report's recommendations for Gerritsen Beach have been guided by three primary goals:

Reducing flood risk

New York City's Building Code and Zoning Resolution encourage and allow resilient construction in the floodplain across the city. As part of an update to these zoning provisions, a special zoning designation that is more compatible with the low-scale, tightly packed residential neighborhood character of Gerritsen Beach is appropriate for this neighborhood.

Planning for adaptation over time

With sea level rise and climate change, flood risks will increase in the future. Zoning regulations can allow for development that is more resilient to severe storms and limit further stress on existing infrastructure by limiting residential development on small lots.

Creating resilient, vibrant neighborhoods

New development in the neighborhood can be resilient while the existing small-scale neighborhood character is preserved. Expanding the variety of allowed commercial uses and services that could locate along Gerritsen Avenue can encourage the development of maritime uses along the waterfront and strengthen the key commercial corridor.

In addition, this report provides a detailed description of the outreach, research, and analysis that has informed these goals, as well as an overview of the planning framework and regulatory context that underpin these efforts. A glossary of key terms is provided following the conclusion section.

This work is important, but coastal resiliency cannot be achieved through one study at one moment in time. Rather, it must be pursued through ongoing recognition of and responses to evolving risks and changing conditions. In response to this challenge, the City will continue to work with communities such as Gerritsen Beach to ensure that resiliency goals can be met while maintaining a focus on equity, livability, and safety for residents.

BULKHEADS

often located on private property, offer waterfront properties an added level of protection from waves

SHORELINE

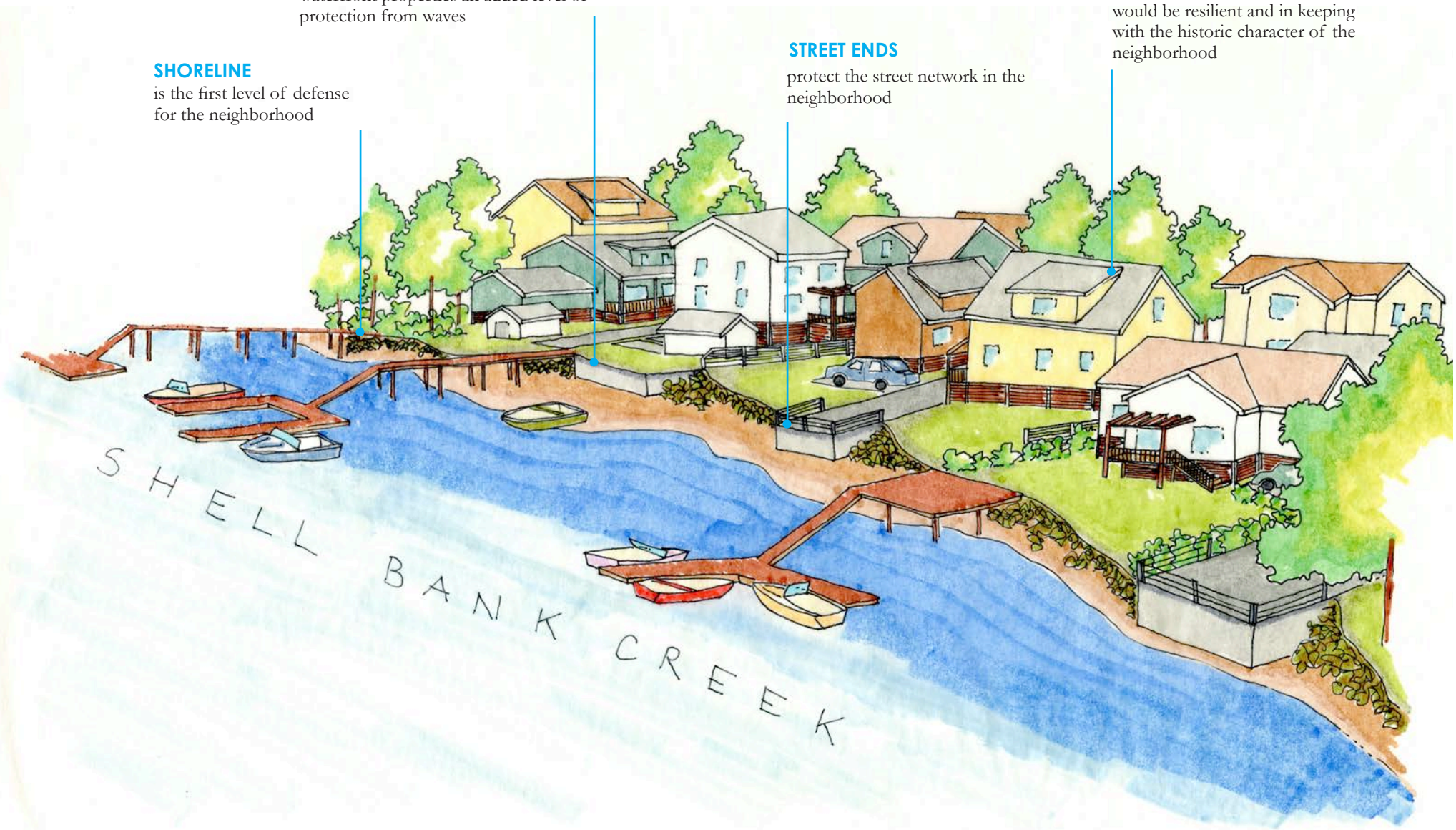
is the first level of defense for the neighborhood

STREET ENDS

protect the street network in the neighborhood

ELEVATED HOMES

would be resilient and in keeping with the historic character of the neighborhood



Resiliency Planning in New York City

Following Hurricane Sandy in October 2012, the City developed *A Stronger, More Resilient New York*, which laid out a detailed action plan for rebuilding post-Sandy and making the city's coastal communities, buildings, and infrastructure more resilient in the long-term. The City has made significant progress implementing the plan, including funding a \$20 billion climate resiliency program, advancing housing recovery through the Build it Back program, and making long-term resiliency a reality by investing in infrastructure upgrades. Drawing on this work and earlier planning efforts, the City released in Spring 2015 *OneNYC: The Plan for a Strong and Just City*, a long-term strategy to address the city's most pressing challenges, including a rapidly growing population, rising inequality, aging infrastructure, and climate change.

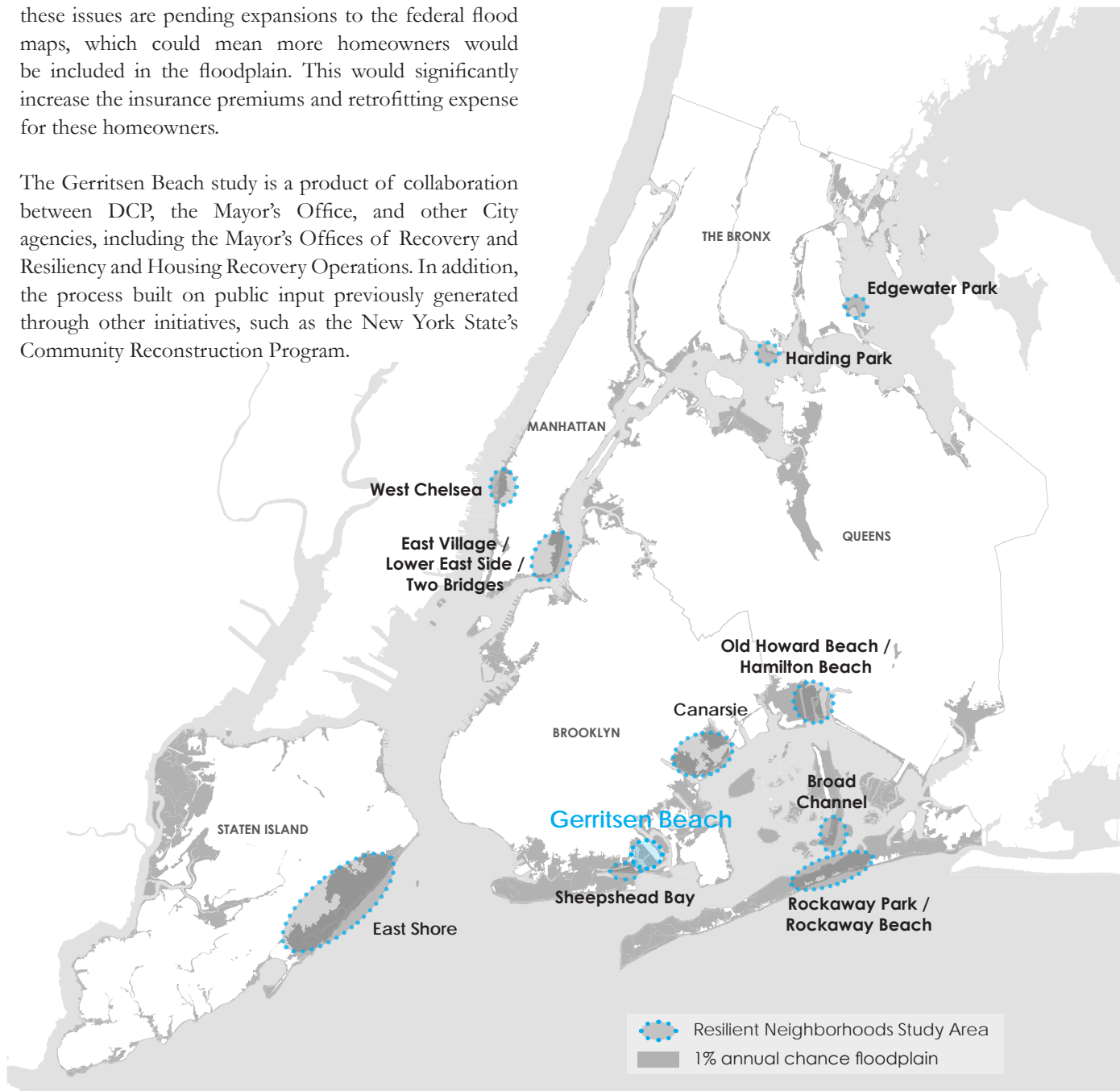
Resilient Neighborhoods

One of the projects described in *OneNYC* is Resilient Neighborhoods, a place-based planning initiative to identify tailored strategies, including zoning and land use changes, to support the vitality and resiliency of communities in New York City's floodplain. Based on collaboration with residents, stakeholders, elected officials, and other City agencies, the initiative focuses on ten study areas located in all five boroughs that represent a variety of demographic and built conditions. The Department of City Planning (DCP) identified these study areas because they present specific land use, zoning, and other resiliency issues that cannot be fully addressed by citywide zoning changes.

As Hurricane Sandy showed, Gerritsen Beach is particularly vulnerable to flooding from coastal storm surge, a risk that will only increase with climate change and projected sea level rise. This high flood risk, coupled with the unique shallow and narrow lots in the area, and homes sitting close together, create distinct challenges for resiliency and were reasons the neighborhood was selected for the Resilient Neighborhoods study. Compounding

these issues are pending expansions to the federal flood maps, which could mean more homeowners would be included in the floodplain. This would significantly increase the insurance premiums and retrofitting expense for these homeowners.

The Gerritsen Beach study is a product of collaboration between DCP, the Mayor's Office, and other City agencies, including the Mayor's Offices of Recovery and Resiliency and Housing Recovery Operations. In addition, the process built on public input previously generated through other initiatives, such as the New York State's Community Reconstruction Program.





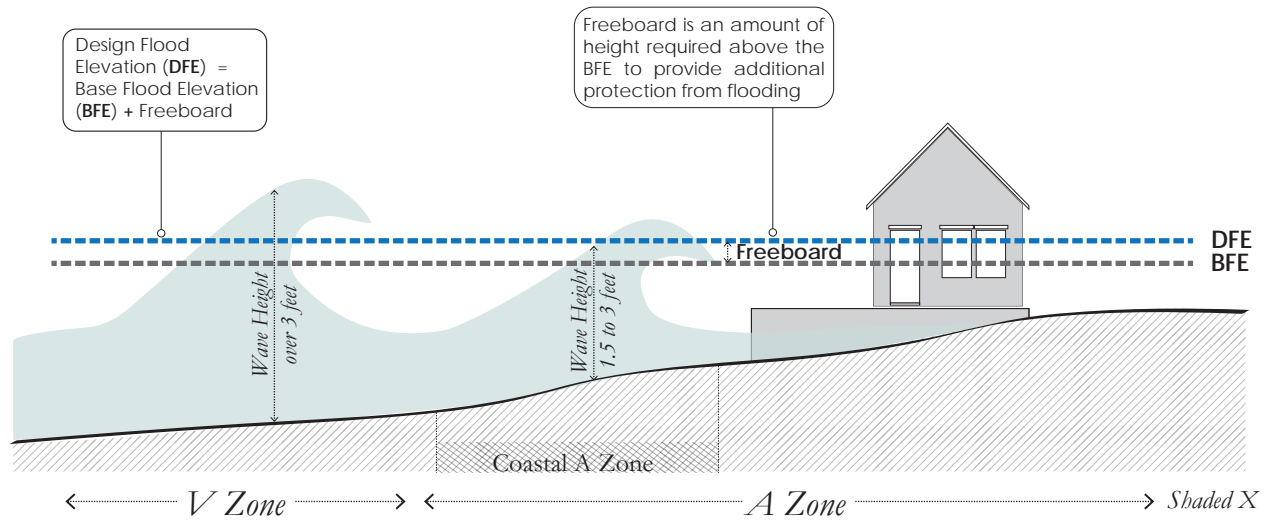
Regulatory Context

A wide array of programs and regulations at various levels of government shape the City's approach to managing flood risk and promoting resilient development. In the United States, floodplain regulation begins with Flood Insurance Rate Maps (FIRMs), which the Federal Emergency Management Agency (FEMA) creates and maintains. The maps show the extent and elevation to which flood waters are expected to rise during a 100-year flood or a flood that has a 1% chance of occurring in any given year. The elevation of the expected 1% annual chance flood is called the Base Flood Elevation or BFE. FIRMs also show the 500-year or 0.2% annual chance floodplain, which is shown as the Shaded X Zone.

The 1% annual chance floodplain is divided into three areas – the V Zone, Coastal A Zone, and A Zone – each associated with a different degree of flood risk. The diagram to the right illustrates these zones and the types of flood risk in each.

The 1% annual chance floodplain is also the area where property owners with federally-regulated or federally-insured mortgages are required to carry flood insurance. For residential structures, flood insurance premiums under FEMA's National Flood Insurance Program (NFIP) are determined by the relationship between the lowest occupied floor of the structure and the BFE shown on the FIRMs at the structure's location, as well as other factors. Homes built before the FIRMs were established have historically been offered subsidized insurance rates. However, due to recent federal legislative changes, those subsidized rates are gradually increasing to come in line over time with actuarial rates more closely reflecting the flood risk a home faces.

For the past several years, FEMA has been in the process of updating the FIRMs for New York City, which were implemented in 1983 and most recently updated in 2007. As part of the mapping update, FEMA issued updated



	ELEVATE	WET FLOODPROOF	DRY FLOODPROOF
	Open structure Eg. Open lattice	Water to run in / run out Eg. Flood vents	Watertight structure Eg. Flood shields
Ground Floor Configuration	<p>Open Structure</p> <p>Bottom of <u>lowest horizontal structural member</u> to be at or above Design Flood Elevation</p>	<p>1 inch of net open area per 1 sq.ft of enclosed area</p> <p>Lowest occupiable floor to be at or above Design Flood Elevation</p>	<p>Flood shields prevent water from entering</p> <p>Lowest occupiable floor allowed to be excavated below grade. (Not permitted for residential buildings)</p>
Permitted Uses (BELOW DFE)	<input checked="" type="checkbox"/> Parking <input checked="" type="checkbox"/> Access <input checked="" type="checkbox"/> Storage <input checked="" type="checkbox"/> Non-Residential <input checked="" type="checkbox"/> Residential	<input checked="" type="checkbox"/> Parking <input checked="" type="checkbox"/> Access <input checked="" type="checkbox"/> Storage <input checked="" type="checkbox"/> Non-Residential <input checked="" type="checkbox"/> Residential	<input checked="" type="checkbox"/> Parking <input checked="" type="checkbox"/> Access <input checked="" type="checkbox"/> Storage <input checked="" type="checkbox"/> Non-Residential <input checked="" type="checkbox"/> Residential

Preliminary FIRMs (PFIRMs) in December 2013 with another revision in January 2015. In most places, these PFIRMs show an expanded 1% annual chance floodplain. The City found inaccuracies in FEMA's underlying analysis that resulted in overstating the size of the city's current 1% annual chance floodplain. Following a successful appeal of the PFIRMs, New York City is working with FEMA to create a set of new flood maps for the city. There will be one map for insurance purposes based on current flood risk, and another for planning purposes that incorporates climate change. In the meantime, the PFIRMs remain in use for building code, planning, and zoning, as described below, while flood insurance still refers to the 2007 effective FIRMs.

Flood Resilient Construction and Building Design

The primary purpose of the FIRMs is to establish parameters for NFIP, based on present-day flood risk. However, the same maps also establish where federal minimum standards for flood resistant construction apply. These standards are enacted through the New York City Building Code's Appendix G on "Flood-Resistant Construction," which as of 2013 applies to the 1% annual chance floodplain shown on FEMA's PFIRMs or the 2007 effective FIRMs, whichever of the two is more restrictive. Appendix G includes different elevation and floodproofing requirements for each flood zone, as well as separate requirements for residential and non-residential structures. Appendix G also includes rules requiring that most residential and commercial developments be floodproofed an additional one or two feet of "freeboard" above the FEMA-designated BFE. The elevation of the BFE plus freeboard is called the Design Flood Elevation (DFE).

To fully comply with Appendix G requirements, residential buildings must elevate all living space to be at or above the DFE, and any enclosed space below the DFE must be wet floodproofed. Non-residential buildings (any building

that contains non-accessory non-residential floor area) have the option of elevating and wet floodproofing, or dry floodproofing. Where there is a mix of residential and non-residential uses, dry floodproofing is allowed, but no dwelling units may be located below the DFE. Full compliance with Appendix G results in lower NFIP premiums.

Buildings that are neither new, "Substantially Damaged," nor "Substantially Improved" (see glossary) are not required to meet Appendix G requirements as long as any changes to the building do not increase the level of noncompliance, but owners may voluntarily choose to implement partial flood mitigation strategies including elevating or floodproofing a building's mechanical systems. These measures may not currently result in lower NFIP premiums, but will reduce a building's overall vulnerability to future floods and enable the building to be reoccupied more quickly after a flood.

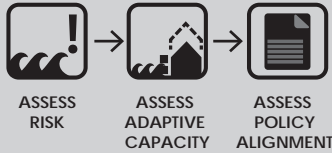
Citywide Zoning for Flood Resiliency

The City has instituted a series of zoning changes that remove impediments to retrofitting residential and commercial properties and accommodate many of the aforementioned building regulations. The first of these changes was an emergency Executive Order, issued in January 2013, which suspended height and other restrictions to the extent necessary for property owners to rebuild after Sandy. Many of these provisions, plus additional regulation, were included in a subsequent zoning text amendment to make the emergency order part of the City's legislation. This text amendment created allowances for measuring building height from the latest FEMA flood elevations (including freeboard required by building code), providing access from grade to elevated buildings, locating mechanical systems above flood levels, accommodating off-street parking requirements, and allowing reallocation of floor space that is abandoned and wet floodproofed. It also incorporated provisions to

Regulatory Context Summary

- The Federal Emergency Management Agency (FEMA) creates Flood Insurance Rate Maps (FIRMs) that show the extent and elevation of the 1% and 0.2% annual chance floodplains.
- FEMA also administers the National Flood Insurance Program (NFIP).
- The New York City Building Code's Appendix G on Flood-Resistant Construction applies within the 1% annual chance floodplain.
- The Department of City Planning works to create zoning, which controls the size and use of buildings, to accommodate flood resilient building regulations and remove impediments to flood resilient construction.

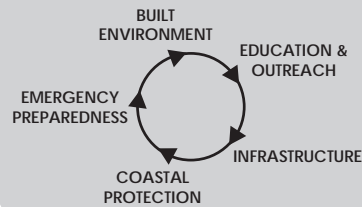
RESILIENCY ASSESSMENT



The resiliency assessment evaluates coastal risks, the capacity of neighborhoods to adapt to these risks, and the potential to align adaptation options with other policy goals or community priorities. The objective is to determine which hazards and vulnerabilities are present within a neighborhood and evaluate the potential for adaptive strategies, such as retrofitting buildings or creating new coastal protection infrastructure, to reduce these vulnerabilities.

Ongoing community outreach

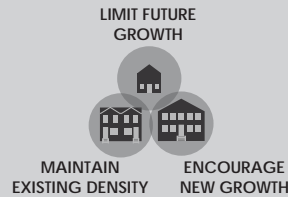
ESTABLISH RESILIENCY FRAMEWORK



The resiliency framework uses the results of the resiliency assessment to envision the range of changes necessary to make the neighborhood more resilient, which might include coastal protection, infrastructure investments, changes to regulations, and community education, among other strategies.

Ongoing community outreach

SELECT LOCAL RESILIENT LAND USE STRATEGIES



Across the city, there is a spectrum of potential land use strategies that can be used as appropriate to achieve the goals envisioned in the resiliency framework. In areas that are at significant risk from future frequent tidal flooding due to sea level rise, as well as more severe flooding from extreme events, it will often make sense to limit growth. In other areas where buildings are at risk of flood damage primarily from extreme events, there may be ways to alter regulations to promote retrofits. Where growth can be supported, increasing densities may promote investment in resilient buildings that will reduce risks of flood damage. More than one type of land use strategy may be appropriate in different parts of a neighborhood, based on flood risk and other planning considerations.

Ongoing community outreach

IMPLEMENT RESILIENCY STRATEGIES



Resiliency strategies can be implemented through a range of tools, including but not limited to zoning changes, changes to other City, State, or Federal regulations, operational measures, education and outreach, financial assistance, construction or upgrades of infrastructure, and emergency preparedness training. A combination of tools enacted at different scales and amongst different stakeholders is likely to be necessary to fully implement a set of resiliency strategies.

mitigate adverse streetscape impacts. The rules, now part of the Zoning Resolution, remain in effect and apply to all buildings in the PFIRM 1% annual chance floodplain.

The 2013 Flood Resilience Zoning Text Amendment was conducted as an emergency measure to facilitate ongoing rebuilding and retrofitting following Sandy, and included a sunset provision, so will expire a year after new flood maps are adopted by the City. DCP anticipates advancing another amendment that will make permanent the basic provisions set forth in the 2013 text, and potentially address resiliency challenges identified since then, to make it easier for property owners to make existing and new buildings resilient to current and future flood risks, while supporting the vibrancy and character of neighborhoods.

Planning Approach for Resiliency

The ten Resilient Neighborhoods study areas each exhibit a variety of physical, environmental, social, and economic conditions, the combination of which creates a distinct set of resiliency challenges, and different potential strategies for addressing them. To account for this diversity of contexts and to ensure that a consistent planning approach underpins the City's resilient land use goals, DCP developed a four-step process for coordinated analysis to guide risk-based decision-making. The diagram shown to the left explains this approach and the latter half of this report details the strategies and recommendations generated for Gerritsen Beach using this process.



City Planning staff presenting at a Community Board 15 public meeting

Outreach Process

During the course of the Resilient Neighborhoods study, DCP has worked closely with members of the community, local groups, and elected officials to prepare for future storms and ensure the long-term resiliency and vibrancy of Gerritsen Beach.

The study launched in June 2014 when DCP presented goals for Resilient Neighborhoods to Community Board 15. Subsequently, DCP convened a Community Advisory Committee (CAC) with representatives from several local groups, including the Gerritsen Beach Property Owners Association, Gerritsen Beach Cares and Tamaqua Marina, to provide input throughout the duration of the study.

The CAC met periodically to discuss the neighborhood's post-storm recovery, zoning issues related to rebuilding after the storm, and a long-term resiliency vision for the neighborhood. In the spring of 2015, draft zoning recommendations were discussed with the CAC, including recommendations targeted to serve as an incentive for resilient investments and adaptation to future risks, while preserving the existing neighborhood character and density.

Following suggestions from the CAC members, DCP held a public meeting in collaboration with the Gerritsen Beach Property Owners Association in the summer of 2015 to present final draft recommendations to the larger community and gather feedback on the study. DCP presented findings and recommendations to the local community board and elected officials in the fall of 2015 and intends to initiate implementation of zoning changes through ULURP in 2018.

COMMUNITY RISK PROFILE

History

Gerritsen Beach is a maritime community in Southern Brooklyn nestled on a low-lying area along Plumb Beach Channel with houses set close together on shallow lots and narrow streets. Over 5,000 residents live in the Gerritsen Beach study area, which comprises the entire Gerritsen Beach peninsula south of Allen Avenue.

The neighborhood was first inhabited in the early 17th century by a Dutch settler who built a house and a mill along Gerritsen Creek, now in Marine Park. Gerritsen Beach was mostly marshland, like other neighborhoods along Jamaica Bay today, including parts of Canarsie, Manhattan Beach, Bergen Beach, and Mill Island, prior

to being developable land. The area remained largely undeveloped until the early 20th century when Realty Associates, a real estate builder, developed a summer resort of one-story wooden bungalows at the southern end of the peninsula, as shown in the historic aerial below.

The development gained great popularity and by the 1930s the rest of the peninsula was occupied with summer bungalows built close to each other on small lots with no backyards. Over time, the seasonal buildings were converted to year-round two-story residences.

Today, Gerritsen Beach is a residential neighborhood

predominantly characterized by single-family detached homes, with the exception of semi-detached and attached two- to three-story buildings in the northern portion of the neighborhood and one-story commercial buildings along Gerritsen Avenue, the community's only commercial corridor. Lying to the west of the neighborhood, Plumb Beach Channel is used for recreational boating and fishing, and to the south residents have boats docked along Shell Bank Creek as well as the inner canal.

To the northeast of Gerritsen Avenue is Marine Park, Brooklyn's largest park by acreage with extensive recreational spaces and natural land.



© 1924 Aerial Photography, New York City Department of Information Technology and Telecommunications.

Historic (left) and current (opposite page) aerial views of Gerritsen Beach

The historic aerial shows Gerritsen Beach in its first days as a summer bungalow colony surrounded by wetlands, circa 1924. Over time bungalow homes have been transformed into year-round residences and today the neighborhood is a lively maritime community along Jamaica Bay.

The study area is highlighted in the orange outline.



Avenue W

Allen Avenue

Devon Avenue

Avenue Y

Knapp Street

Florence Avenue

Cyrus Avenue

Marine Park

Voornies Avenue

Lois Avenue

Plumb Beach Channel

Belt Pkwy

Emmons Avenue

0 0.05 0.1 0.2 Miles



Flood Risk Vulnerabilities

Gerritsen Beach was almost entirely inundated with surge waters when Hurricane Sandy made its landfall on October 29th, 2012. The tidal surge came in from the Gerritsen Inlet as well as over Plumb Beach and the Belt Parkway, flowing into Shell Bank Creek and Plumb Beach Channel and inundating the neighborhood with flood waters up to seven feet above grade. Basements and ground floor levels were flooded throughout the neighborhood, and a number of homes also experienced floodwaters on upper floors, where inundation destroyed electrical equipment and other building systems. Residents suffered moderate to severe structural damage to their properties, as well as extensive losses to belongings damaged by the flood. One resident of Gerritsen Beach lost her life in the storm.

Like many areas of New York City, the Sandy inundation area was more extensive than what is shown as the effective 1% annual chance floodplain on FEMA's current Flood Insurance Rate Maps (FIRMs), which date from 1983. FEMA is currently in the process of updating the FIRMs for the entire city and issued Preliminary maps (PFIRMs) in late 2013, with an update in January 2015. On the 2015 PFIRMs the vast majority of the neighborhood south of Avenue W is included in the 1% annual chance floodplain, more than doubling the number of at-risk buildings from under 700 to about 1,900. Of these 1,900 buildings, there are over 1,600 residential units in the expanded floodplain, housing over 5,000 residents. As noted on page 7, the City has filed an appeal of these PFIRMs and is committed to resolving the underlying analysis methods with FEMA and adopting more accurate flood maps as quickly as possible.

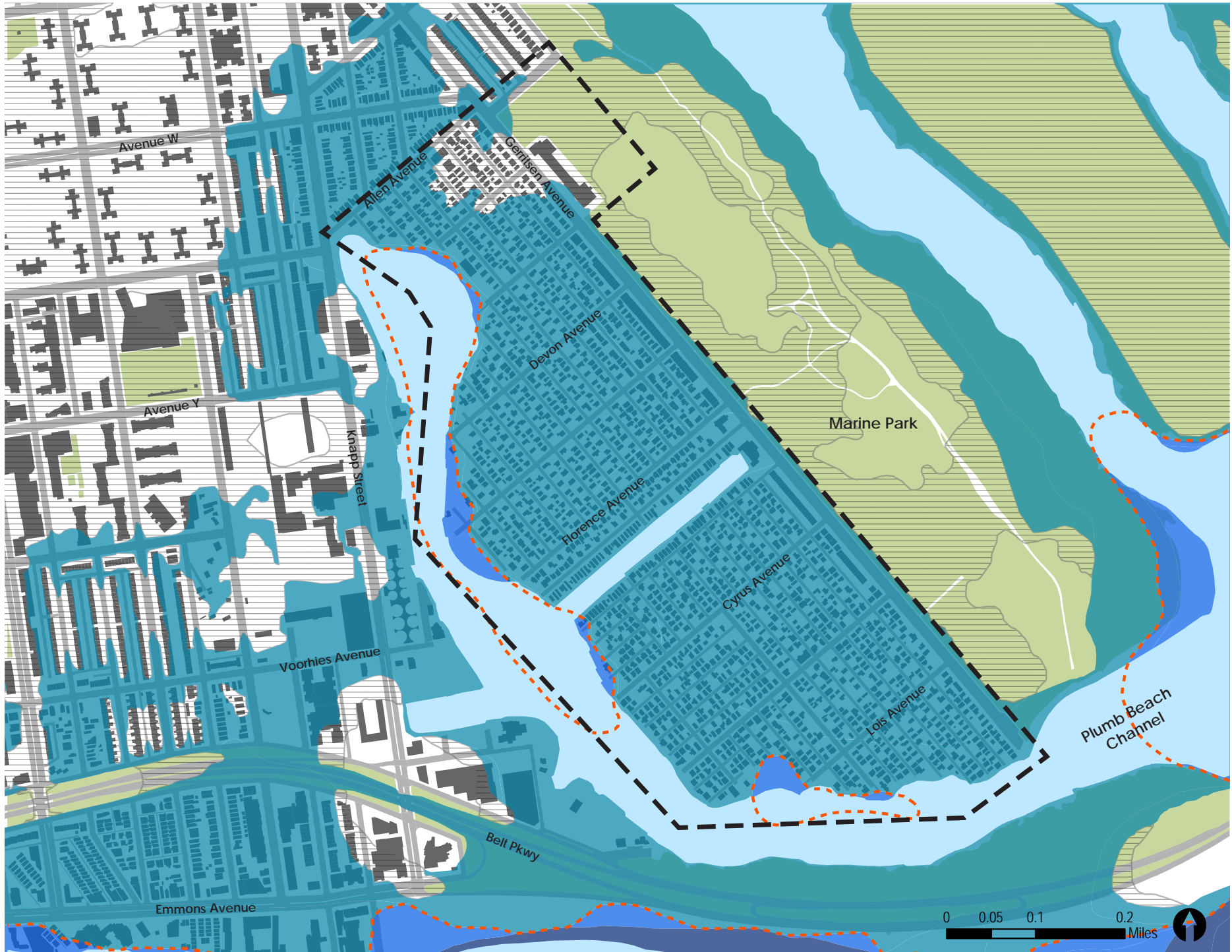
In addition to new areas being added to the 1% annual chance floodplain, the new preliminary federal flood maps also generally present higher Base Flood Elevations (BFE), as shown on the map on page 14, ranging on average from between ten to twelve feet above sea level,

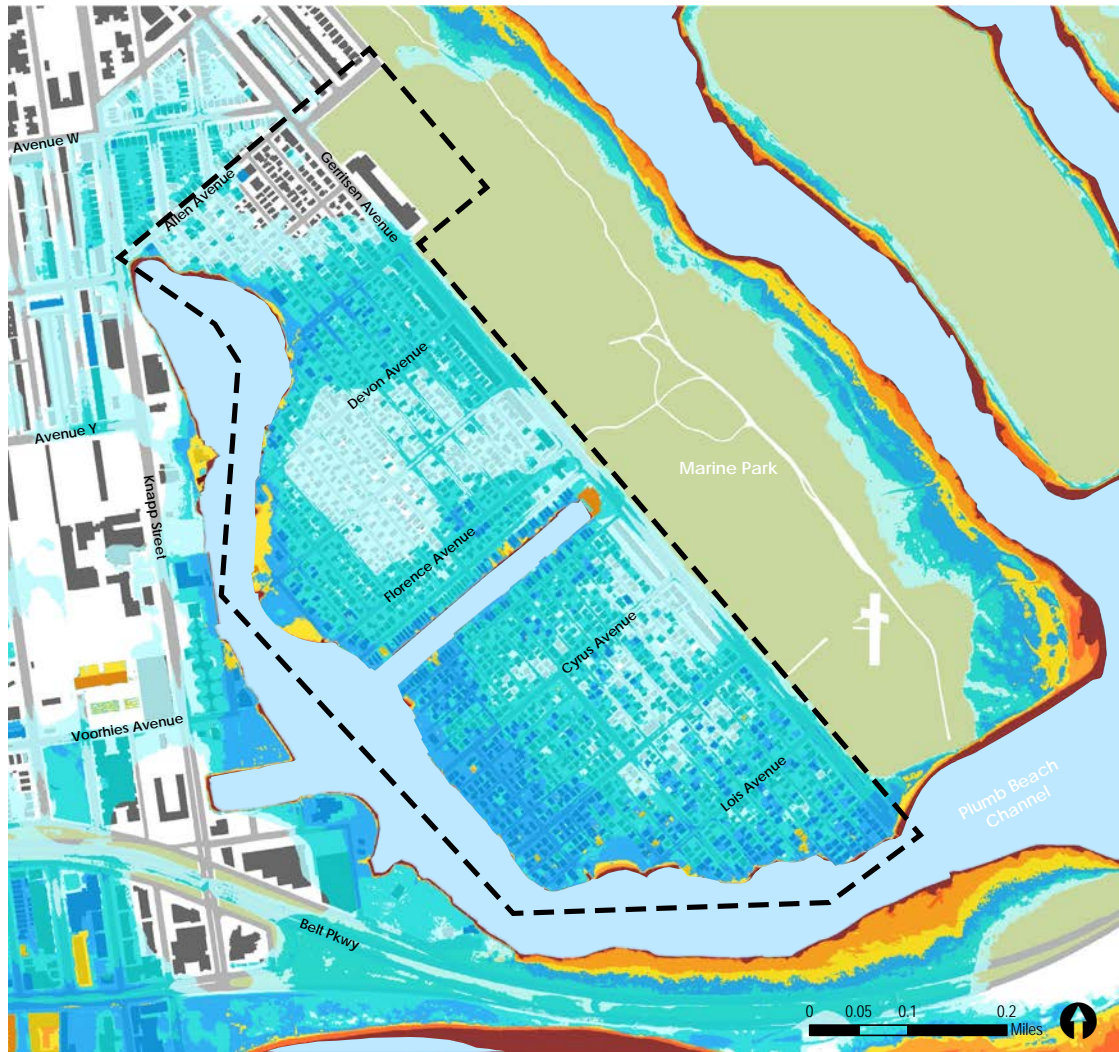


Typical detached home with first occupiable floor below street grade

FEMA Flood Zones - PFIRMs (Opposite Page)

V Zone	
Coastal A Zone	
A Zone	
Shaded X Zone	
Subject to Wave Risk (LiMWA)	
Study Area	





Projected Flood Elevations - PFIRMs

- 0.1 - 2 feet
- 2.1 - 4 feet
- 4.1 - 6 feet
- 6.1 - 8 feet
- 8.1 - 10 feet
- 10.1 - 12 feet
- 12.1+ feet

*All values are referenced to the level of grade

or one to eight feet above ground level. The BFE is the computed elevation in feet to which floodwater is anticipated to rise during the 1% annual chance storm. A building's flood insurance premium is largely determined by the relationship between the BFE and the level of the lowest occupied floor of a structure.

On average substantially damaged or substantially improved homes in these locations are required to elevate the lowest occupied floor to a DFE of three to five feet above grade in order to come into full compliance with flood resilience construction standards (Appendix G of the New York City Building Code). Some areas of the neighborhood are subject to greater risk, particularly along the waterfront of Plumb Beach Channel and the inner canal. Here BFEs range from three to eight feet above grade, with DFEs of five to ten feet above the street level. There is also the risk from wave action between one-and-a-half and three feet in height (Coastal A Zone) in an area currently unbuilt in the northern section of the neighborhood along Plumb Beach Channel.

Less severe but more frequent storms also affect Gerritsen Beach, as the majority of areas along the waterfront are within the 10-year storm floodplain (according to FEMA's preliminary analysis), the area that would be affected by the 10% annual chance flood event. Nearly the entire neighborhood is also within the 50-year storm floodplain, which has a 2% chance of occurring every year, presenting an additional risk.

Infrastructure Vulnerabilities

Other factors that may exacerbate the risk of flooding in Gerritsen Beach relate to the current condition of the infrastructure in the neighborhood. Because of its origin as a summer bungalow community, most streets were designed for pedestrian use, not vehicular circulation. Today most of these streets are deteriorating and, apart from Gerritsen Avenue, present unusually narrow widths,

ranging from thirty feet to as little as fifteen feet wide, including sidewalks. All streets feed into Gerritsen Avenue, which serves as the only evacuation route for the neighborhood in case of an emergency. Such non-standard roadway conditions present accessibility challenges and safety risks. To address these challenges, a local volunteer fire department was incorporated in 1922 and it is still in service today, representing a key emergency management asset for the neighborhood. Additionally, when the neighborhood was built, sanitary sewer infrastructure was limited to only a few areas on the peninsula. The neighborhood's very limited storm sewer capacity and its high water table make on-site waste water retention quite challenging and exacerbate Gerritsen Beach's vulnerability to flooding.

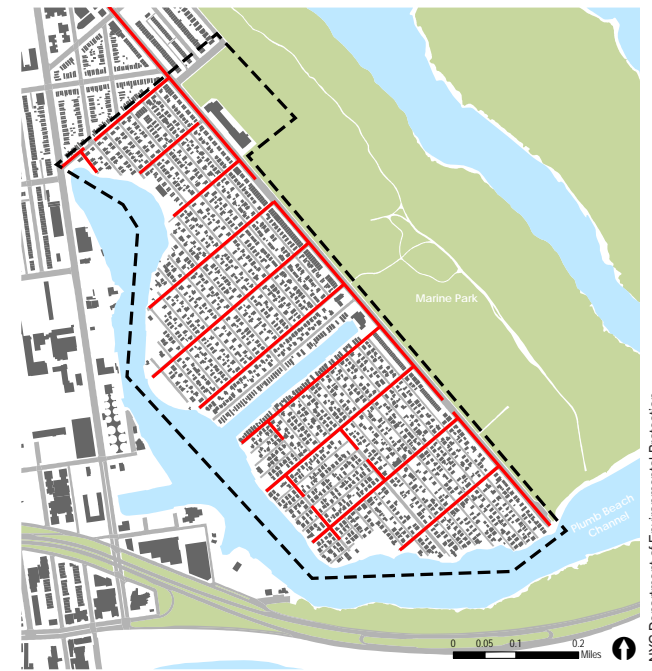
The NYC Department of Transportation (DOT), using federal funding made available by FEMA after the storm, as well as local funding allocated by the City of New York and State Senator M. Golden, is planning to restore streets in portions of the neighborhood to a state of good repair and incorporate hazard mitigation design elements as appropriate to support climate resiliency. While this project aims to reconstruct and resurface damaged streets, DOT will also be collaborating with the Department of Environmental Protection (DEP) to address the lack of storm sewer infrastructure and integrate new infrastructure into the system where possible.

A number of bulkheads in Gerritsen Beach are presently in a state of poor repair and the waterfront and surrounding areas could require extensive hard and soft infrastructure improvements to further protect the neighborhood from future storms and projected sea level rise. However, the repairing or replacing of bulkheads could be challenging because most are privately owned, which would require significant private investments and be cumbersome to coordinate among all parties involved.

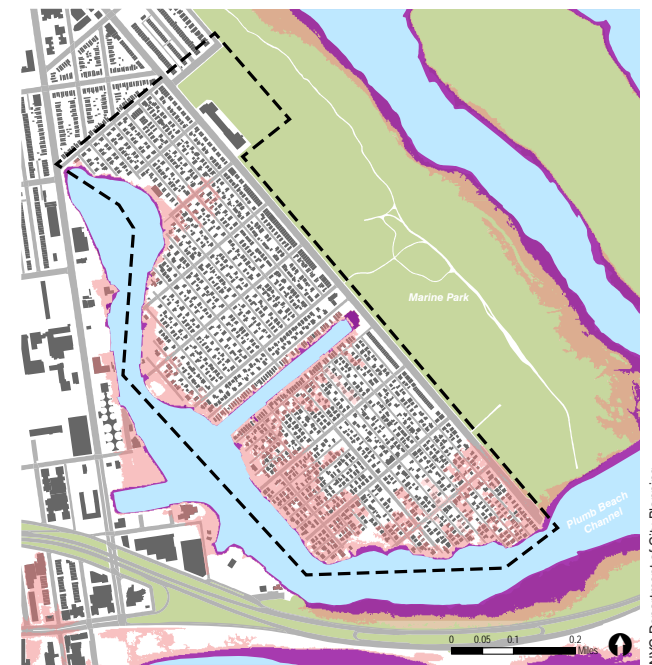
Exposure to Future Risks

The neighborhood does not currently experience street flooding in non-storm conditions during high tides, but projections from the New York City Panel on Climate Change (NPCC), a group of scientists and private sector experts that provides local climate change projections for the city of New York based on global models, show increased vulnerability to daily tidal flooding for certain areas of the neighborhood in the next twenty-five to fifty years. The projections provided by the NPCC take into account different climate change scenarios and inputs of global growth and greenhouse gas reductions to arrive at high- and low-end sea level rise projections for the 2020s, 2050s, 2080s, and 2100.

As shown in the map to the bottom-right, under high-end projections, sea level rise will have relatively minor impacts before the 2050s, but if no shoreline improvements are made, the neighborhood could be more significantly impacted by the 2080s, given current projections. With fifty-five inches of sea level rise, which is the 90th percentile or high-end projection for the 2080s, the majority of the southern portions of the neighborhood and almost the entire shoreline of the peninsula would be flooded at high tide.



NYC Department of Environmental Protection



NYC Department of City Planning

- Storm Sewer Infrastructure (top right)**
- Existing Storm Sewer within Neighborhood ———
 - Study Area - - - - -
- Tidal Flooding Projections (bottom right)**
- High-end projections - 2050s ———
 - High-end projections - 2080s ———
 - Study Area - - - - -

Social and Financial Vulnerabilities

The majority of residents in Gerritsen Beach have lived there for several generations, and while the area has seen a small influx of new residents since 2000, the overall population (about 5,000 residents) has decreased about five percent in the last fifteen years.

Over two-thirds of new households arriving since 2000 are renters, but about eighty percent of total housing units in the neighborhood are owner-occupied. The median value of owner-occupied residential units in Gerritsen Beach is below the average for properties in Southern Brooklyn and citywide. And, while the area median income (about \$60,000 per year) is higher than city and borough averages, owner-occupied households have lower average incomes than homeowners in the rest of the borough and the city, suggesting limited resources to invest in retrofitting homes, buy flood insurance or recover from future floods.

Of all the buildings in the study area, only a small portion (about five percent) were built after 1983, when FEMA FIRMs first came into effect and buildings were required to be designed and built with flood resiliency in mind. This suggests that the vast majority of homes in Gerritsen Beach would likely require extensive retrofits to comply with current resiliency standards. Moreover, while homeowners have been investing in their properties for several generations, limited disposable incomes may make it more difficult to undertake resiliency retrofits without additional assistance.

Homeowners with government-backed mortgages are required to purchase flood insurance. While insurance requirements increase the incentive to make retrofits that can help strengthen the resiliency of the community, insurance costs alone may be a financial burden for some. Today, even though seventy percent of owner-occupied homes in Gerritsen Beach have a mortgage, only one-third of the total number of residential buildings in the

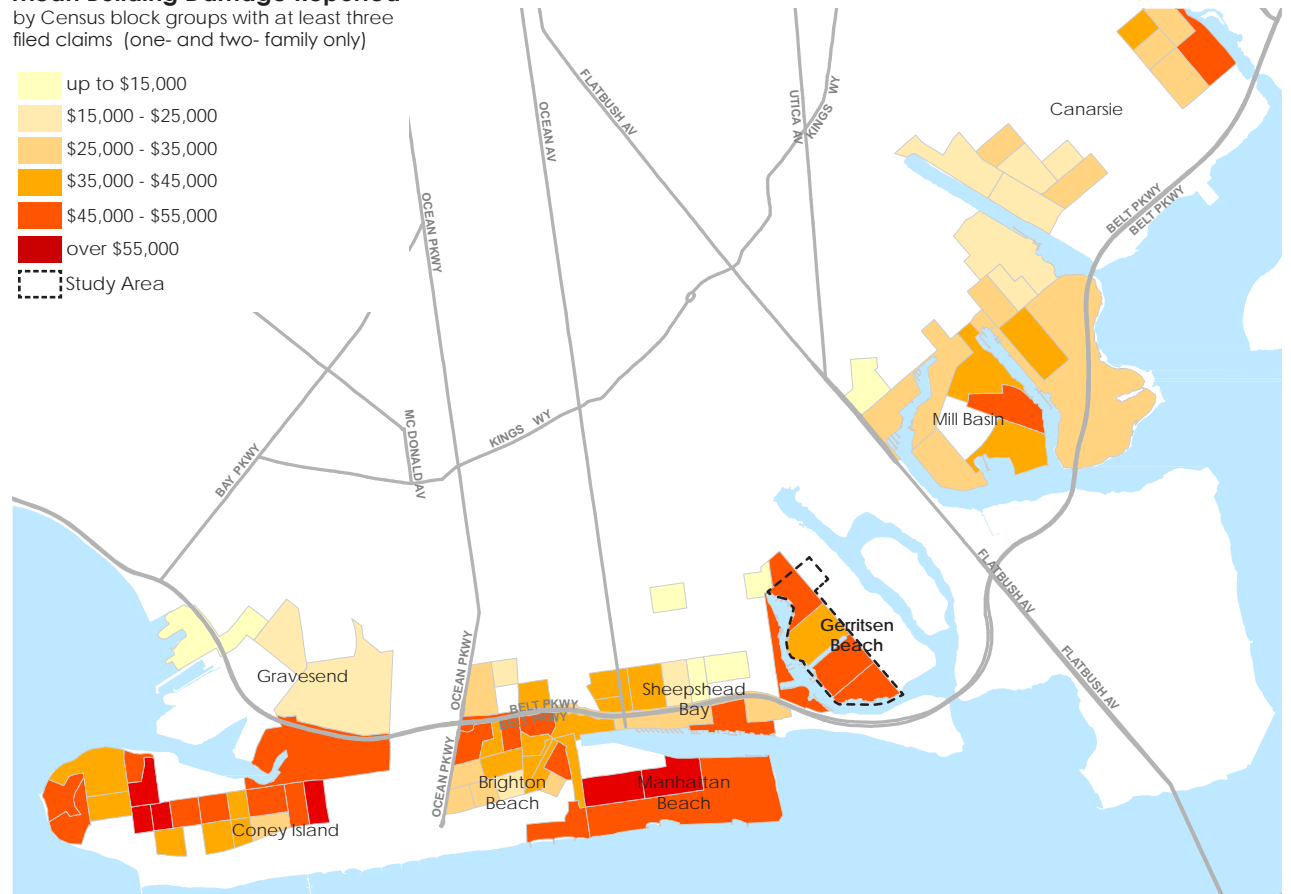
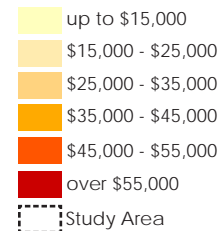
neighborhood and less than half of buildings built after 1983 have flood insurance coverage.

The total number of policies in the neighborhood increased by over forty-five percent since the storm, in line with the average increase in Brooklyn and above the city's average. Average flood insurance premiums as of May 2015 in the neighborhood were \$1,144 per year, slightly above the average premiums paid in neighborhoods with similar characteristics in the city's floodplain, likely because the existing buildings have living space below the BFE.

Post-storm assistance provided a major incentive for resilient retrofits in the neighborhood. As shown in the maps below, the damage from Hurricane Sandy reported to FEMA by homeowners in Gerritsen Beach was among the highest for one- and two-family homes in Southern Brooklyn, averaging between \$45,000 and \$55,000 per household, with the highest values registered in the southern portion of the neighborhood. In total, property owners reported nearly \$22 million in Sandy damages to the NFIP, virtually all of which was to single to four-unit homes.

Mean Building Damage Reported

by Census block groups with at least three filed claims (one- and two- family only)



Existing Built Context

The Gerritsen Beach study area includes approximately 1,900 buildings with over 2,680 housing units. The built environment consists mostly of lower-density residential buildings, predominantly single- and two-family detached homes, generally two stories high. However, pockets of attached homes are located on a few blocks along Gerritsen Avenue and within the residential areas west of Knapp Street and east of Gerritsen Avenue, to the north of the study area.

Because of the time in which they were built, the majority of the buildings in Gerritsen Beach do not meet today's flood resilience construction standards. Many of the homes are built at or below grade, often with basements partially or entirely below street level, which makes them all the more vulnerable to flooding. In addition, the non-standard lots with narrow street frontage and shallow front yards mean homes often don't meet minimum yard requirements, and there is not enough space to provide stairs to elevated buildings and incorporate streetscape amenities like porches and plantings.



Typical detached home in Gerritsen Beach

Building and Lot Typologies

The majority of the lots in Gerritsen Beach are relatively small and shallow, compared to standard lots around the city. In the northern residential section of the neighborhood, average lot dimensions are thirty-five by fifty-five feet (or 1,785 square feet), while to the south, lot size is generally forty by forty-five feet (or 1,800 square feet). Many of these small lots have been merged to create larger, standard-sized lots. Similarly, a large number of the lots designated as “vacant land” and “parking facilities,” as shown in the land use map on page 21, are typically owned by the adjacent property owner and used as open space, storage, or parking. Along the canal, lots are deeper but narrower, with average dimensions of twenty-four by sixty-six feet, abutting directly on the water.



Homes on narrow lots along the canal



Two-family residential development on a merged lot



Attached homes on Gerritsen Avenue



Vacant lot along the canal area of the neighborhood



Attached one-story commercial buildings along Gerritsen Avenue

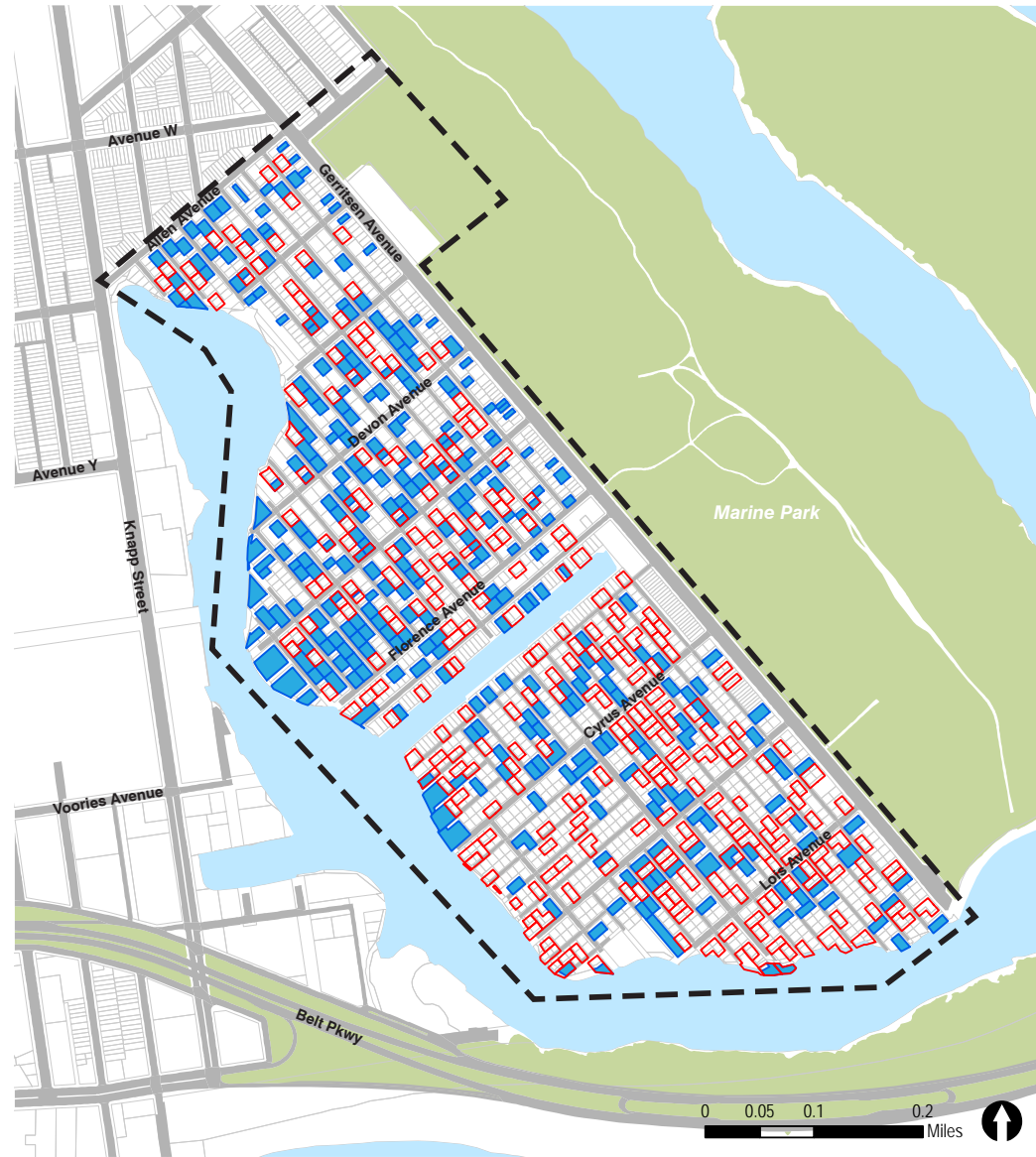
The neighborhood originated as a summer bungalow community and the majority of the homes still reflect that original character of detached two-story wood-frame homes with a sloped roof. The neighborhood has seen little new construction in recent years, and while buildings may have been updated and enlarged since the early 1900s, the character was preserved as that of a lower density community, as shown in the images on the previous page.

Along Gerritsen Avenue, the major north-south spine connecting the neighborhood to the rest of the borough, building typologies are varied, from one-story attached commercial buildings to attached and semi-detached two-story multi-family homes, as shown in the photos to the left. The attached and semi-detached building stock is difficult and costly to retrofit for flood resilience and may require extensive investments from property owners. The area's main commercial node, which primarily serves local residents, extends for a few blocks along Gerritsen Avenue between Allen Avenue and Florence Avenue. The corridor offers a small variety of services, but in general residents travel to other parts of the borough, including nearby Avenue U, to fulfill their shopping needs.

There are a few maritime commercial uses in the northern residential section, including several commercial marinas and a restaurant. Additionally, two public facilities are located in the study area: Public School 277, just outside of the designated flood zone, and the Gerritsen Beach Library, a branch of the Brooklyn Public Library that was recently reopened after suffering severe damage during the Hurricane.

Zoning and Land Use

The majority of Gerritsen Beach is currently zoned as a lower density residential district (R4), which allows for a variety of building types including single- and two-family homes as well as multi-family attached buildings. Buildings in this district are required to provide a



NYC Department of City Planning, PLURD

Combined Lots

- Merged Lots
- Adjacent Lots with Same Ownership
- Study Area

minimum ten-foot front yard or be set back eighteen feet from the streetline to provide room for parking. A minimum side yard of eight feet is required for semi-detached buildings, while detached homes are required to provide two side yards that total to a minimum of thirteen feet, with one side yard being at least five feet. The majority of homes in the neighborhood were built long before the zoning was put in place for this area and often have very small front and side yards. The large yard requirements are often a burden for new construction on the small lots typical of Gerritsen Beach, leading to limited buildable floor area and producing taller buildings with an inefficient floorplan as a result.

Zoning requirements allow for buildings to be a maximum of thirty-five feet, or three stories high, with a perimeter wall requirement of twenty-five feet, which produces a pitched roof. Such height allowances, coupled with DFEs that can be up to ten feet above grade, may result in new development that is not compatible with the existing surrounding context.

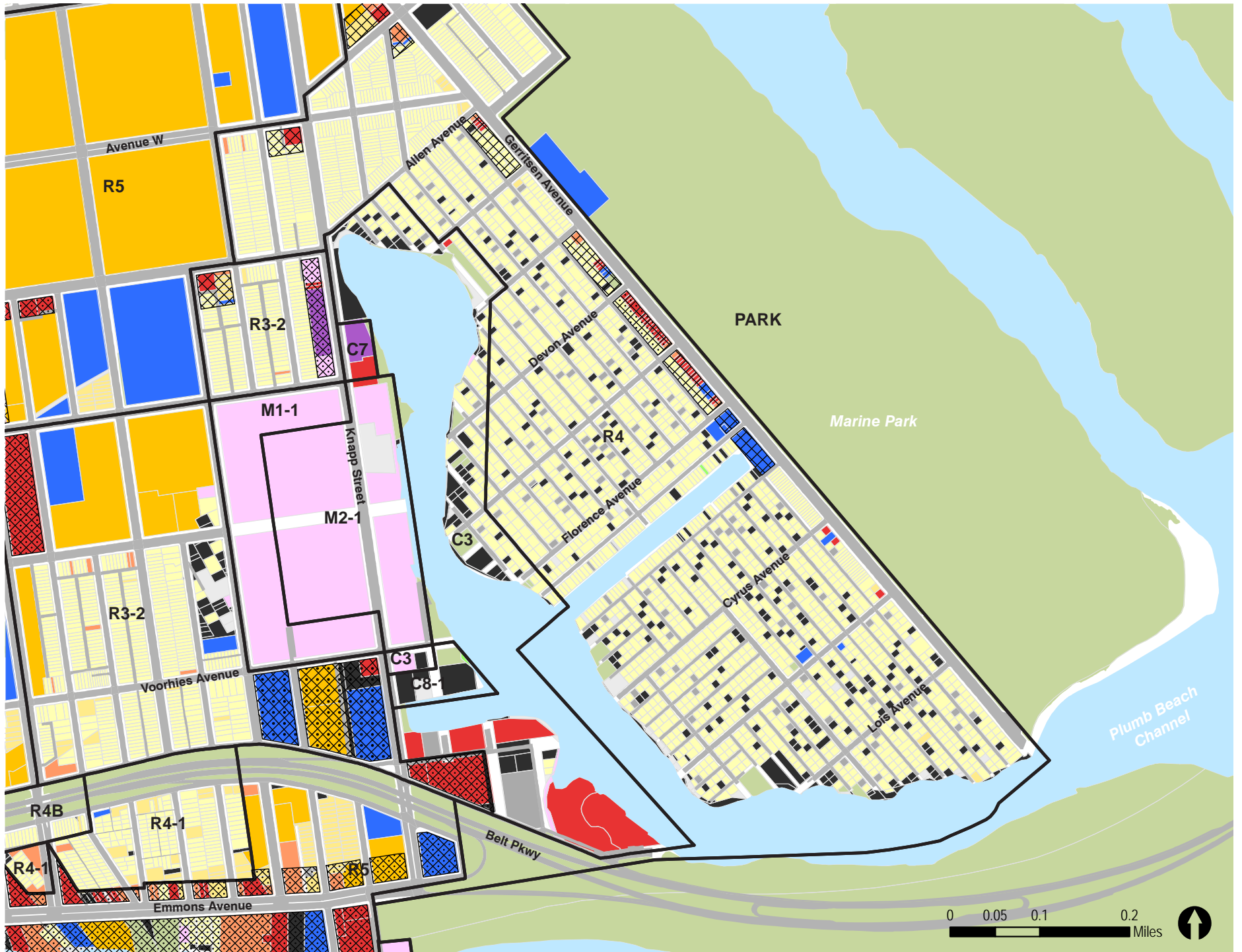
Several lots along the water in the northern portion of the neighborhood are currently zoned for waterfront recreational uses, under the C3 designation, which primarily includes facilities to support boating and fishing activities, as well as aquatic sports equipment sales and rentals, ice cream stores, and other types of small shops. Residential uses are also allowed in this district and currently most lots in this area are developed as one- and two-family homes. Residential developments in C3 districts are subject to lower-density zoning district regulations (R3-2), which also allow for a variety of housing types, including low-rise attached houses, small multi-family apartment houses and detached and semi-detached single and two-family homes. Similar to R4, the maximum building height is thirty-five feet with a perimeter wall of twenty-one feet, and side yards are required to be a minimum of thirteen feet for detached



Typical Gerritsen Beach detached two-story homes

Zoning and Land Use (Opposite Page)

One & Two Family Homes	
Multi-Family Walk Up	
Multi-Family Elevator Building	
Mixed Residential & Commercial	
Commercial & Office	
Industrial & Manufacturing	
Transportation & Utility	
Community Facility	
Open Space	
Parking	
Vacant Land	
Commercial Overlay C1-2	
Commercial Overlay C2-2	
Zoning Districts	





Commercial establishments along Gerritsen Avenue

homes. Homes have to provide a minimum front yard depth of fifteen feet, which can be impractical on small shallow lots.

Six blocks along Gerritsen Avenue are currently mapped with a commercial overlay (largely C1-2 with one block mapped as C2-2) that allows for commercial uses aiming to serve local retail needs within a residential district. Typical retail uses in C1 districts include grocery stores, restaurants and beauty parlors, while C2 overlays permit a slightly wider range of uses, such as home services and repair services serving the nearby community. Today, commercial uses along Gerritsen Avenue are limited and do not support an active streetscape. Commercial spaces in the flood zone are required by federal and local standards to be dry-floodproofed up to the designated DFE. This can be costly for property owners, but the 2013 temporary citywide zoning text amendment provided a floor area exemption of up to 10,000 square feet for existing properties electing to dry-floodproof to promote active commercial streets.



Uses along the waterfront include marinas and restaurants

Post-Hurricane Sandy Neighborhood Recovery

Gerritsen Beach suffered extensive damage during Hurricane Sandy and almost every building in the neighborhood was affected by the storm. Since Sandy, the New York City Mayor's Office of Housing Recovery Operations (HRO) has been dedicated to helping homeowners repair and rebuild their homes through the Build it Back Program. The program has been designed to provide assistance to property owners to retrofit their buildings for flood resiliency through basic repairs, full house elevations or rebuilds, reimbursement for incurred expenses, or acquisition for redevelopment. As of spring 2017, over 200 households in Gerritsen Beach have been enrolled in Build it Back for home rebuilding or elevation. These homeowners have been working with HRO on identifying the best path to restore their building to a livable and more resilient condition.

Both private and City-sponsored retrofits have been able to take advantage of the Executive Order and subsequent Citywide Flood Resilience Text Amendment adopted by the City Council in 2013, which temporarily eliminates many zoning impediments to resilient rebuilding (see page 9). Through the work done by HRO in coastal communities in New York City in the years following the storm, the city was able to further identify zoning regulations that had hindered the recovery process and prevented homeowners from elevating and rebuilding their homes. Mainly affecting homes built prior to 1961, these obstacles to resiliency created a lengthy and burdensome documentation process for determining whether a given home is considered "non-conforming" or "non-complying" – legal statuses defined in the Zoning Resolution.

In March 2015, DCP, together with HRO and the Department of Housing Preservation and Development (HPD), proposed a zoning text amendment, "Special Regulations for Neighborhood Recovery," to accelerate post-Hurricane Sandy recovery and enable flood-resilient building construction within designated "neighborhood



Build It Back home elevation in Gerritsen Beach

recovery areas" in Staten Island, Queens and Brooklyn, which included Gerritsen Beach. The proposal was adopted by the City Planning Commission in May 2015, and subsequently by the City Council in June 2015.

The text amendment provides targeted zoning changes to facilitate elevating existing homes, and replacing substantially damaged homes with more resilient ones, by:

- simplifying the process for documenting non-compliances;
- removing disincentives for property owners to make resilient investments; and
- establishing a new zoning envelope for narrow and shallow lots that more accurately reflects the existing neighborhood character.

Together, these zoning changes will speed up the process for owners of Sandy-damaged homes to obtain building permits for elevation and reconstruction, will reduce the community's vulnerability to future floods, and will protect homeowners against higher flood insurance premiums. With the goal of accelerating recovery in Sandy-impacted neighborhoods, these zoning changes are set to expire in 2021.

While these provisions are targeted to assist all homeowners affected by Hurricane Sandy, additional zoning issues uncovered through the analysis of the unique local conditions of Gerritsen Beach will also need to be addressed. Furthermore, the Citywide Flood Resilience Text Amendment adopted in 2013 needs to be made permanently available to all communities in the floodplain.

Zoning Case Study: 40' x 45' Lot

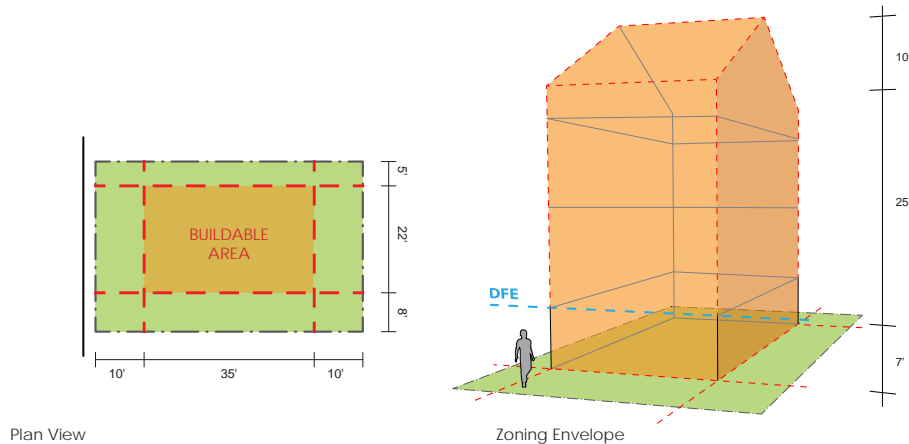
The following case study compares the existing built context and the current zoning requirements for new construction to floodproofing standards in an R4 zoning district. This analysis was conducted to identify any specific issues with the current zoning designation and the non-standard lots of Gerritsen Beach.

ZONING REQUIREMENTS

The current R4 zoning designation requires buildings to be setback ten feet from the street line and, for lots shallower than fifty feet, also ten feet from the rear yard line. Additionally, new developments are required to provide two side yards at a total width of thirteen feet. The typical lot size in the southern portion of the neighborhood, Old Gerritsen, is forty feet wide by forty-five feet deep. Existing zoning requirements result in a small buildable area on the already small lot, potentially leading to an inefficient floorplan in the new homes and buildings taller than the existing context.

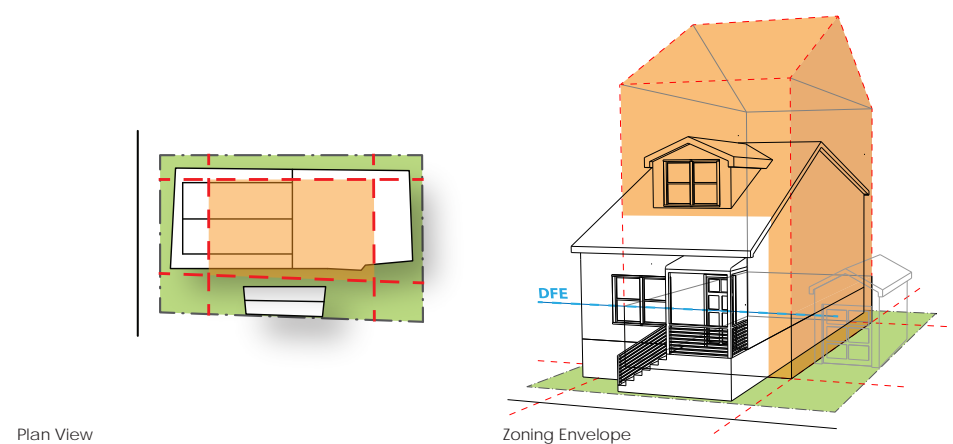
EXISTING BUILT CONTEXT

Homes in Gerritsen Beach often do not comply with current yard requirements, especially front and rear yards. The small detached homes typical of this neighborhood often occupy the majority of the lot area with only a couple of feet between the property line and the building facade. Most buildings are two-story one- and two-family detached homes with a pitched roof.



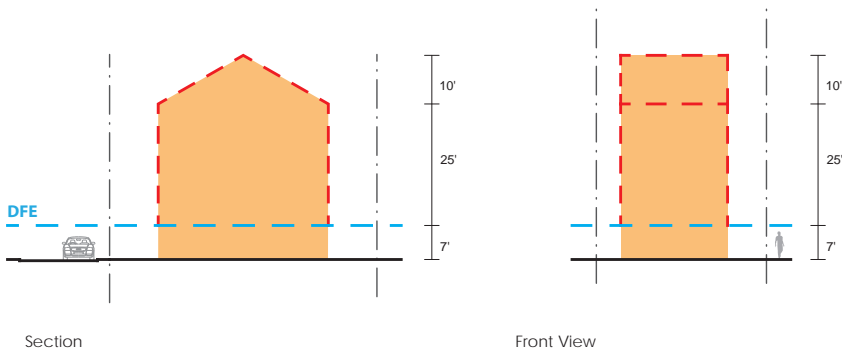
Plan View

Zoning Envelope



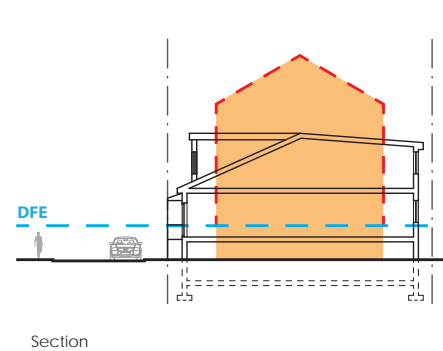
Plan View

Zoning Envelope



Section

Front View



Section

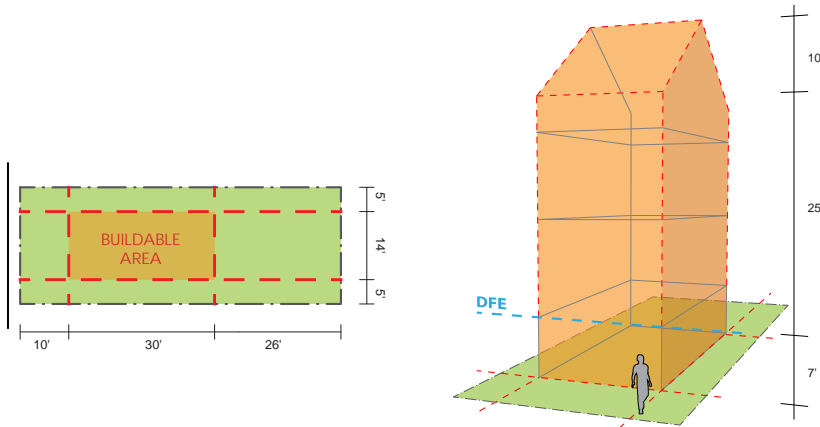
Front View

Zoning Case Study: 24' x 66' Lot

The following case study compares the existing built context and the current zoning requirements for new construction to floodproofing standards in an R4 zoning district. This analysis was conducted to identify any specific issues with the current zoning designation and the non-standard lots of Gerritsen Beach.

ZONING REQUIREMENTS

R4 zoning district regulations require a ten-foot front yard and a thirty foot rear yard. The rear yard can be reduced if the lot's depth is less than seventy feet. Side yards, usually requiring a minimum of thirteen feet, can also be reduced to five feet each, given the narrow lot condition. Even though adapted to fit smaller lots, these requirements still produce very small buildable areas on the zoning lot, potentially resulting in tall and narrow homes with inefficient floorplans. Furthermore, these lot conditions make it difficult for the homeowners to maximize the available floor area within the allowed envelope.

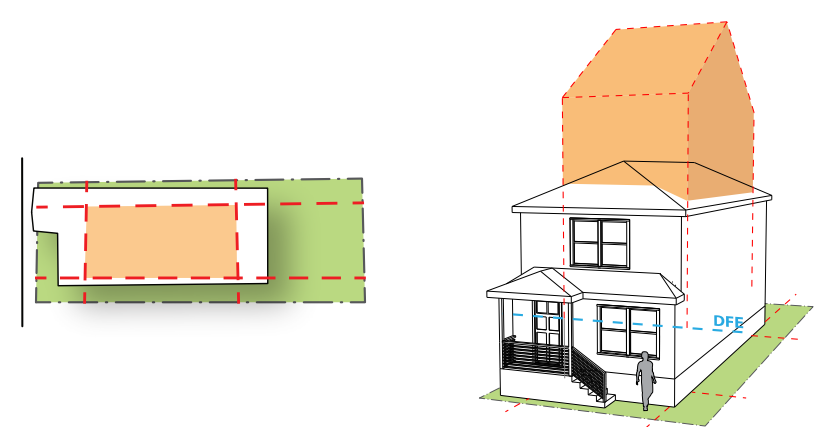


Plan View

Zoning Envelope

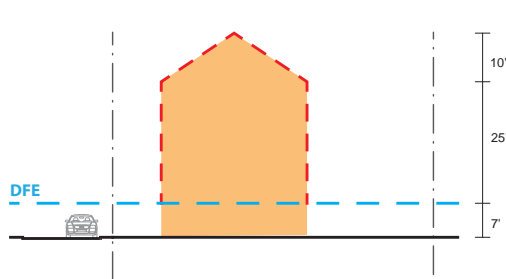
EXISTING BUILT CONTEXT

Lots along the canal are narrower than the lots in the rest of the neighborhood, with an average of twenty-four foot width and sixty-six foot depth. Homes here are small and narrow, but in several instances still do not comply with current zoning requirements under the R4 designation. Buildings are set close to the street line and often present much smaller side yards than the minimum required five feet on each side. Most properties do not comply with current rear yard requirements, with buildings extending into the required rear yard. These homes are also one- and two-family detached bungalows two stories high, often with a basement.

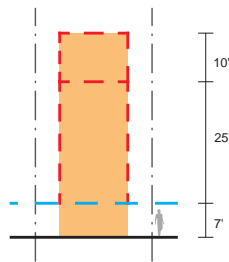


Plan View

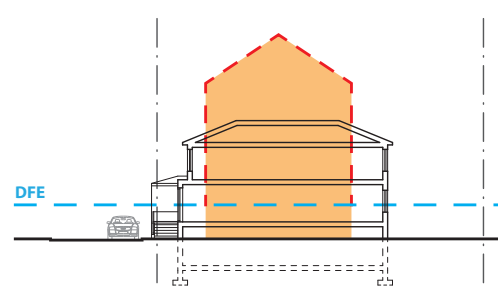
Zoning Envelope



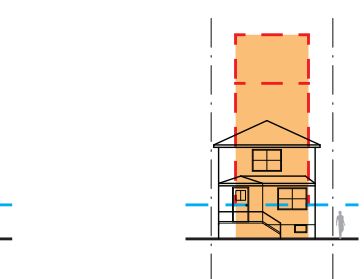
Section



Front View



Section



Front View



Bulkhead condition on the waterfront along Shell Bank Creek

Summary of Resiliency Challenges

1 Current and future flood risks

Today, Gerritsen Beach is almost entirely within the floodplain, with medium-high Base Flood Elevations. Future flood projections show that portions of the water's edge are at high risk of recurrent inundation from less severe, but more frequent, storms and may be vulnerable to daily tidal flooding before the end of the century.

2 Barriers to retrofitting

Lots with narrow yards pose practical challenges for elevating homes above flood elevations as well as challenges related to ADA access, streetscape design, and neighborhood character. BFEs in this area are high, and many developed lots are sunken below grade. Residential uses found below the DFE throughout the neighborhood result in further challenges to resilient redevelopment.

3 Limited infrastructure capacity and street widths

Many streets, particularly in the southern section of the neighborhood, have unusually narrow widths (as narrow as 20 feet) which present safety risks and accessibility issues during emergencies. Storm sewer capacity is very limited throughout the neighborhood, which increases vulnerability to flooding when it rains.

RESILIENCY FRAMEWORK

Today Gerritsen Beach is subject to coastal flooding during a storm and is also projected to experience effects from sea level rise, with the potential for daily tidal flooding by the end of the century. Implementation of resiliency measures can play a key role in enabling the neighborhood to thrive in the future.

This resiliency framework, shown on the map on the next page, was informed by the extensive public outreach conducted during the course of this study and identifies three major areas where the City will focus its efforts to help Gerritsen Beach become more resilient: the residential core of the neighborhood, the waterfront area in the northern portion of the peninsula and along Gerritsen Avenue. In addition, this section begins with a description of building-scale retrofitting strategies that can be used to increase the resiliency of building types commonly found in the neighborhood.

Residential Core

The residential areas include Old Gerritsen and large portions of New Gerritsen, which together represent the vast majority of the study area. Here, small detached homes mostly built in the early 20th century sit close together on small lots often sunken below grade along narrow streets. Existing Building Code and zoning provisions available to buildings in the floodplain ensure that new developments are resilient. Zoning changes to establish new height and setback limits that better fit existing character would ensure that new or altered buildings fit within the neighborhood fabric.

Gerritsen Avenue

Gerritsen Avenue is both the primary means of getting to and from the neighborhood and a local retail corridor that today offers limited services to the community. This framework proposes ways to strengthen the corridor to better serve Gerritsen Beach with both transportation and commercial functions, especially following future storms that may affect the neighborhood.






Waterfront

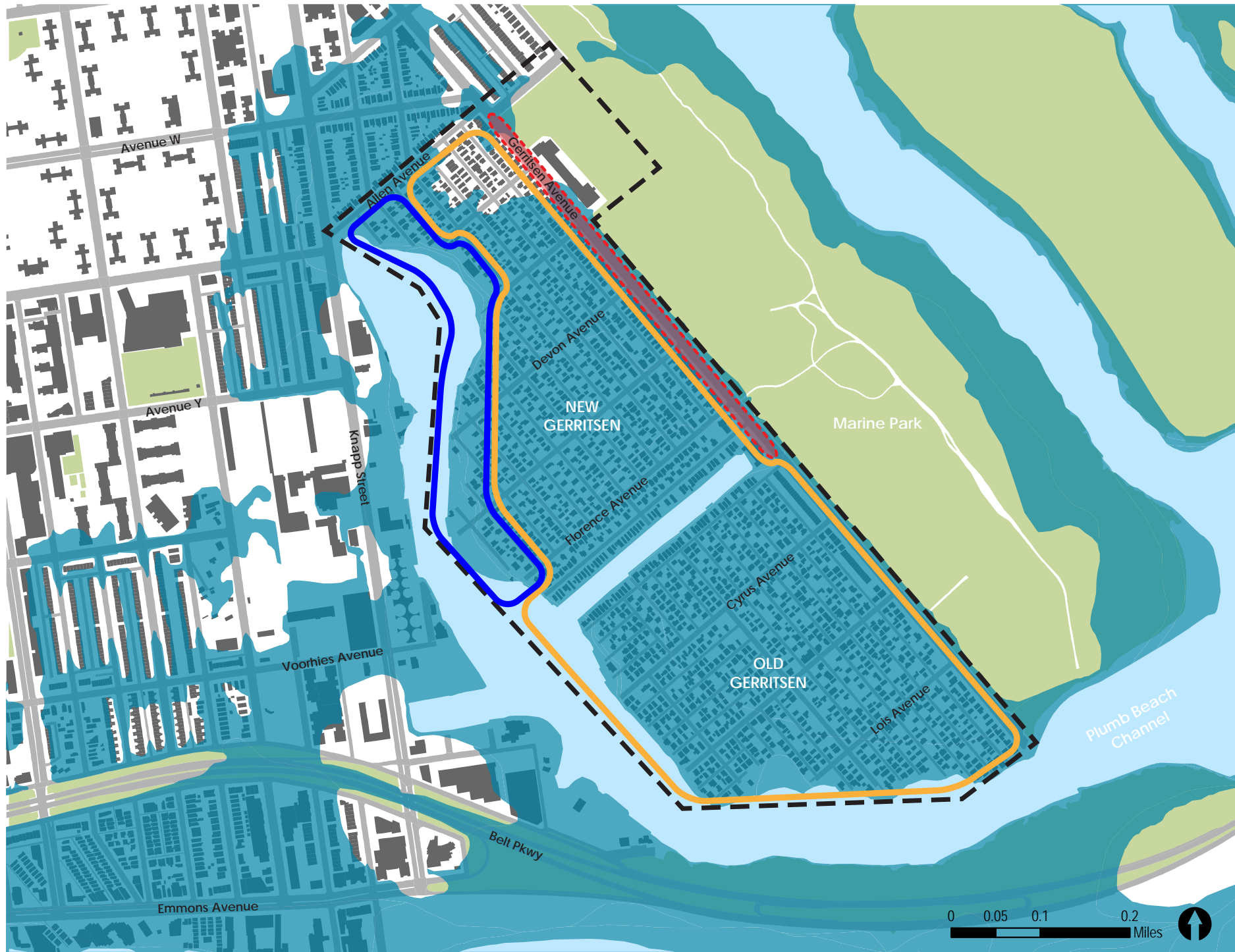
The Gerritsen Beach community has a strong connection to its waterfront and the water-related recreational activities along Plumb Beach Channel. Docks line the entire shoreline of the neighborhood. While this waterfront area is a key asset and defining part of the character of the neighborhood, it is also very vulnerable to future storms. Allowing any small residential buildings as well as maritime and related commercial uses here would support resiliency investments to the current building stock, while fostering waterfront activity that can adapt to future risks.

Resilient Infrastructure

Streets, sewers and bulkheads are key infrastructure elements that play an important role in the resilience of a neighborhood, especially during a major storm. New investments in streets and sewers, improved management of city-owned bulkheads, and a citywide program of prioritized shoreline improvements will help to reduce flooding from rain, high tides, and coastal surge in areas like Gerritsen Beach.

Framework Map (Opposite Page)

- Residential Core 
- Waterfront 
- Gerritsen Avenue 
- 1% Annual Chance Floodplain 
- Study Area 



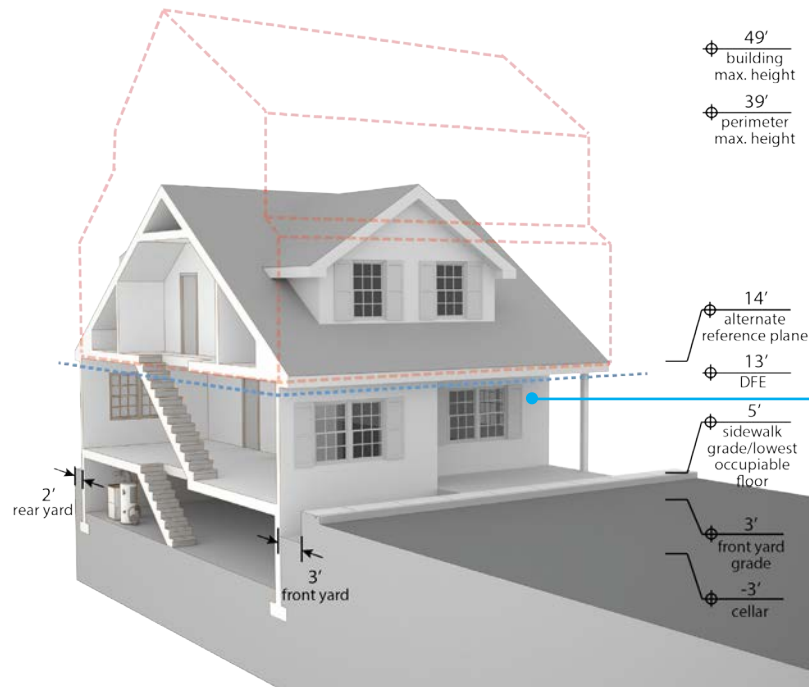
Residential Core: Building Scale Retrofits

The small detached bungalow homes typical of Gerritsen Beach resemble in many ways the building typology for which the federal floodproofing standards are most clearly applicable. The majority of homes in the neighborhood are built with a lightweight wood-frame structure on a masonry foundation, a structure type that can easily be elevated in place. Even so, the tight site conditions in this neighborhood can make retrofitting and staging construction difficult.

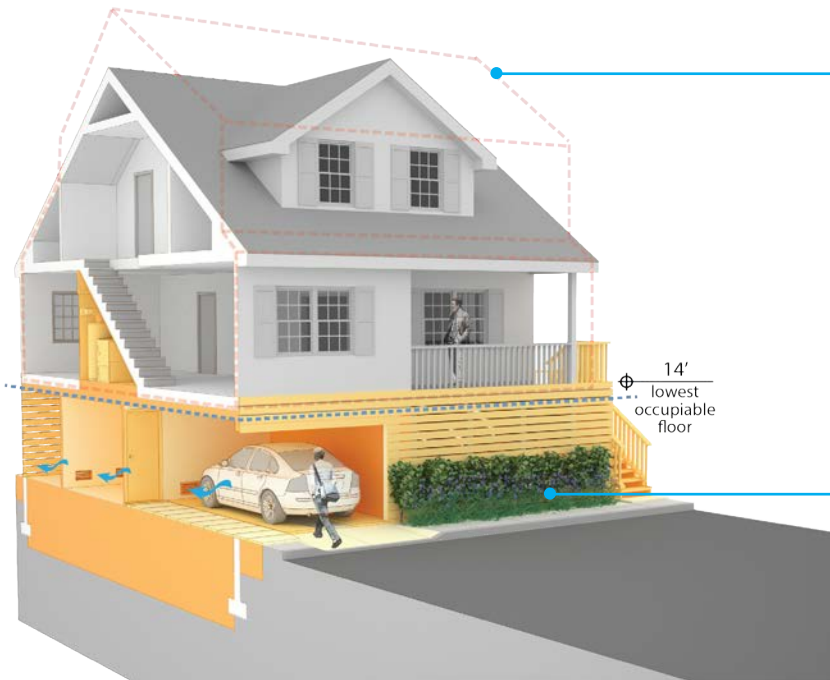
Retrofit strategies for existing buildings that will result in the lowest annual premiums under NFIP include elevating the structure on a new foundation to bring the lowest occupiable floor above the DFE and filling the basement/cellar to the lowest adjacent grade, as shown in the image to the lower-right. Critical systems should be elevated above the DFE within the building in a fire-rated mechanical room or in the yard, though on shallow lots clearance is rarely provided. It is important to note that elevation requires assessment of the building's structural integrity and any implications of site excavation for the neighboring buildings.

The space on the ground floor below the elevated structure can be left open to allow for floodwaters to easily flow through the building during a flood or can be enclosed and wet floodproofed by installing flood vents on all interior and exterior walls on at least three sides of the building. All finishes below the DFE should be replaced with flood damage resistant materials and the space should be designed for use as parking, crawl space, access, and storage only.

Ground-floor level windows and doors facing the street have historically been prevalent features of buildings in New York City and can create a sense of security and comfort for pedestrians. These architectural elements also provide visual interest, which in turn promotes a walkable, vibrant neighborhood. Elevating the first floor of a building



Existing detached home



Detached home elevated above the DFE

RESIDENTIAL USES BELOW DFE

Residential uses below the level of the DFE are highly vulnerable. The homeowner should thoughtfully consider any available retrofit option, including elevating the lowest occupiable floor of an existing home above the designated DFE.

ZONING ENVELOPE

In the flood zone, the zoning envelope is adjusted to account for use limitations below the Base Flood Elevation. Building height is measured from a base plane at the level of the DFE to allow homeowners to take full advantage of the permitted floor area in their zoning district.

STREETSCAPE ENHANCEMENTS

When elevating buildings, thoughtful consideration should be given to the design of the first floor. Adding elements such as planting, stair turns, porches, or raised yards can enhance the streetscape and pedestrian experience.

can limit this visual connectivity. When elevating buildings in residential neighborhoods, homeowners should consider adding elements that enhance visual connectivity to the street. In accordance with the above principles, the New York City Zoning Resolution requires homes to provide specific streetscape mitigations such as planting along the building façade, open or covered porches, stair turns, or raised yards. These elements, which are already part of the architectural language in the majority of homes in Gerritsen Beach, can help mitigate the visual disconnection caused by elevating buildings and help preserve the safety, comfort, and visual interest of the streetscape.

As the building stock in New York City’s floodplain becomes more resilient, the form of neighborhoods will change. However, changing the building height and

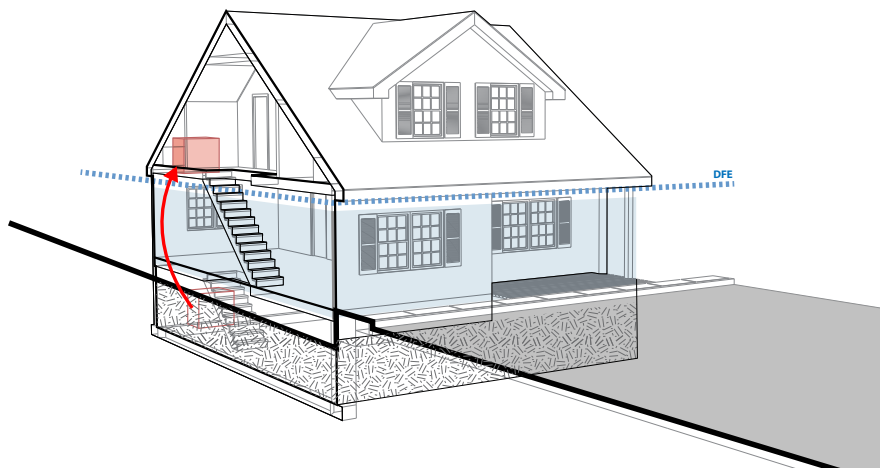
elevating the first floor will not necessarily change the fundamental character of the neighborhood. Designers should respect a neighborhood’s character by taking cues from the existing context and built form, including fenestration, rooflines, and other architectural elements. Most of all, they should get to know the place and its people to design a building that suits the neighborhood, while meeting the standards of flood protection.

Alternative Strategies

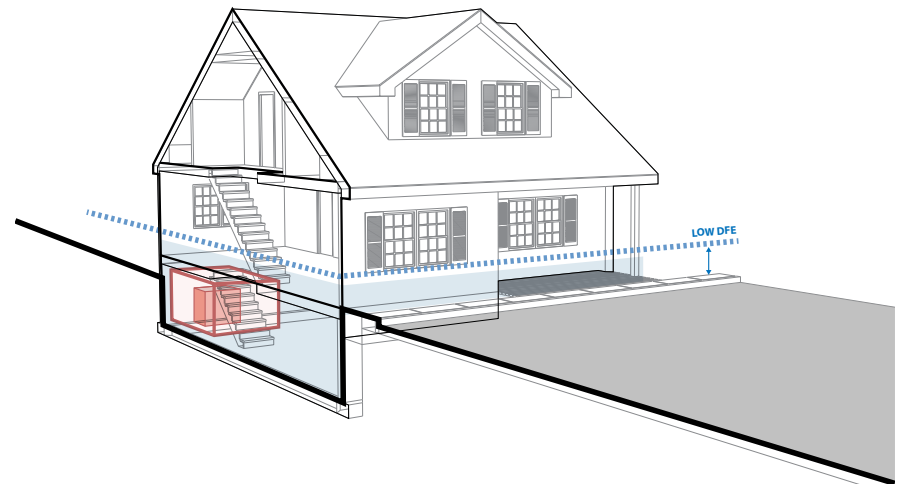
Existing non-substantially damaged buildings within the flood zone are not required to come into full compliance with Flood Resilient Construction Standards of the New York City Building Code. This allows for greater flexibility in adapting for current and future risks. In Gerritsen Beach the vulnerability of the wood frame structure limits

alternative adaptation strategies, but homeowners may want to consider elevating critical systems to minimize damage during a storm event and disruption following the storm. If the DFE is within a few feet of the first floor, homeowners may consider keeping the structure in place and protecting systems by dry floodproofing in place, while also using flood damage-resistant materials below the DFE.

Even though these measures are helpful in improving the resiliency of homes in the floodplain, under current NFIP regulations, they may not result in lower insurance premiums. It is important to note that if people are still living below the BFE, they are less safe. Residents should always follow evacuation procedures.



Filled in basement and elevated mechanical systems (shown here in red) above the DFE



Floodproofed mechanical systems (shown here in red) in place

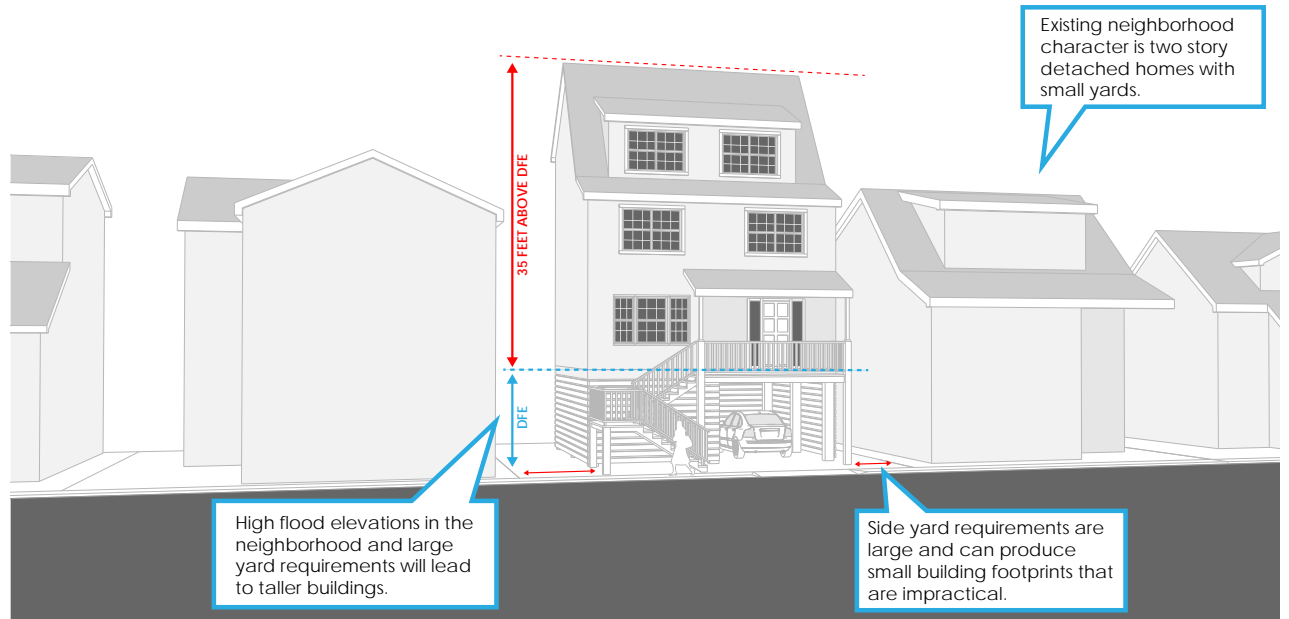
Residential Core: Resilient Development

In Gerritsen Beach's residential core, the creation of special zoning regulations can better support resilient construction that is in keeping with existing neighborhood character. Such zoning changes would limit new buildings to detached and semi-detached single and two-family homes, as per the R4-1 zoning district. Reduction in side yard requirements would address the extensive small lot condition throughout the neighborhood, and maximum building height would be limited to two stories above the DFE, to avoid out-of-character development. The current maximum floor area ratio would remain unchanged.

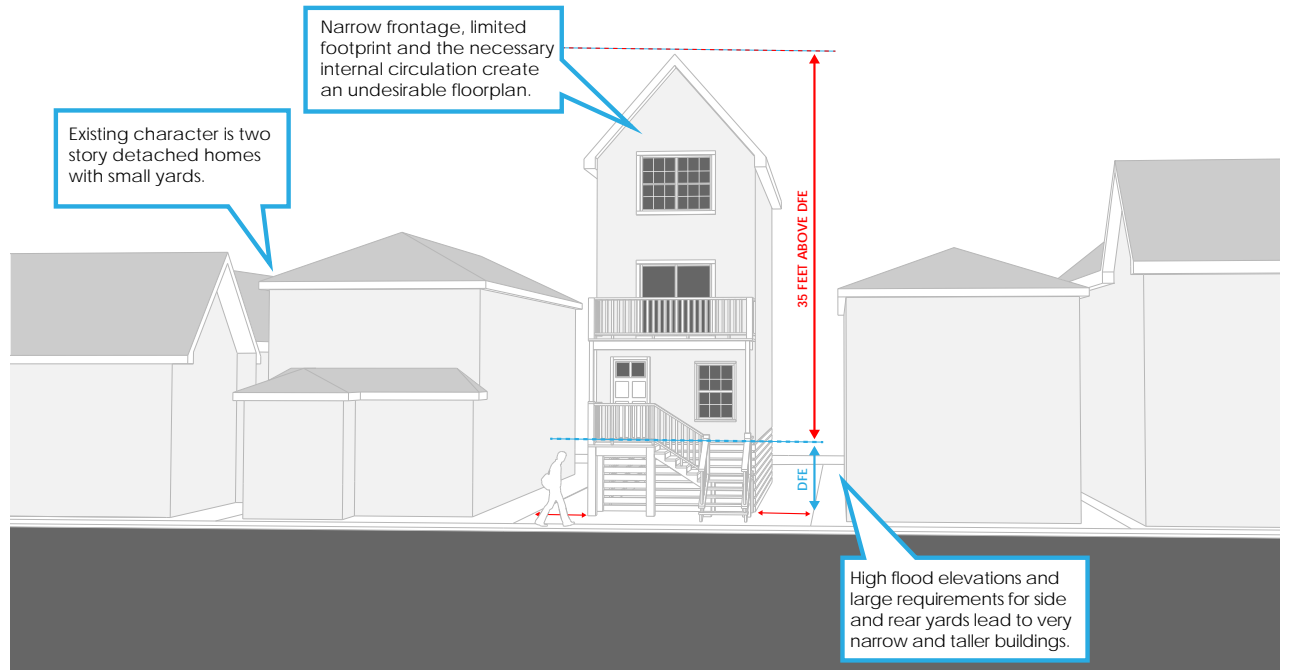
These changes would follow existing zoning district lines south of Allen Avenue but would exclude the blocks fronting Gerritsen Avenue between Allen and Seba Avenues, which would remain R4 to match the existing character of the attached buildings there. Portions of the existing C3 district along the waterfront that have an established residential character and are not at the water's edge would also be included in the new R4-1 district.

In addition, to avoid increasing the population vulnerable to future storms, zoning changes can limit new development to single-family residences on lots smaller than 3,000 square feet in size while allowing one- and two-family development on larger lots. Such a provision, in combination with the rezoning to R4-1, would maintain appropriate limits on density, prevent further stress on the limited infrastructure capacity, and improve the overall resiliency of the neighborhood by limiting growth in the areas with the highest flood risk.

CURRENT ZONING PROVISIONS

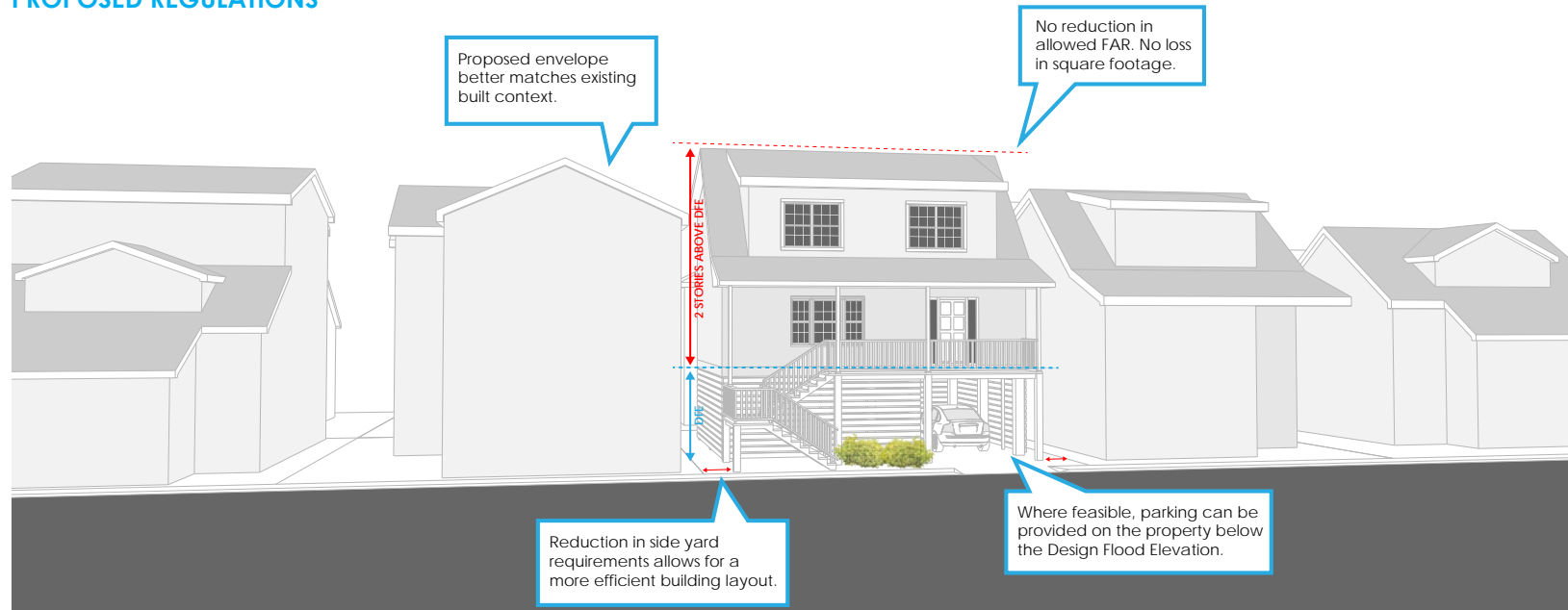


New construction on a typical single lot under current R4 zoning designation

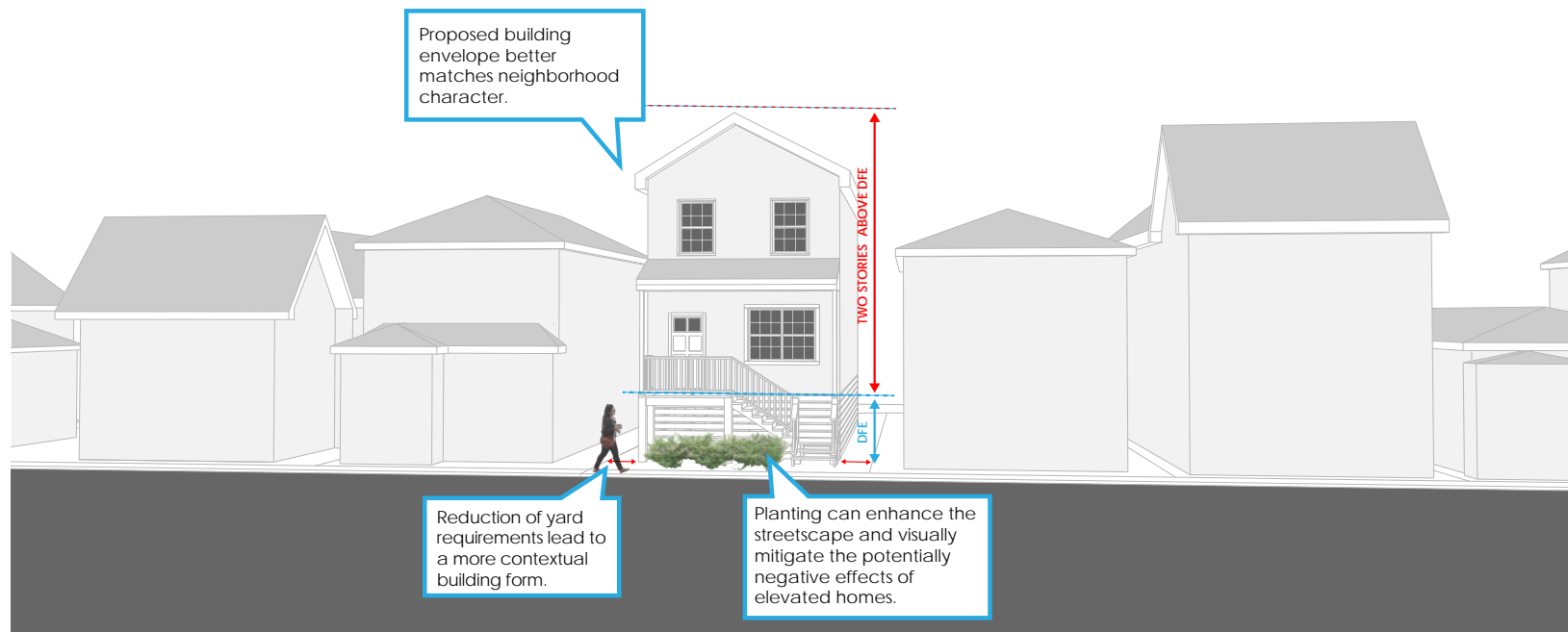


New construction along the canal blocks under current R4 zoning designation

PROPOSED REGULATIONS



New construction on a typical single lot under the proposed zoning regulations



New construction along the canal blocks under the proposed zoning provisions

Gerritsen Avenue

In the aftermath of Hurricane Sandy, DCP and partner agencies, including Small Business Services and the Mayor's Office of Recovery and Resiliency, have been working to build operational and resilience capacity within local business communities in and near the City's floodplain. The City will continue to work with local business and property owners to develop strategies that strengthen the role of the commercial corridors as community centers and ensure that critical retail services

are available to support neighborhood recovery following natural disasters.

Along Gerritsen Avenue, this framework seeks to promote new resiliency investments and to ensure the viability of the corridor by updating the existing commercial zoning designation on commercial blocks along the avenue with a new mapped commercial overlay. The new overlay would allow for a somewhat wider range of uses than the existing

one, including services that support existing businesses, such as printers and caterers; home maintenance and repair services, such as plumbing and electrical and appliance repair shops; and small amusement establishments. The strategy seeks to enhance the local retail character of the corridor and attract new businesses that could serve residents, especially in the aftermath of a storm. More information on strengthening retail corridors across the floodplain can be found in DCP's *Resilient Retail* report.



Resiliency retrofit options for commercial spaces along Gerritsen Avenue

RELOCATE COMMERCIAL SPACE

While commercial spaces can be located below the DFE if dry-floodproofed, businesses may want to consider relocating portions of their operations on a second story.

MECHANICAL SYSTEMS

Mechanical systems are the most vulnerable to flood waters and, when damaged, can severely impact a business' ability to bounce back after the storm. All mechanical systems should be elevated above the level of the DFE and potentially relocated to a second story or the roof to ensure a business' resilience to a storm.

FLOODPROOFING

Business owners can protect their business by dry-floodproofing the lowest floors up to the designated DFE. This can be achieved by installing deployable flood gates and ensuring that walls could structurally withstand the hydrostatic pressure generated by flood waters.



Existing C3 zoning district and approximate boundaries of new waterfront designation.

Waterfront

To address current and future flood risk in Gerritsen Beach, this framework recommends changes to zoning in certain areas along the waterfront in the northern portion of the neighborhood. These areas, already mainly designated for maritime and low-density residential uses (C3 zoning district) and mostly within the Coastal A flood zone, are subject to a higher degree of flood risk. Buildings in a Coastal A flood zone can experience wave action during a storm, which can cause severe structural damage, and are therefore required to be built to higher floodproofing design standards. Residential development may be impractical or inappropriate at the currently allowed densities.

In these areas, the City recommends limiting development to detached one- and two-family homes and maritime and other related commercial uses, which would include marinas, restaurants and small shops. This provision would preclude the construction of new multi-family residential development in the most vulnerable areas of the neighborhood.

Other changes would rezone blocks currently zoned C3 that are not directly abutting the water and are occupied by one- and two-family homes to the same designation as the rest of the residential core of Gerritsen Beach, R4-1. This would ensure that new development that is in context with the existing character of the neighborhood.

Waterfront Designations

- Subject to Wave Risk (LIMWA)
- Existing C3 Zoning District Boundary to be Modified
- Existing C3 Zoning District Boundary
- Proposed New Waterfront Designation

Resilient Infrastructure

At the neighborhood scale, infrastructure systems that include the street network, storm sewers and bulkheads, are key to protecting the neighborhood during coastal storms, rainstorms, and against rising sea levels.

To help mitigate flooding from rain events, the City continues to invest in improvements to storm sewers and streets, as funding is available. Over the long term, elevation of streets and storm sewers and potential green infrastructure strategies may need to be explored in order to maintain the area's drainage infrastructure as sea levels rise. This type of strategy would require extensive coordination with the adjacent property owners regarding potential implications for their properties.

The bulkheads that line the shoreline of Gerritsen Beach provide protection against minor but more frequent storms. Many of these bulkheads are in need of repair. The City is currently mapping shorelines throughout the city, which is the first step to better understanding the issues that affect all 520 miles of the city's shoreline. In addition, the City is improving the maintenance and management of all City-owned shoreline structures through the development of a centralized waterfront inspection program for its entire portfolio of coastal and waterfront assets and has dedicated \$100 million over the next four years to address the areas in greatest need.

The U.S. Army Corps of Engineers (USACE) is currently studying coastal storm risk management projects for Jamaica Bay and surrounding communities, including Gerritsen Beach and Coney Island.

The USACE is assessing strategies for controlling erosion and reducing risks from coastal storms along the Atlantic shorefront, including groins, dunes, berms, and



Bulkhead and street end condition along Shell Bank Creek in Gerritsen Beach

reinforced dunes. To reduce risks from flooding in the bay, four alternatives are being analyzed: three hurricane barrier alternatives and one shoreline protection perimeter alternative. All alternatives also include the exploration of strategies for Coney Island.

The USACE has thus far determined that the hurricane barrier option is more cost-effective and will have less environmental impacts. Barrier Alternative C has been tentatively selected as the preferred alternative, but implementation of the project will require several more years of permitting and design. The alignment is still being analyzed to ensure, among other things, that water quality and coastal habitats in the bay are not compromised.

In the interim, the City recommends that the USACE advance the Atlantic oceanfront element of the project, which includes beach restoration and a reinforced seawall, as well as smaller-scale projects within the bay to protect low-lying areas from sea level rise and improve coastal habitats. Importantly, the implementation of the project is not currently funded and requires approval and appropriation from Congress.

To achieve these resiliency goals, the City will continue exploring the necessary measures to address future risks and opportunities, while working jointly with state and federal government agencies managing other infrastructure projects to advance regional coastal protection.

U.S. Army Corps of Engineers Rockaways and Jamaica Bay erosion control alternatives examined





SARDINE

TRIO

CONCLUSION

Gerritsen Beach was one of the neighborhoods in New York City most severely affected by Hurricane Sandy. Floodwaters filled basements and reached the first floors of most homes in the peninsula as the storm surge flooded many of the narrow streets of this former summer bungalow community. Hurricane Sandy showed how vulnerable the neighborhood is to flooding. Future projections for climate change show increased risks not only of major storm events, but also of less severe storms and potential daily tidal flooding related to sea level rise.

Through the Resilient Neighborhoods initiative, DCP has been working closely with local residents to recognize major challenges affecting the neighborhood recovery after the storm and to identify how the neighborhood can be more resilient. Through this collaborative process, the following recommendation to strengthen Gerritsen Beach have been identified:

Ensure resilient residential development is consistent with neighborhood character

Current regulations generally allow elevation of existing homes to meet new flood resistant standards. Future zoning changes can better accommodate appropriate new construction by limiting residential development to one- and two-family homes, limiting buildings to two stories above the flood elevation, and allowing only single-family homes on small lots.

Strengthen the commercial corridor

Expand the variety of uses allowed along Gerritsen Avenue to enable provision of a wider range of services that can support the local community both on a day-to-day basis and in the aftermath of a storm.

Limit intensity of use in the most vulnerable areas

Along portions of the waterfront that are at higher risk of flooding, limit permitted uses to maritime and related commercial uses, and single- or two-family homes.

The City of New York will continue to work with the Gerritsen Beach community to advance the resiliency goals highlighted in this report. By carrying out the goals presented at the beginning of this report through the recommendations identified above, the City will help Gerritsen Beach continue to thrive as a vibrant and resilient waterfront neighborhood.

GLOSSARY OF KEY TERMS

Base Flood Elevation (BFE)

The computed elevation in feet to which floodwater is anticipated to rise during the 1% annual chance storm shown on the Flood Insurance Rate Maps (FIRMs) issued by the Federal Emergency Management Agency (FEMA). A building's flood insurance premium is determined by the relationship between the BFE and the level of the lowest floor of a structure.

1% Annual Chance Floodplain (100 Year Floodplain)

The area that has a 1% chance of flooding in any given year. It is indicated on FEMA's Flood Insurance Rate Maps (FIRMs). See "Special Flood Hazard Areas," below.

Design Flood Elevation (DFE)

As defined by the New York City Building Code, the Design Flood Elevation (DFE) is the minimum elevation to which a structure must be elevated or floodproofed. It is the sum of the BFE and a specified amount of freeboard (see definition below) based on the building's structural category.

Flood Insurance Rate Maps (FIRMs)

The official flood map, on which FEMA has delineated the Special Flood Hazard Area (SFHA), 0.2% annual floodplain (Shaded X Zone), Base Flood Elevations (BFEs), and floodways.

Preliminary Flood Insurance Rate Maps (PFIRMs)*

The PFIRMs are the best available flood hazard data. FEMA is in the process of updating the Flood Insurance Rate Maps (FIRMs) for New York City and issued PFIRMs in December 2013 and again in 2015 as part of this process. The New York City Building Code requires new and substantially improved buildings to use the PFIRMs (unless the effective FIRMs are more restrictive) until the maps become effective. The PFIRMs, however, are not used to guide the requirements of the National Flood Insurance Program.

Floodproofing, Dry

For non-residential buildings, a flood mitigation technique that results in the building resisting penetration of flood water up to the DFE, with walls substantially impermeable to the passage of water and structural components having the capacity to resist specified loads.

Floodproofing, Wet

A flood mitigation technique designed to permit parts of the structure below the DFE to intentionally flood, by equalizing hydrostatic pressures and by relying on the use of flood damage-resistant materials. With this technique, parts of the building below the DFE are only to be used for parking, storage, building access, or crawl space.

Freeboard

An additional amount of height above the BFE to provide a factor of safety to address the modeling and mapping uncertainties associated with FIRMs, as well as a degree of anticipated future sea level rise. It is a risk reduction requirement found in Appendix G of the Building Code and recognized by NFIP as an insurance premium reduction factor. In New York City, one foot of freeboard is required for commercial and multi-family buildings, and two feet for single- and two-family buildings.

* In summer 2015, the City submitted a formal appeal to FEMA, citing internal technical analysis that showed a smaller 1% annual chance floodplain across much of the city. As part of the public review of the PFIRMs, FEMA will review the appeal and determine if a re-mapping of the floodplain is necessary.

National Flood Insurance Program (NFIP)

Federal program that makes flood insurance available to municipalities that enact and enforce floodplain management regulations that meet or exceed the criteria established by FEMA. Under this program, properties within the SFHA with a federally-backed or -regulated mortgage are required to buy flood insurance. Communities participating in the NFIP must incorporate flood-resistant construction standards into building codes.

Special Flood Hazard Areas (SFHA)

Area of the floodplain that has a 1% chance, or greater, of flooding in any given year. Also referred to as the 100-year floodplain or the 1% annual chance floodplain. The SFHA is separated into zones depending on the level of hazard:

V Zone

The area of the SFHA subject to high-velocity wave action that can exceed three feet in height.

Coastal A Zone

A sub-area of the A Zone that is subject to moderate wave action between one-and-a-half and three feet in height.

A Zone

The area of the SFHA that is subject to still-water inundation by the base flood.

Substantial Damage

Damage sustained by a building whereby the cost of restoring the structure to its pre-damaged condition would equal or exceed fifty percent of the market value before the damage occurred. When a building is substantially damaged or substantially improved (see below), it is required to comply with Appendix G of the Building Code as if it was a post-FIRM structure.

Substantial Improvement

Any repair, reconstruction, rehabilitation, addition or improvement of a building with cost equaling or exceeding fifty-percent of the current market value of the building. When a building is substantially improved, it is required to comply with the flood-resistant construction requirements of Appendix G of the Building Code.

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Data Sources

Federal Emergency Management Agency
NYC Panel on Climate Change
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RESOURCES

TECHNICAL GUIDANCE

New York City Department of City Planning

Retrofitting Buildings for Flood Risk

www1.nyc.gov/site/planning/plans/retrofitting-buildings/retrofitting-buildings.page

Resilient Retail

www.nyc.gov/resilientretail

Designing for Flood Risk and Urban Waterfront Adaptive Strategies

www1.nyc.gov/site/planning/plans/sustainable-communities/climate-resilience.page

Flood Resilience Zoning Text Amendment

www1.nyc.gov/site/planning/zoning/districts-tools/flood-text.page

Special Regulations for Neighborhood Recovery

www1.nyc.gov/site/planning/plans/special-regulations-neighborhood/special-regulations-neighborhood.page

New York City Department of Buildings

Building Code Appendix G Flood-Resistant Construction

www1.nyc.gov/site/buildings/codes/2014-construction-codes.page

Federal Emergency Management Agency

Flood Insurance Rate Maps

region2coastal.com

National Flood Insurance Program

floodsmart.gov

INFORMATIONAL RESOURCES

OneNYC

nyc.gov/onenyc

Mayor's Office of Recovery and Resiliency

www.nyc.gov/html/planyc/html/resiliency/resiliency.shtml

New York City Panel on Climate Change

onlinelibrary.wiley.com/doi/10.1111/nyas.2015.1336.issue-1/issuetoc

