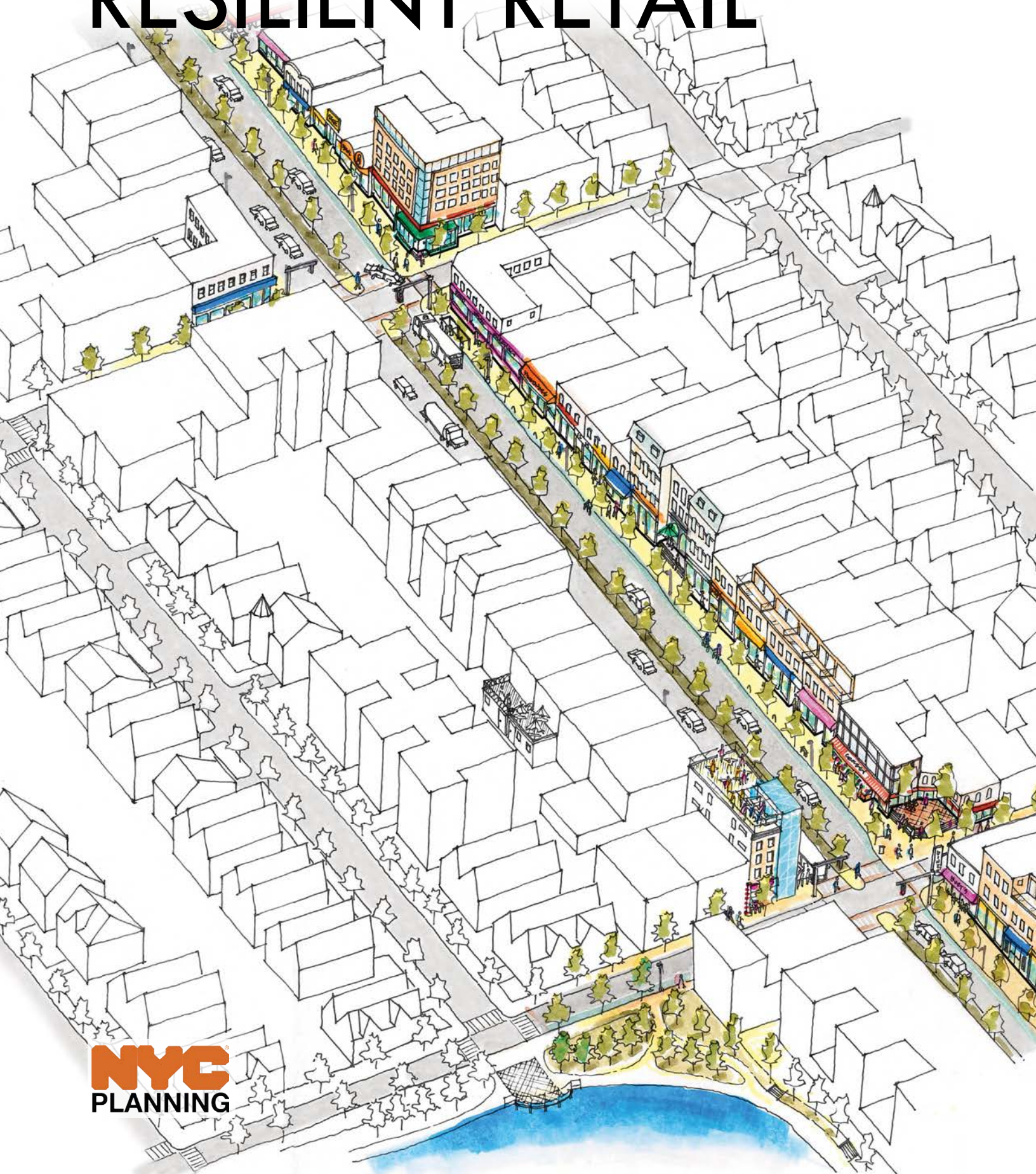


COASTAL CLIMATE RESILIENCY

RESILIENT RETAIL



This study was funded through a U.S. Department of Housing and Urban Development (HUD) *Community Development Block Grant Program (CDBG-DR)*, as part of the New York City Department of City Planning's *Resilient Retail Initiative*.

resilient retail
NYCPLANNING



RESILIENT RETAIL

THE CITY OF NEW YORK

Mayor Bill De Blasio

DEPARTMENT OF CITY PLANNING

Carl Weisbrod, Director

July, 2016

www.nyc.gov/resilientretail

FOREWORD

Resilient Retail addresses the challenges and opportunities faced by our coastal retail corridors and the businesses and residential communities that rely on them for jobs and essential goods and services. It is a unique resource in helping New Yorkers, and others throughout the region, navigate ongoing changes to floodplain regulations and better understand the challenges to adapting retail businesses in constrained built environments and complex market dynamics.

Hurricane Sandy exposed the vulnerability of many of our coastal communities to flooding and storms, and highlighted the need to mitigate against future damage and losses. As flood risks continue to increase over time with sea level rise, understanding the extent of these risks and the strategies available to protect buildings in the floodplain will become increasingly critical to supporting long-term community resilience and a stronger New York City.

This report provides short- and long-term options for assisting business and property owners to mitigate flood risks while remaining operational and accessible year-round. It also demonstrates the limitations of the existing federal flood regulations in the context of the city's dense neighborhoods and building stock, and provides specific suggestions for alternative mitigation options that FEMA should explore.

Building a more resilient city requires focusing not just on the buildings themselves, but on the entire neighborhood, and taking action on the Local, State and Federal levels. The recommendations presented here are largely informed by the guidance and experiences shared by many of the city's merchant associations, BIDs, Chambers of Commerce, and small businesses who, since Hurricane Sandy, have worked to rebuild their retail corridors and provide technical assistance to affected property owners.

To make sure that communities continue playing an active role in shaping their future, the Department of City Planning will remain engaged with waterfront residents and business owners in the five boroughs to identify neighborhood-wide strategies that support the vitality and resiliency of communities in the floodplain.



Carl Weisbrod, Director, Department of City Planning

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EXECUTIVE SUMMARY

The Department of City Planning's *Resilient Retail* study addresses the ongoing challenges that commercial retail corridors continue to face in the aftermath of Hurricane Sandy and within a new regulatory environment. While this study focuses on New York City's floodplain retail corridors, it identifies challenges and opportunities that urban coastlines throughout the region face.

The study is guided by two main goals:

Support the continuing vitality of retail corridors and the neighborhoods they serve by addressing short-term needs and long-term regulatory challenges related to flood risk.

Promote retrofitting and rebuilding strategies that reduce flood risk to individual businesses, while ensuring they remain accessible, viable and able to meet community needs for critical goods and services.

Hurricane Sandy left many small retailers heavily damaged and unable to reopen quickly – or at all. At the same time the gradual reduction of flood insurance subsidies, stringent building requirements for properties in the floodplain, and updated Federal flood maps that will expand the 1% annual chance floodplain to encompass thousands of additional properties in New York City are having profound impacts on coastal businesses and residents. Many businesses that were largely unaffected by Sandy's direct impact still remain at risk from future floods and the associated economic challenges of community recovery and flood mitigation.

Challenges to Supporting Retail Corridors

Urban retail corridors are diverse. Across neighborhoods, a corridor's mix of businesses reflects the communities it supports, while its built form is a product of historical development patterns and zoning regulations.

The *Resilient Retail* study focuses on local retail corridors in New York City, typically comprised of older, attached street wall buildings, and drawing customers primarily from within the surrounding neighborhoods. As customers in many parts of the city usually depend on local providers of goods and services to meet many of their day-to-day needs, these types of retail corridors are particularly critical throughout the floodplain. To a lesser extent this study also considers resiliency challenges faced by newer, more automobile-oriented commercial corridors, where buildings are likelier to be detached and set back from the street and where customers may be more reliant on cars or buses to reach their shopping destination.

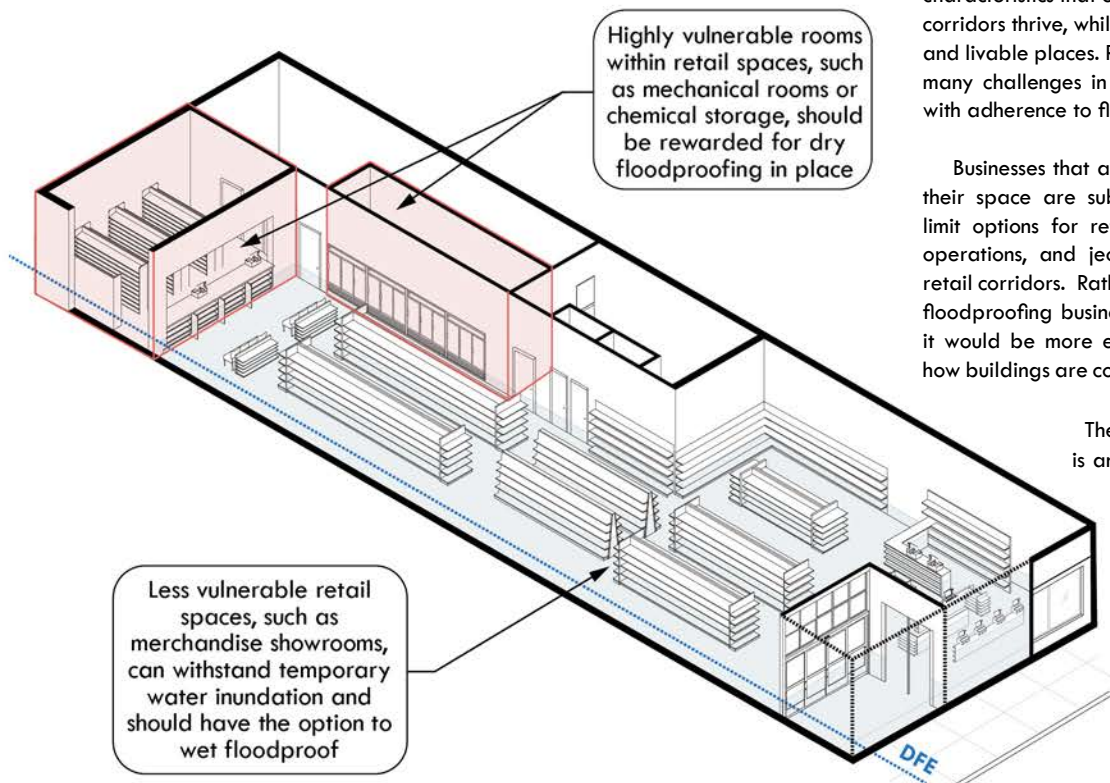
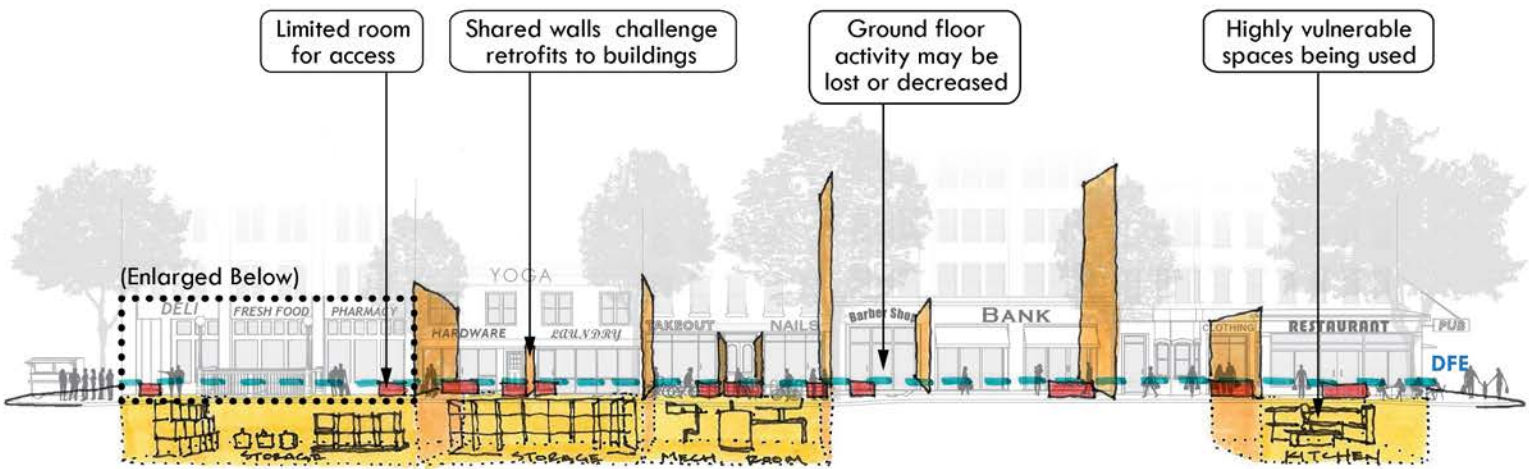
Across New York City's five boroughs, corridors face a range of coastal flood risks. In some areas potential flood waters exceed 10 feet above grade during heavy storms, while other areas may only have to prepare for a foot or two of water during storm events. While the corridors explored in this study all face some variation of storm surge or other coastal flood risk, their potential approaches to resiliency and challenges will vary based on their built typologies, the strength of their business markets, and the magnitude of potential flooding. Nonetheless, the questions confronting New York City's corridors have many commonalities with denser urbanized coastal communities and inland riverine towns and cities throughout the country.

Floodplain regulations for commercial buildings typically require elevating the lowest occupied floor to a level above which base flood waters are expected to rise, or dry floodproofing the entire portion of a structure below the flood elevation if businesses hope to remain at street level. However,

A Healthy Main Street ...



... Can Face Major Challenges To Floodproofing



The urban retail block above illustrates some of the characteristics that ensure businesses remain healthy and retail corridors thrive, while helping keep our neighborhoods vibrant and livable places. Retailers located within the floodplain face many challenges in balancing cost-effective flood mitigation with adherence to floodplain construction regulations.

Businesses that are interested in or required to floodproof their space are subject to stringent requirements that may limit options for retrofit strategies, greatly impact business operations, and jeopardize the vibrancy of neighborhood retail corridors. Rather than prescribing a singular strategy to floodproofing businesses and other non-residential buildings, it would be more effective to develop strategies based on how buildings are constructed and how the businesses operate.

The pharmacy or convenience store to the left is an example of how risk can be distributed differently across components of a retail space. By offering partial credit for partial mitigation, there are more opportunities to protect businesses and keep retail corridors, and the neighborhoods that depend on them, active and resilient.

this prescriptive approach to mitigating flood risk in commercial buildings is often impractical for properties located in dense urban environments.

The physical complexity of most of New York City's buildings, many of which include sub-grade cellars, and the importance of connecting and organizing retail space that sits alongside other uses and is accessible to customers, often means that currently permitted regulatory solutions are structurally infeasible or cost-prohibitive. The physical challenges are compounded by the difficulty of finding affordable flood insurance and the nuanced relationships between businesses and property owners, making the task of ensuring that neighborhood retail corridors remain vibrant and secure even more challenging. This study identifies specific physical and regulatory challenges associated with maintaining healthy and flood-resilient commercial corridors and offers policy and operational strategies to assist businesses in floodplains to become more resilient and meet existing regulatory requirements.

Local Strategies to Support Resilience

Local changes to land use policy, zoning and other actions will seek to help businesses, and the neighborhoods they serve, withstand and recover quickly from future flood events. Strategies will build on the Flood Resilience Zoning Text Amendment, adopted in October 2013 to make it easier for property owners to retrofit existing buildings throughout designated flood zones, and ongoing technical support programs that the City has in place to assist small businesses.

LAND USE STRATEGIES

Review how zoning regulations can support existing and new retail businesses in adapting to federal flood resiliency standards while remaining operational and accessible year-round.

The Flood Resilience Zoning Text Amendment will sunset following adoption of any future flood maps. DCP is continuing to review existing coastal neighborhood conditions to identify which temporary provisions should be made permanent and find other ways that zoning changes can better enable property owners to make building retrofits that mitigate flood risk.

Review opportunities for supporting resiliency of critical retail uses, such as supermarkets, banks, hardware stores, and pharmacies, within the floodplain.

The City will continue to identify ways that local land use strategies may be able to support the construction and operation of buildings that provide critical neighborhoods retail goods and services. Hurricane Sandy demonstrated the importance of access to essential retail goods and services following the disaster when lack of transportation or information and language barriers kept many residents from accessing businesses outside their neighborhoods.

BUSINESS ASSISTANCE STRATEGIES

Provide technical, operational and financial assistance for flood mitigation to property owners.

Ongoing initiatives to provide direct technical and operational expertise, along with added financial resources to support private investments, will be critical to ensuring small businesses and property owners are assisted in making retrofitting decisions.

Improve printed and online resources available to individual property owners to help them make better-informed decisions on flood mitigation.

There has been insufficient guidance published to date offering businesses and non-residential property owners clear information on mitigating flood risk within dense, built-up communities. More material, such as this report, will be required to work in tandem with on-the-ground technical assistance to support businesses in incorporating flood mitigation strategies.

Federal Reforms to Support Resilience

Local strategies alone will likely be insufficient to enable floodplain businesses to rebuild and adapt to future flood risk. Further reforms to federal floodplain requirements will also need to be explored.

PARTIAL MITIGATION STRATEGIES AND NFIP REFORM

Partial mitigation strategies for commercial buildings that provide more options for flood mitigation, while still minimizing losses from flooding, should be recognized.

Current federal regulations guiding floodproofing measures for non-residential buildings in the 1% annual chance floodplain are restrictive, inflexible and imply wholesale redevelopment of existing neighborhood retail streets; a highly disruptive and impractical outcome. Federal regulations do not recognize the full range of lower-cost and less onerous opportunities available to businesses to mitigate flooding such as dry floodproofing mechanicals in place, or wet floodproofing commercial retail space. Despite acknowledging that such alternative mitigation investments may lower flood risk, FEMA neither recognizes the cost savings of many of these strategies nor grants these investments partial credit towards lower NFIP premiums for businesses and property owners.

Increased flexibility should be provided to retail, office and community facility spaces to accommodate safe exit out of the building to households located above ground floors.

Under current federal regulations, buildings must either fit stairways that rise up and over dry floodproofed ground floors with limited floor to ceiling heights, or implement completely separate dry- and wet- floodproofing systems for the separate non-residential areas and residential access points. This creates conflicts that compromise the ability to implement effective floodproofing strategies for mixed-use buildings. Federal mitigation guidance should address the unique challenges to retrofitting such buildings, particularly on narrow lots where residential entryways with stairwells leading upstairs are adjacent to businesses.

Insurance rates and design standards should also consider the inherent durability of the masonry and steel frame construction techniques that characterize much of the building stock in New York and other cities.

Sandy only minimally affected the structure of masonry and steel frame-constructed buildings. Most of the damage was to electrical, mechanical, and other accessory support systems located in cellars, basements, and elsewhere below the Base Flood Elevation (BFE), as well as to building contents. Few commercial or mixed use buildings were deemed Substantially Damaged and required to rebuild anew, as compared to the many light-frame homes that were destroyed by the storm.

Moving Towards Resilient Retail

Long-term resilience will require mitigating flood risk to existing buildings and incorporating new floodproofed construction in a way that preserves access to goods and services while upholding neighborhood character and diversity. This process requires long-term coordination between individual businesses, merchant groups, public agencies, and community-based organization to ensure that New York City and other flood-prone cities are prepared to manage future flood risks and other challenges.

DCP will continue to work together with partner agencies and community stakeholders to review local zoning and other land use policies that ensure communities are supported in mitigating flood risk. In order to secure the long-term access to essential goods and services coastal communities will continue to require, the City will also continue to advocate for revisions in Federal floodplain regulations to allow greater flexibility for businesses and commercial property owners to reduce flood risk.

INTRODUCTION

Hurricane Sandy brought to light the many vulnerabilities our communities face from flooding. From destroyed homes, to cut-off roads, fuel shortages, and loss of access to critical goods and services needed in the aftermath of a storm, Sandy deeply affected communities. Along with the thousands of households that were impacted, many retail businesses were inundated by floodwaters from coastal storm surge and rising stormwater from backed-up sewers. Most small businesses lacked flood insurance and were unable to access federal disaster loans. The financial burden of cleaning up debris, managing business interruption and rebuilding fell squarely on the shoulders of business, property owners and the communities they serve. Today, several years after Sandy, many businesses have still not been able to fully repair storm damages or retrofit their buildings to mitigate against the next flood event.

Addressing current and future flood risks will be central to ensuring our coastal communities, and the retail corridors they rely on, can remain versatile and resilient in the years to come. Furthermore, as the floodplain expands and construction regulations continue to evolve, local strategies that highlight each corridor's unique opportunities and challenges will need to be combined with Federal-level reforms that make mitigating future flood risks easier, more cost-effective and more reflective of our urban landscapes.

Ensuring Resilient Retail Corridors

Resilient Retail explores challenges to renovating and redesigning ground floor retail to help businesses survive future flooding. This report considers the physical implications of retrofitting and rebuilding to flood resilient construction standards post-Sandy, attempting to identify ways in which elevation or floodproofing may work, and what the NYC Department of City Planning can do to improve the viability of these solutions. It also explores the impacts of floodplain regulatory requirements on affected commercial corridors and the surrounding community to address ways that federal and local agencies can work together to ensure that neighborhoods remain complete.

Guidance for retrofitting commercial buildings to mitigate against flooding has generally followed one of two paths: sealing off entry points and installing flood barriers up to the Base Flood Elevation (BFE) where water might inundate a building's interior, also known as dry floodproofing, or vacating the ground floor and elevating uses above the projected BFE. Both of these flood protection measures pose specific challenges to commercial viability during the majority of times where the risk of flood is not imminent, when success depends on unencumbered access from the sidewalk to the business and the fluid movement of pedestrians and shoppers. They are also extremely expensive and logistically challenging. A third option, wet floodproofing, involves fitting out a building interior with materials that can withstand temporary water inundation while elevating critical equipment, such as building boilers and electrical meters. This can provide real flood protection to businesses while having a minimal impact on how shoppers experience a place, but such "partial mitigation" strategies are not in and of themselves FEMA compliant. They will not necessarily reduce NFIP premiums, nor will they bring a building up to code as defined by the NYC Department of Buildings.

The goals of this study are to inform future planning policy around the support of vibrant neighborhoods and to facilitate the development and approval of alternative mitigation techniques that might reduce flood risk in neighborhoods that cannot undertake the two existing NFIP-compliant options for commercial uses: elevation or dry floodproofing. The challenges of long-term viability cannot be overcome by City agencies alone, and research thus far has indicated



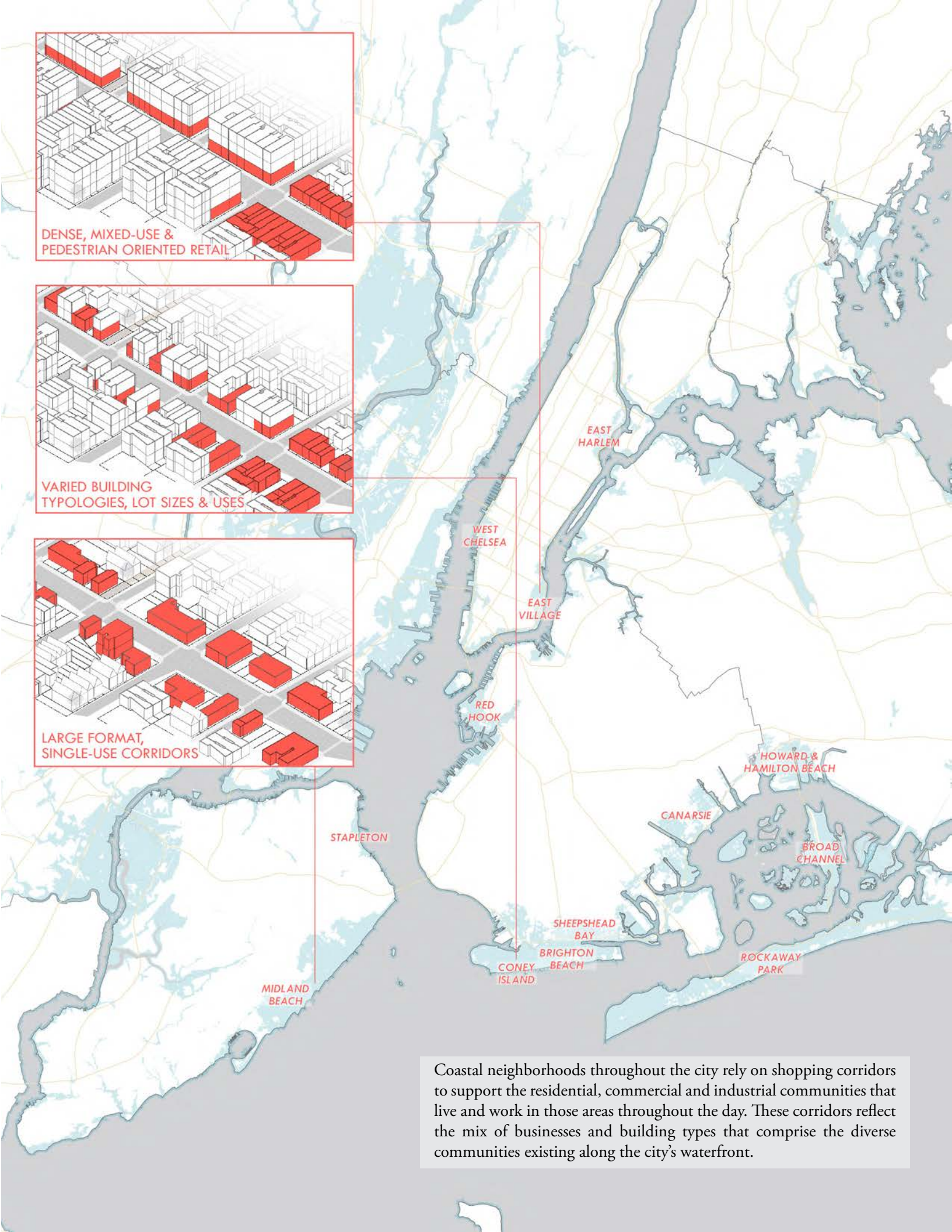
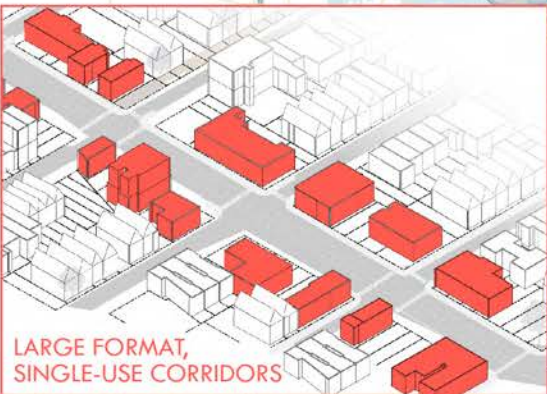
Flood resilient construction standards are established by FEMA and enforced by the city's floodplain administrator, the NYC Dept. of Buildings.



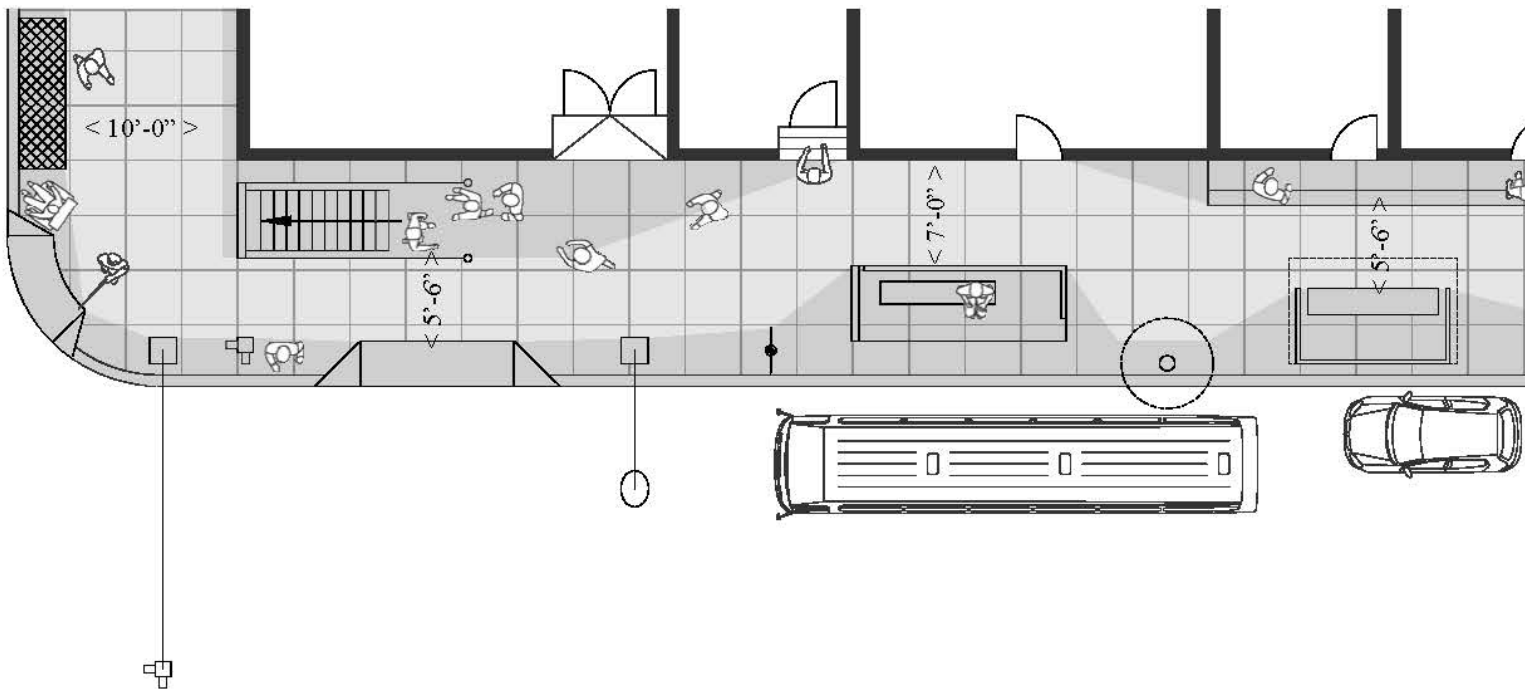
BFE, or Base Flood Elevation, means: the height to which flooding is expected to rise during a 1% annual chance storm. It is the basis of flood risk measured by FEMA's Flood Insurance Rate Maps (FIRMs).



NFIP (National Flood Insurance Program) is: a federal program that makes flood insurance available to property owners in municipalities that enforce floodplain management regulations established by FEMA.



Coastal neighborhoods throughout the city rely on shopping corridors to support the residential, commercial and industrial communities that live and work in those areas throughout the day. These corridors reflect the mix of businesses and building types that comprise the diverse communities existing along the city's waterfront.



that NFIP and federal floodplain construction regulations will have to evolve to accommodate certain realities and necessities of New York City’s dense retail landscape if our corridors and neighborhoods are to withstand future natural and economic challenges.

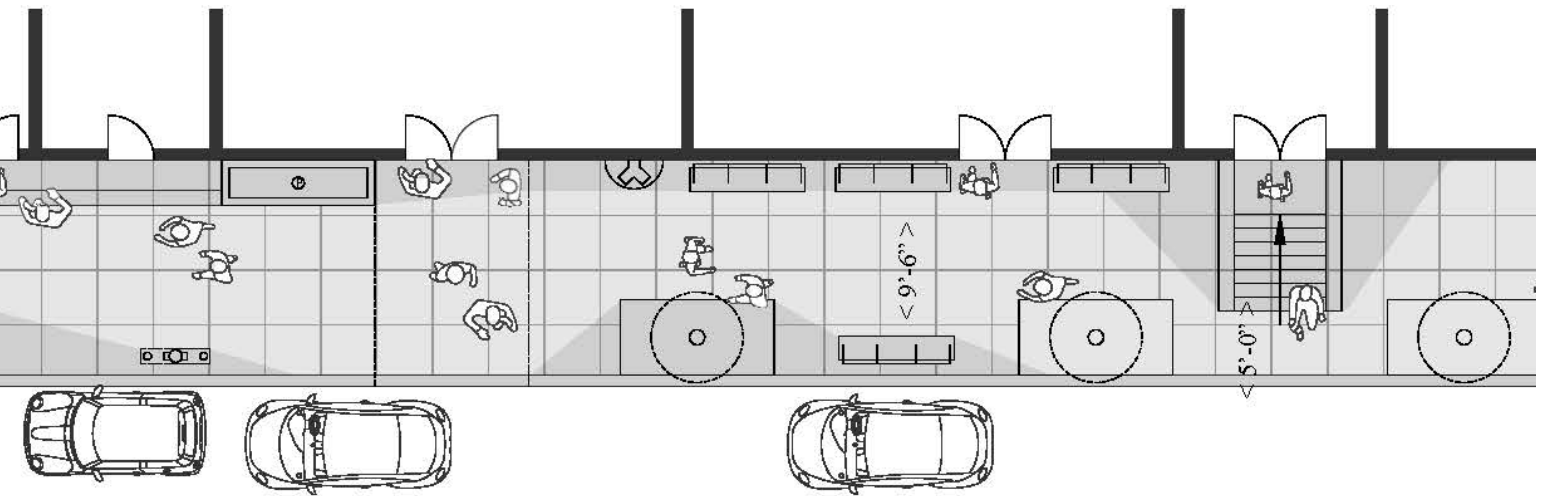
Process

The Resilient Retail study kicked off with a rigorous analysis of commercial land use in the floodplain. The team identified 14 street corridors that provided opportunity for in-depth case studies based on the presence of neighborhood-serving retail, vulnerable building fabric and varying heights of potential floodwaters. A group of planners and designers then visited each corridor in order to experience the day-to-day operations and record its physical characteristics. The team analyzed the sidewalk experience, documented retail uses and measured the critical dimensions of both the retail frontage and public realm. This in-depth inventory of the urban landscape provided an accurate template for our team to examine the physical constraints of local and federal regulations that may conflict with adapting retail spaces to higher flood risks.

Over the Fall of 2014, the Department of City Planning engaged commercial stakeholders, including BIDs, merchant groups, business chambers, and other community-based organizations in a survey to share their constituent businesses’ experiences

before, during, and after Sandy. Later that year, thirteen stakeholder groups representing a broad range of impacted communities were joined by city agency representatives, including NYC Economic Development Corporation (EDC), NYC Emergency Management (NYCEM), Small Business Services (SBS), and the Mayor’s Office of Recovery and Resiliency (ORR), to identify priorities for addressing operational and structural challenges to resiliency. Those recommendations, along with our physical understanding of each case study corridor, became the framework for considering where the agency could most effectively support, through advocacy and policy recommendations, resilient retrofitting across commercial corridors within New York City’s floodplain.

In the Spring of 2015, DCP joined other agency partners in a series of business resiliency workshops that once more brought together stakeholders from all five boroughs. The workshops provided guidance on existing opportunities for retrofitting buildings to mitigate against flood risk and to explain how changes in floodplain mapping and building construction standards will impact commercial buildings. They also allowed the agency to collect additional feedback on proposed land use policies from participants.



The image above was diagrammed in order to illustrate the effective “clear path” along one of the case study corridors, necessary for emergency and pedestrian access. This information shows how constrained the sidewalk on Avenue C already is without even considering what effect flood proofing may have on the streetscape experience. As part of the case study analyses a group of staff visited 14 retail corridors across New York City’s floodplain. Pictured below are two staff members measuring and recording information that was used to create a qualitative analysis of the retail corridors.





1% annual chance means: the area that has a 1% chance of flooding in any given year. It is indicated on FEMA's FIRMs. Also referred to as the 100-year floodplain, and the Special Flood Hazard Area (SFHA).



"Resilient Neighborhoods" may be viewed at: <http://www1.nyc.gov/site/planning/plans/resilient-neighborhoods.page>



"Retrofitting Buildings for Flood Risk" may be downloaded at: <http://www1.nyc.gov/site/planning/plans/retrofitting-buildings/retrofitting-buildings.page>

Resiliency Planning in New York City

< As a first step towards addressing zoning challenges to rebuilding in the 1% annual chance floodplain in the wake of Sandy, the City adopted the Flood Resilience Zoning Text Amendment in October 2013 to encourage existing buildings to retrofit throughout designated flood zones. The adopted changes were needed in order to remove zoning barriers that would hinder or prevent the reconstruction of storm-damaged properties.

< In addition to *Resilient Retail*, the Department of City Planning has undertaken other planning studies that highlight the scale of the flood mitigation challenge. The *Resilient Neighborhoods* initiative is working with communities on identifying local zoning and land use strategies that reduce neighborhoods' risks from flooding and coastal storms, while also fostering adaptable and vibrant communities. It focuses on areas that present specific local land use, zoning, and resiliency issues that cannot be addressed fully by citywide zoning changes, with an emphasis on areas where heavy damage occurred during Sandy or substantial flood risk exists. *Resilient Industry* is assessing the vulnerability of New York City's industrial sectors to flooding as businesses continue to recover from Sandy and plan for the future. The study is identifying physical and operational strategies that industrial facilities can pursue to prepare for future storms.

< The *Retrofitting Buildings for Flood Risk* manual, published in October 2014, was a detailed analysis of how New York City's diverse building typologies are impacted by federal floodplain construction requirements and provided guidance to property owners on how to approach decisions about retrofitting while advocating for regulatory reforms to facilitate mitigation.

Drawn together, these initiatives are providing a framework for steering New York City towards a coordinated resilience strategy that engages communities, advances land use policies and zoning, and builds off of other local, state and federal initiatives aimed at safeguarding where we live, work and experience the city collectively.

Using this Report

This report is a critical step forward in highlighting the current options available to existing businesses and property owners to mitigate flood risk within their buildings through technical and operational guidance. Recommendations are also meant to identify opportunities for reducing federal and local regulatory hurdles to floodproofing businesses. To that end, we hope this report will become a helpful tool in policy reform, building community awareness and providing tangible guidance to retail business and property owners throughout the floodplain.



As an advocacy tool to encourage more flexibility in how federal floodplain regulations allow New York City's retail corridors to adapt their buildings to mitigate future flood risks.



By identifying the scale of neighborhoods and retail corridors affected by floodplain regulations, and the associated challenges for maintaining business viability and efficient operations.



Through providing case study retail corridors, clearly defining their physical and operational challenges and illustrating potential measures for helping make retail businesses whole.

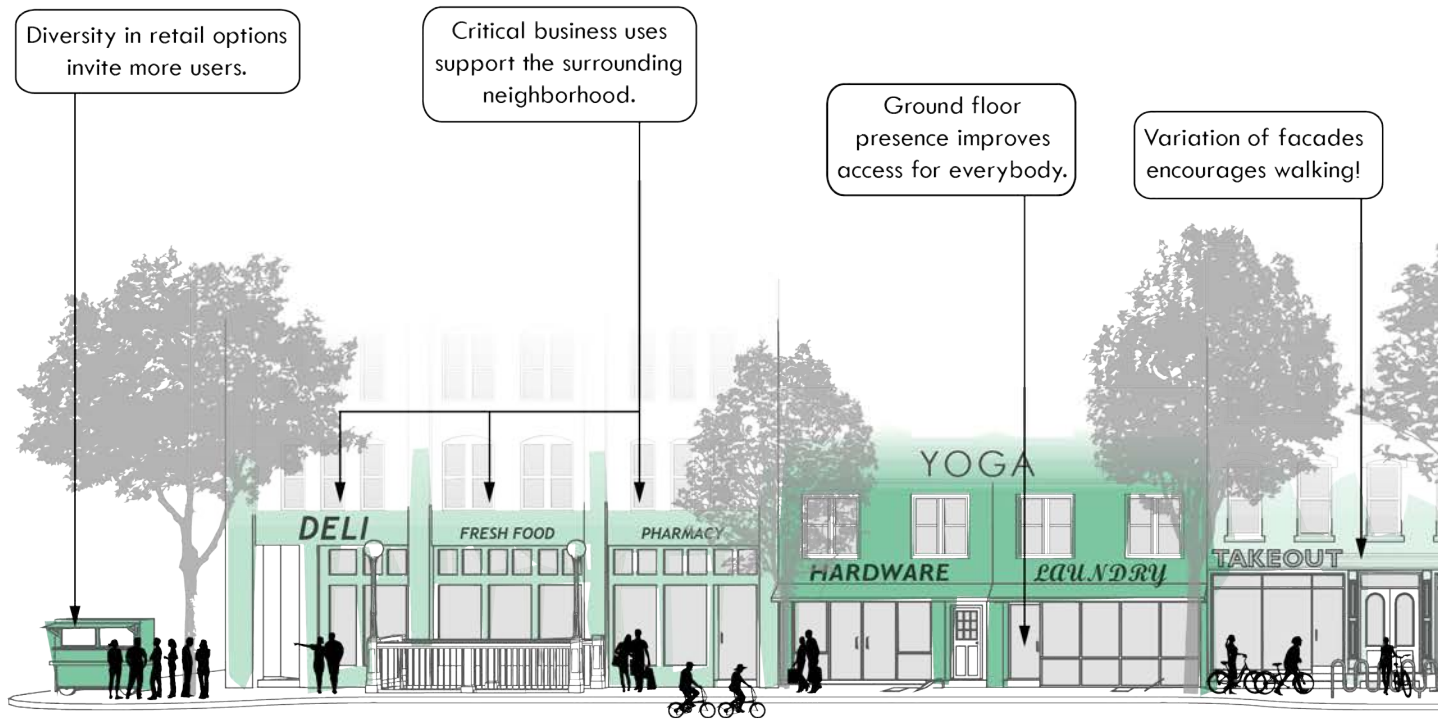
CHAPTER 1 URBAN RETAIL STREETS

How do people in a city as diverse as New York shop? Residents access the full range of retail goods and services that they need in a combination of neighborhood shopping corridors and regional shopping destinations, relying on a mix of transit options. Businesses fit their operational requirements into the constrained built environment, with the most successful businesses constantly adapting to changing customer needs and preferences.



Retail shops along Sheepshead Bay Road in southern Brooklyn attract customers from nearby residential neighborhoods. The corridor is also well connected to the B and Q subway lines that further its ability to serve a larger population.

New York City's "Main Streets"



New York City is largely a city of pedestrian-oriented “Main Streets”, where business is conducted in a series of small, specialized shops. These corridors, including streets like Beach 116th Street in Queens, Van Brunt Street in Brooklyn, Bay Street in Staten Island, and Avenue C in Manhattan, are the primary focus of the Resilient Retail Initiative. They are defined by their street wall – continuous retail uses that are easily accessed directly from the sidewalk – and by buildings with small footprints and shared party walls that are among the most complicated and costly to retrofit.

Customers often arrive on foot, and because building footprints, along with stores, tend to be smaller, shopping is characterized by more frequent, smaller trips. As a result, in strong retail markets, the sidewalks remain active throughout the day. Vibrant commercial corridors promote interactions between pedestrians, shoppers, and businesses in shared spaces on the sidewalk, with easy access into individual establishments. Transparent windows, allowing light into stores and allowing pedestrians to “window-shop”, retail continuity with few interruptions to storefronts along a corridor, and welcoming ground floor entries that enable casual browsing, facilitate a more fluid relationship between public and private spaces. At the same time, there are a handful of neighborhoods where

Pedestrian Experience

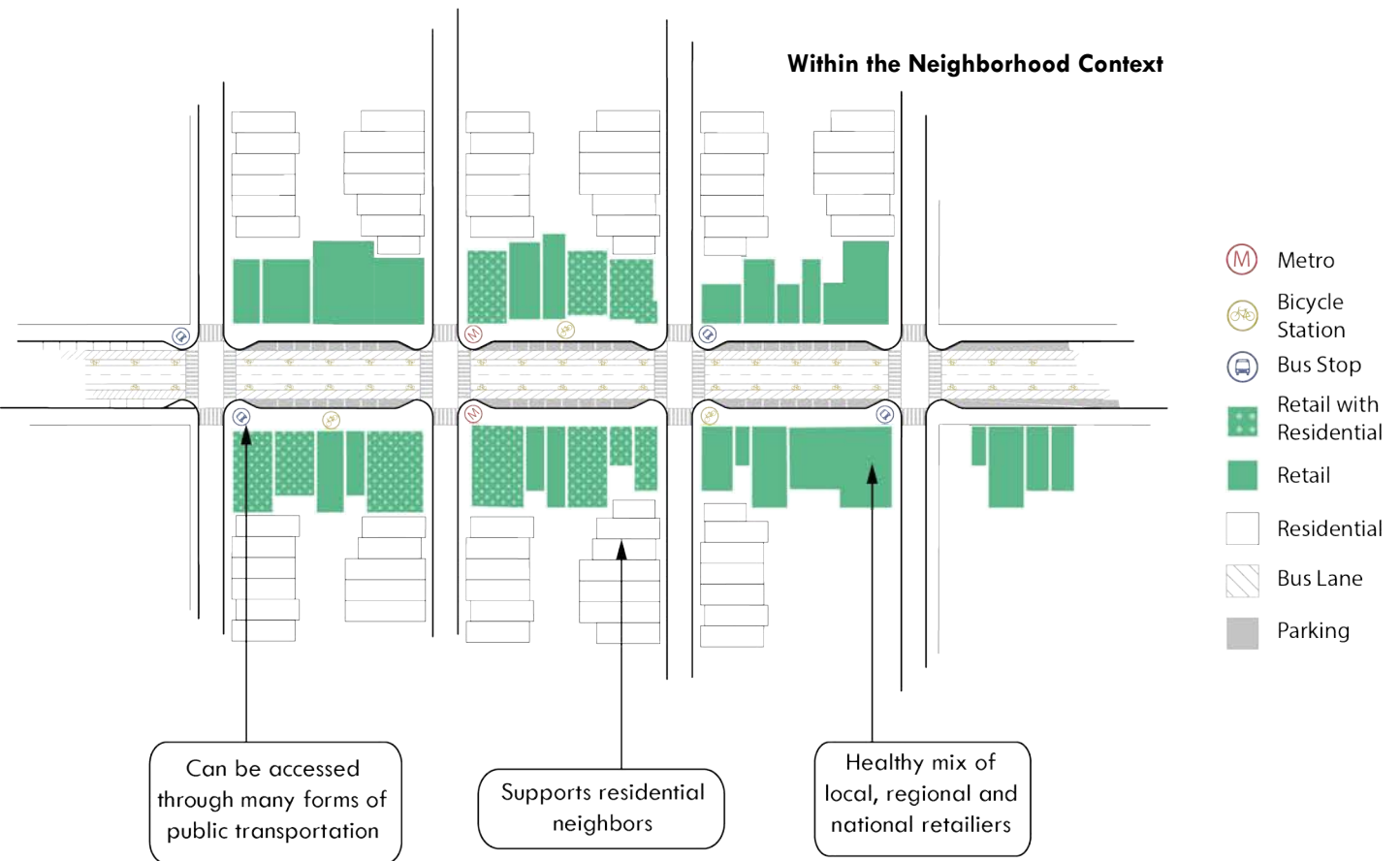


Architectural detailing, variation in the street wall facade, and ground floor transparency make for an interesting sidewalk experience that engages pedestrians

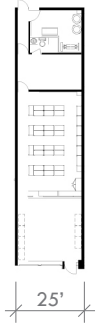


Individuality of businesses bring character to the neighborhood.

A continuous streetscape with active retail encourages 'Eyes on the Street'.



**Typical NYC “Main Street”
Retail Footprint (Not to Scale)**



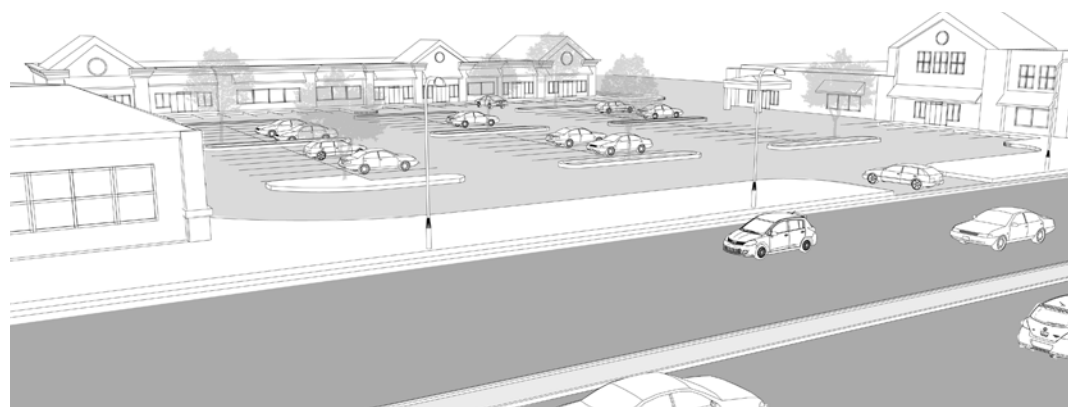
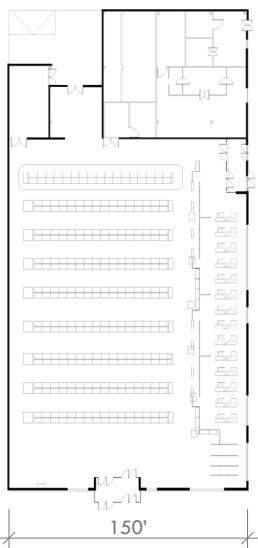
“Main Street” corridors in New York City are comprised of multiple different retail businesses within each urban block. Much of the ground floor is occupied by small businesses that require minimal street frontage, with residential units on the upper floors.

commercial activities are aligned towards more auto-oriented shopping centers and strip malls that are usually less dense and composed of newer buildings. Shopping can be done less frequently and in bulk, and establishments tend to be destinations rather than places people happen upon. These corridors, such as Cross Bay Boulevard in Queens and Hylan Boulevard on Staten Island, provide area residents with goods and services, but typically lack the pedestrian experience enjoyed along the “main street” corridors as retailers tend to provide parking in the front and have their entryways set back from the street. Corridors are sometimes broken up by non-commercial structures like schools or clusters of housing. Many rely on anchor tenants like a large supermarket or drug store, which attract local customers who then patronize the smaller businesses nearby. Automobile convenience is key in these areas. Because customers can drive elsewhere if the shopping is easier or less expensive, anything impeding convenience can be especially damaging to businesses.

Commercial corridors benefit from retail continuity. Consistent ground floor occupancy by active retail uses, as opposed to vacancies, residential uses, or certain less active commercial or community facilities, attracts customers. When one storefront remains vacant, others are more likely to follow.

The *Resilient Retail* study looks closely at what drives corridor success in serving surrounding neighborhoods. The primary focus is on corridors facing the greatest challenges to becoming resilient, for reasons that include constrained lot sizes and building sizes, occupancy by smaller tenants with less physical and financial flexibility to retrofit or rebuild, and the dependence of the surrounding residential neighborhood on these locally-serving goods and services. However, recognizing that businesses on larger lots along more auto-oriented corridors may still face significant challenges in

**Typical Auto-oriented
Retail Footprint (Not to Scale)**



Auto-oriented retailers can be found along the edges of the City’s outer boroughs, adjacent to lower density residential neighborhoods. Many businesses in these corridors operate on large lots with a significant amount of parking; few maintain presence along the street wall.

becoming resilient, this study will explore ways these areas, too, can withstand the physical and financial constraints associated with resilient redevelopment while still meeting the daily needs of local residents.

Identifying Retail Corridors

With its coffee shops, grocery stores, 24-hour pharmacies, hardware stores, laundromats, and restaurants, a healthy and active neighborhood retail corridor services the spectrum of wants and needs of a community. Ideally, a corridor intersperses critical daily needs like functioning supermarkets, laundromats and drug stores with the retail amenities that reflect the needs and preferences of the surrounding area. While retail variety is greatly valued and readily acknowledged, the Resilient Retail study has classified the city's local retail corridors into three general typologies based on building densities and lot sizes, in order to highlight the challenges that are particular to each grouping.

The retail corridors chosen as case studies in this report represent a broad range of commercial corridor typologies throughout the City. New York's commercial communities encompass a variety of built forms and commercial mixes, from very dense corridors with ground floor commercial and residential units located above, to single-story strip mall corridors surrounded by surface parking. Each grouping highlights the range of physical and economic issues our communities face in adapting for long-term resiliency while maintaining healthy, vibrant, and accessible retail designs that meet neighborhoods' local and regional commercial needs. The study identifies challenges on the building and corridor scales, as well as along operational and structural characteristics.







In addition to the corridor types described on the following page, a variety of other retail clusters are found throughout the city's floodplain. Though more specialized than the primary year-round retail corridors, they provide a broad range of retail and commercial services to surrounding communities.

Waterfront/Beach destination corridors, such as those that line Brighton and Coney Island beaches in Brooklyn, Rockaway Beach in Queens, and Midland Beach in Staten Island, benefit from their proximity to New York City's beaches and boardwalks and support these areas as key summertime destinations. While many traditional retail services are found alongside such waterfront districts, destination retail differs in that it draws from a much larger geography that may or may not patronize surrounding year-round businesses. Due to their coastal proximity and limited seasonal use, retail businesses located within these areas are often not permanent and housed in temporary structures such as sheds and deployable shipping containers, or operate out of carts and trucks.

Maritime commercial districts are waterfront-adjacent commercial hubs that include marinas and other maritime retail facilities that cater to boating and other on-water recreational and commercial activities. These areas may also draw a broader regional community, as they are often far from beaches and located within bays and harbors that offer more natural protections, such as Eastchester Bay in the Bronx and Great Kills on Staten Island.

TYPE A | Dense, mixed-use and pedestrian oriented

Common Characteristics







-  Small Lot Sizes
-  Dense Lot Coverage
-  Consistent Street Wall
-  Multiple Stories
-  Attached Buildings
-  Retail with Residential

Prototypical Layouts



Commercial corridors such as Avenue C in the East Village and Van Brunt Street in Brooklyn are dense corridors composed of small lots and multi-story buildings attached to their neighbors. Most of these corridors are busy and active, providing key neighborhood services throughout the day and evening, while others are destinations that draw citywide patrons. Most buildings have commercial uses occupying ground floor spaces, with residential dwelling units above. Interspersed at the ground floor are other uses associated with the neighborhood, including residential entryways and commercial loading areas. Within the floodplain, these corridors tend to include the oldest buildings, and the highest concentration of residents, businesses, and buildings. For these reasons, this typology presents unique challenges for mitigation.







TYPE B | Varied building typologies, lot sizes and uses

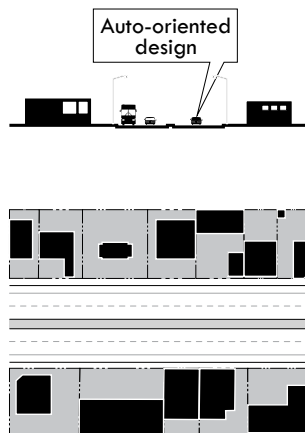
-  Mixed Lot Sizes
-  Less Dense Lot Coverage
-  Varied Street Wall
-  Mostly Single Story
-  Mostly Attached Buildings
-  Mostly Neighborhood Serving



These commercial corridors, such as Midland Avenue on Staten Island, and Mermaid Avenue and Lorraine Street in Brooklyn, contain a wider range of lot sizes and a mix of attached and detached buildings. Structures along these corridors are mostly low level, single or two story buildings and have less dense lot coverage. These corridors, where the street wall tends to be inconsistent and where non-commercial uses are interspersed along the corridor, often draw lower levels of pedestrian activity and may be more reliant on customers who also arrive by car than the denser mixed-use corridors mentioned earlier.

TYPE C | Large-format, low density shopping corridors

-  Larger Lot Sizes
-  Fairly Sparse Lot Coverage
-  Street Wall Setback
-  Single Story
-  Detached Buildings
-  Large Format Retail



Commercial corridors like Cross Bay Boulevard in Queens and Avenue U in Marine Park, Brooklyn, consist of larger, widely spaced lots, and single story buildings with significant surface parking, resulting in very few buildings at the sidewalk or street wall. In New York City, such corridors often exist along major thruways and atop former water-adjacent industrial sites. Larger-format retailers and facilities such as department, home improvement stores and bulk sales retailers tend to be found along these corridors, along with some smaller and more locally-serving businesses such as restaurants and medical offices. These commercial corridors are often auto-oriented and less accessible to pedestrians.



“Type A” corridors like Sheepshead Bay Road in South Brooklyn offer a wide variety of retail options that are very accessible to pedestrians, some of whom may live directly above.



“Type B” corridors such as Rockaway Beach Boulevard represent a more varied ground floor mixed with retail, community facility and stand-alone residential buildings.



“Type C” corridors like Cross Bay Boulevard in Howard Beach, Queens are more auto-oriented due to their generous building footprints and large parking facilities.



Bulk means:

the size of buildings or other structures, and their relationships to each other and to open areas and lot lines.



How Does Zoning Affect Retail Corridors?

Zoning is the primary mechanism employed by the NYC Department of City Planning to regulate building use and bulk. At a very local level, zoning influences the subtle variations in building size and shape that help define a neighborhood’s character; at a broader level, zoning allows for the development of compatible uses alongside one another, and facilitates the growth of neighborhoods with an appropriate balance of uses, including commercial infrastructure that enables ready access to goods and services that residents need and desire.

Zoning for commercial uses falls under two primary categories: commercial zoning districts, which allow for a range of large-scale commercial uses, and commercial overlays (see chart below). Overlays are mapped along streets that serve local retail needs, and are found extensively throughout the city’s lower- and medium-density areas and occasionally in higher-density areas. Overlays typically extend to a depth of 100’ to 150’ and allow for uses including neighborhood grocery stores, restaurants, beauty parlors, small hardware stores, bookstores, certain repair services, to name a few. Commercial overlays produce one- or two- story commercial buildings, or mixed buildings with ground floor commercial and residential units on the higher floors above.

Commercial districts, as opposed to overlays, generally allow larger commercial spaces and are often more regionally-serving. Establishments within these districts may serve as retail destinations for residents of other neighborhoods, and for visitors, arriving by public transportation or car.



Commercial overlay districts are where much of the City’s retail area in the floodplain exists. Overlay districts are mapped to ensure that adjacent neighborhoods have convenient access to daily retail needs.

Commercial districts include central business districts like Midtown Manhattan, Lower Manhattan, Downtown Brooklyn, Jamaica Queens, and The Hub in the Bronx. These areas are characterized by large office buildings or regional-style department stores.

Commercial uses may still be found outside of commercial overlays and zoning districts, along streets in residential zoning districts without overlays. “Nonconforming” commercial uses that were in place prior to zoning are permitted to remain, but may not expand. Pockets of nonconforming retail establishments are common and found in neighborhoods across the city.



Commercial overlay district with small-scale retail in Queens

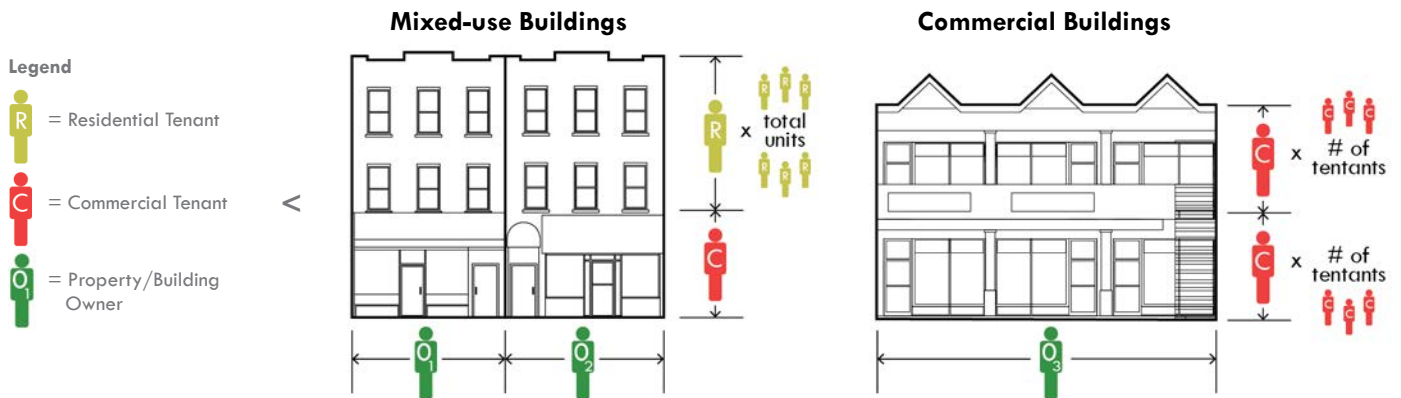


Regional-serving commercial district in Queens

Other Factors Affecting Retail Corridors

OWNERSHIP

The great majority of businesses in New York City and its floodplain are small and independently owned. Many business owners of the shops that dominate the city's local retail corridors live near their business, in homes that may also be in a high-risk floodplain and thus also require attention and resources for mitigation. Business owners, however, often do not own the property on which they operate their store, instead leasing the space from a property owner.



Property owners are connected to the corridor on a daily or semi-regular basis; some live close by and engage directly, while others manage their properties from elsewhere. Regardless, insurance and regulatory compliance is ultimately their responsibility.

Numerous factors affect the capacity of a property owner to respond to new financial and structural challenges. The age and general condition of their building, the size of the lot and adjacency to neighbors, whether they hold a mortgage or have paid off their property, co-ownership arrangements, the length and terms of leaseholders, residential lease terms, and income generated by the property are just some of the factors enabling or inhibiting an individual from making upgrades to his or her property. In many cases, property owners themselves are small business owners, relying on the income generated by their properties and lacking substantial savings or capital to help recover from catastrophic events.

SPACE CONSTRAINTS

How much space a business can occupy serves as a natural limiting factor for the uses within. This is clarified by the zoning code, both directly by setting actual square footage allowances for certain uses, and indirectly by regulating overall building bulk.

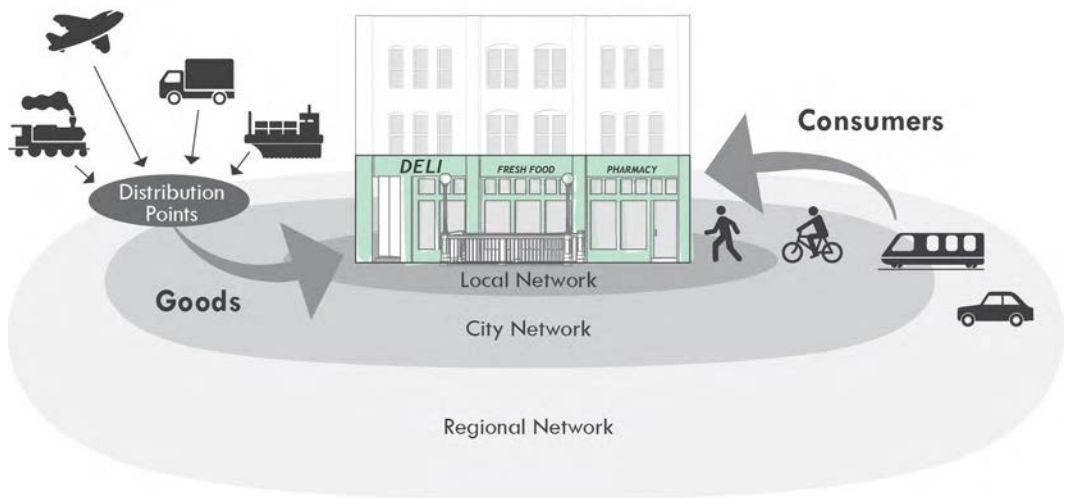
Commercial uses are constrained by their surrounding built environment, which is often entirely built out and offers little or no empty space to facilitate new development, or even sufficient room to stage major renovations. Where new development does occur, buildings are then limited by the street grid. In Manhattan, a block is typically 264' between streets and 900' between avenues. Actual developable area is smaller once sidewalks and access points are considered and, of course, most are already substantially developed. Though the street grid is more varied and less dense outside of Manhattan, block sizes remain constrained by various factors.

In commercial overlay districts, where retail is limited to the first and sometimes second floor of a building and is only permitted to a depth of 100' or 150', stores are typically unable to exceed 20,000 square feet. This size assumes that a store occupies the entire overlay of a standard city block. For some retail uses, this results in a built form that deviates widely from a national model. For example, while the median size of a supermarket in the United States is 40,000 square feet, the median in New York City is only 11,000 square feet.

Blocks with multiple small establishments make for a vibrant and varied streetscape, but exacerbate the challenges of resiliency by requiring collaboration of up to a dozen or more stakeholders along a single block, particularly when individual stores share walls with one another.

SUPPLY CHAIN

New York City's businesses rely on an intricate supply system interconnected through an array of transportation, energy and communications networks. Retailers are heavily reliant on their suppliers and distributors, who themselves are reliant on the broader regional infrastructure to ensure that consumers have access to the goods and services that they need. Many of the key distribution points for oil, gas, energy, food, and freight sit along the waterfront where they can easily connect to cables, pipelines and port terminals. Disturbances at a single terminal can mean the loss of gas supply for thousands of vehicles and businesses. The explosion at a Consolidated Edison power station along the East River during Sandy left much of Manhattan without power for days.



Different points along these chains are responsible for ensuring that their partners are prepared for flood events and have made resiliency mitigations and contingency plans in the case of a storm. Though still very much a regional network, New York City differs from many smaller localities in that many of the critical nodes are located within city limits and impacted by the same floodplain events.

i
Comparison of Average Supermarket Size



CHAPTER 2 FLOODPLAIN PROFILE

Hurricane Sandy emphasized the inherent flood risks to building in the floodplain. With sea level rise and the expansion of the 1% annual chance floodplain, more businesses now find themselves both likelier to experience flooding and newly subject to federal flood regulations. This chapter highlights the geographic and economic impacts of the floodplain on New York's retail corridors.



Beach 116th Street, one of the most vibrant retail corridors in the Rockaways and a regional destination during NYC's summer months, faces flood elevations that put many of its local businesses at risk.



FIRMs or Flood Insurance Rate Maps are: the official flood maps on which FEMA has delineated the 1% annual chance floodplain, 0.2% annual chance floodplain, Base Flood Elevations (BFEs) and floodways.



Floodplain Profile

Nearly 400,000 people live in New York City’s 1% annual chance floodplain, according to FEMA’s 2015 preliminary FIRMs. This represents about 5% of the city’s total population, spread across 48 square miles and with a population density of 8,300 people per square mile. The population density of New York City’s floodplain is significantly higher than any other flood-prone community in the country; New Orleans, by contrast, has a flood zone population density of only 1,300 people per square mile. Closest to New York is Miami, with 8,000 people per square mile.

The implications of population and building density in the floodplain are of major concern. While FEMA guidelines advise elevating buildings and other measures to mitigate flood damage, these solutions are especially difficult in the context of dense neighborhoods. Accordingly, New York City and other urban communities, many tackling these issues for the first time in recent history, are struggling to rebuild and retrofit vulnerable buildings to accommodate residents and businesses in the flood zones under regulations designed for other environments.

Retail at Risk

COMMERCIAL

Across New York City, there is over 1.8 billion square feet of commercial space, 214 million of which is within the 1% annual chance floodplain. Retail uses represent a subset of total commercial square footage; citywide, there is over 260 million square feet of retail, 22 million of which is within the 1% annual chance floodplain. Roughly 14,500 private businesses operate in the floodplain across New York City, employing approximately 270,000 people according to data from the New York State Department of Labor’s Quarterly Census of Employment and Wages.

Size of Businesses in 1% Annual Chance Floodplain (# of Employees)



The vast majority of businesses in the city’s floodplain are small in size. But despite the small-scale business presence, in the aggregate, they represent a substantial economic force: in total, commercial businesses in the floodplain pay close to \$20 billion in aggregate annual wages.

RETAIL

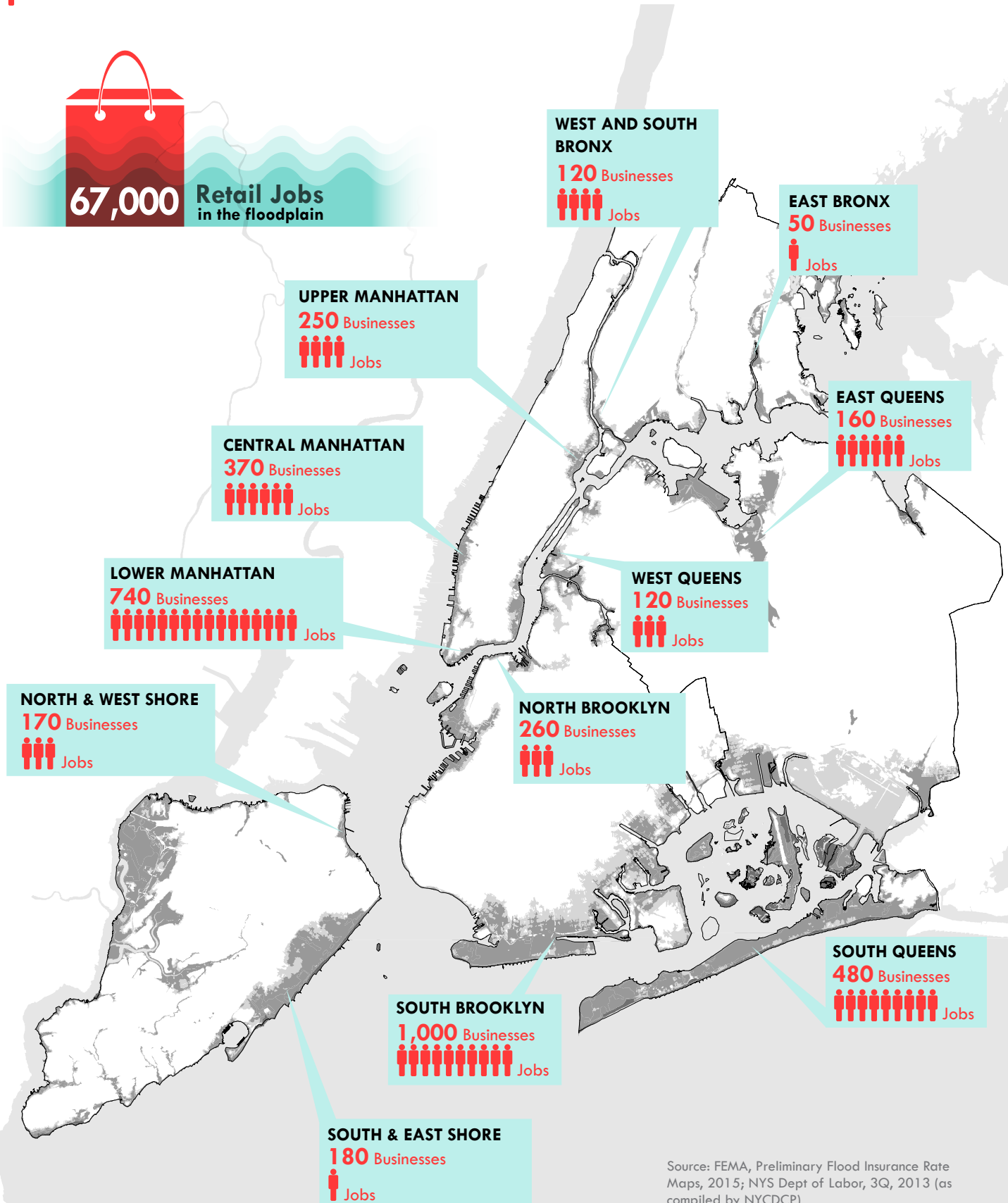
As noted above, retail uses represent a subset of total commercial square footage. For the purposes of this study, retail uses are defined to include retailers of products and services, accommodation, food service, drinking establishments, home and personal care stores, gasoline stations, and certain other miscellaneous retailers, as well as certain personal banking, lending and related activities. Specific businesses include grocery stores, pharmacies, electronics stores, book stores and other types of general retail, as well as food establishments including full- and limited-service restaurants.

There are 47,000 private retail establishments across all of New York City. Nearly half of the city’s total retail square footage is on lots with at least 50,000 square feet of retail space, indicating large-scale destination retail, while the other half is distributed across small lots in the form of individual and often independently operated establishments. Yet, only approximately 500 (fewer than 2 percent) of all retail establishments in New York City have more than 100 employees at any individual location, and the average number of employees per retail establishment is 11.

Approximately 3,900 of the city’s retail businesses, or 8 percent of the total citywide, are located within the 1% annual chance floodplain. These retail businesses employ over 67,000 people and pay nearly \$3 billion in annual wages (see map on page 22). These businesses provide a variety of job opportunities across all income levels, representing businesses small and large, and reinforce the citywide job and neighborhood housing markets.

Retail Businesses within the 1% Annual Chance Floodplain

 = 1,000 Jobs

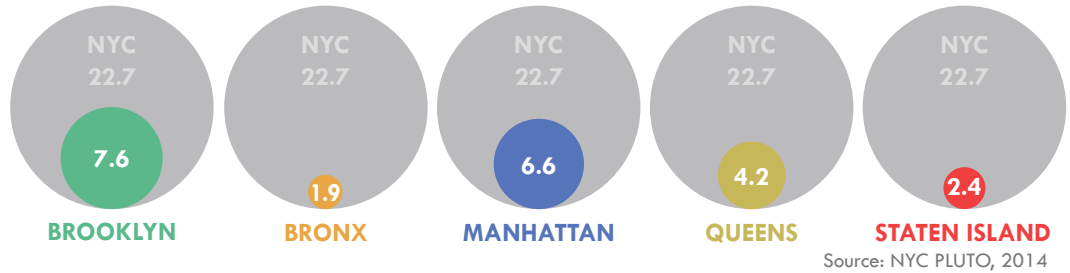


Source: FEMA, Preliminary Flood Insurance Rate Maps, 2015; NYS Dept of Labor, 3Q, 2013 (as compiled by NYCDCP)

Distribution of Retail in the floodplain

With over 22 million square feet of retail square footage located in the floodplain, nearly nine percent of New York City's retail space is at risk from 100-year storm events. Broken down by borough, Brooklyn has the most retail floor area in the floodplain by total square footage with 7.6 million square feet, followed by Manhattan with 6.6 million square feet and Queens with 4.2 million square feet. Staten Island, however, has the largest percentage of its total retail floor area within the floodplain with over 16 percent of the borough's retail area at a higher risk from flooding.

Retail Square Footage in the Floodplain (millions)



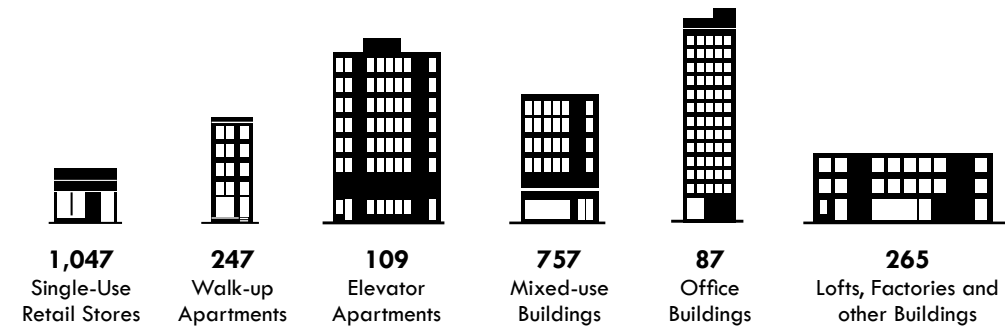
The graphic above compares the distribution of retail square footage in the floodplain across the five boroughs in relation to the New York City's 22.7 million square feet of retail space within the floodplain.

Fraction of Borough's Total Retail Square Footage within the Floodplain



The percentage of each borough's total retail square footage found within the floodplain varies in relation to the overall borough-wide retail square footage. Brooklyn and Staten Island both lie above New York City's average of 8.7%.

What Kind of Buildings do Retail Businesses Occupy?



Source: NYC PLUTO, 2014

Retail businesses are distributed across a wide range of buildings in the city's floodplain. From standalone single-purpose shops, to row house walks-ups, office buildings and mixed-use residential towers, the diversity of building stock also highlights the challenges to providing sufficient opportunities for all businesses to floodproof and mitigate risk. More tools to implement retrofit strategies will be required to ensure all retailers are able to implement strategies that fit the building type and community needs.

Importance of Active Retail during Disasters

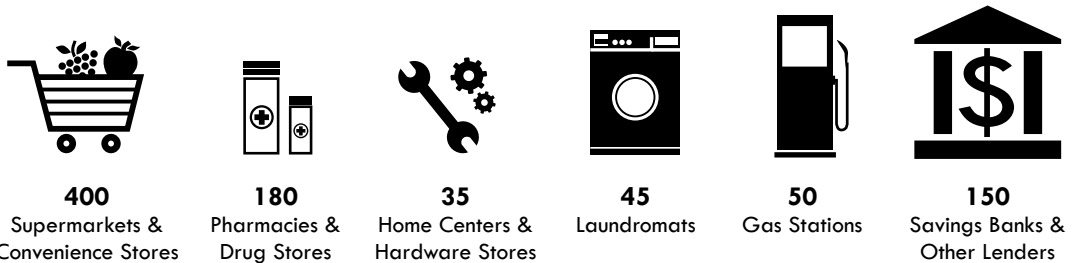
Ensuring the viability of local retail corridors in the flood zone is necessary to protecting property owners, business owners, employees and local residents, all of whom have distinct roles in the community and who rely on active commercial uses in different, but related, ways.

CRITICAL USES

Access to frequently-used goods and services is critical for healthy neighborhoods, and lower rates of car ownership mean more New York City residents reach these establishments on foot or by public transportation. When critical uses in the floodplain are flooded, residents with no means of transportation are most vulnerable.

Of particular concern are the 276 groceries and supermarkets, 45 convenience stores, 80 fresh produce and meat purveyors, 180 pharmacies, and 80 hardware and building materials centers that are located within the city's floodplain and form the backbone of many neighborhood retail corridors. Without ensuring that the buildings supporting these critical retail uses are able to effectively and affordably mitigate flood risk, neighborhoods will find themselves deprived of many important goods and services in the wake of the next storm. Moreover, the risk of higher operational costs associated with development in the flood zone puts neighborhoods at risk of under-supply of such critical uses year round if these establishments choose to relocate to another part of the city to avoid the greater financial costs and risk associated with the floodplain.

Which Critical Retail Businesses are Located in the Floodplain?



What Other Kinds of Businesses Enhance Retail Corridors in the Floodplain?



Source: NYS Dept of Labor, 3Q, 2013
(as compiled by NYCDPC)

Hurricane Sandy's Impact on Retail

Hurricane Sandy devastated businesses across all five boroughs. While damage was borne widely across coastal communities, businesses suffered an exceptional cost as thousands of business owners found their businesses flooded, with critical power and mechanical systems failed, and severed from their customer base. Many business owners also had to bear the double brunt of facing a steep path to recovery while balancing business damages with those suffered at their nearby homes as well.

CITY RESPONSE

Hurricane Sandy drew a rapid response from fire, medical, police and other emergency service crews who were dispatched across storm-impacted areas throughout the city. Immediately following Sandy, the City set up warming shelters and food and water stations, while teams of workers and volunteers distributed donated clothes and supplies in the hardest hit neighborhoods.

In addition to the emergency response, a variety of financial assistance programs were established to aid businesses in the recovery process. City agencies distributed \$28 million in up to \$25,000 low-interest loans and up to \$10,000 matching grants to close to 650 businesses, and over \$1 million in micro-grants to more than 200 businesses. These emergency funds from private and public sources assisted businesses with working capital, damage repairs, and equipment and inventory replacement, among other things. The City also provided more than \$2.8 million in sales tax exemptions through the New York City Industrial Development Agency (IDA) for purchases of rebuilding materials, equipment and personal property needed to rebuild after the storm. Additionally, the City launched programs addressing storefront improvements, general business recovery services and agency fee relief for impacted businesses.

In August, 2013, the Department of Small Business Services (SBS) launched the Hurricane Sandy Business Loan and Grant Program to assist small businesses with remaining unmet recovery need. The program has awarded approximately \$54 million to 349 business across New York City along three distinct award categories: working capital, inventory and movable equipment. The most significant concentrations of grant and loan recipients were in Rockaway Beach, Sheepshead Bay, Coney Island, Lower Manhattan, Red Hook and the East Shore of Staten Island. In November 2015, SBS introduced the Business Preparedness and Resiliency Program (Business PREP) to help small businesses better prepare for emergencies. Assistance includes business continuity workshops, on-site risk assessments with micro-grants to implement specific recommendations, and online resiliency resources.

NFIP CLAIMS

Non-residential NFIP policy holders, of which the vast majority are commercial properties, were heavily impacted by Sandy. In total, nearly \$215 million of building damages and \$60 million of contents losses were reported by NFIP non-residential policy holders. Citywide, only 70 percent of non-residential building damage claims submitted to NFIP were compensated, and only approximately 57 percent of their contents losses. These figures are significantly lower than both multifamily building claims (86 percent of building damages and 81 percent of lost contents) and single to four unit residential buildings where over 99 percent and 85 percent, respectively, were compensated citywide. This suggests the insufficiency of conventional federal flood insurance in meeting the needs of many businesses.

According to Sandy-related NFIP claims data, non-residential claims filed following Sandy amounted to only 5 percent of the total number of claims filed, and yet, by measure of total cost of damage, represented nearly 40 percent of all contents losses and over 18 percent of all buildings damages (for a total of 20 percent of all losses, combined). These figures are magnified considering how under-insured so many commercial properties are within the floodplain.

Current program guidelines for NFIP policies held by non-residential buildings, including all commercial buildings, limit compensation to \$500,000 each for structural damages to the building and for loss or damage to contents. Restrictions on the types of contents that can be covered also



40% of the City's total content losses were from non-residential buildings, including retailers.



Source: FEMA, Sandy NFIP Damage Claims, 2015

limit the ability of many businesses to be compensated for all their losses, while the incremental cost of added insurance premiums make purchasing the maximum amount of coverage prohibitive. Underpinning the challenges to affordable flood insurance, business tenants who rent space are restricted to purchasing contents coverage alone. Many retail commercial businesses in New York are reliant on access to sub-grade cellars for storing inventory. Yet flood insurance will not cover the loss of contents located in basements. Often with limited “back end” space for storing inventory, businesses are left with little recourse. Following Sandy, many retail businesses have still been unable to repair their cellars and are operating with significantly less usable floor space.



Many retail businesses across the City have valuable contents that are stored below the Base Flood Elevation. Some businesses may have reported claims, but research suggests many retail businesses in the floodplain did not have a flood insurance policy.

Challenges Related to Recovery

Businesses and property owners faced a number of obstacles when it came to recovering following Sandy. Because tenant-owner responsibilities in responding to storm recovery are not always clarified in the terms of a lease, businesses struggled to clarify responsibilities during the cleanup and repair stages. Many businesses desperate to restart cash flow to cover expenses bore the immediate material and labor costs of recovery and clean-up without any guarantee of compensation, often paying for such expenses out of pocket. Support from building owners was not always timely or altogether forthcoming. This time lag can be critical to businesses facing interruption in service.

In many neighborhoods where local commercial corridors were impacted, business owners lived within the community and owned homes alongside their customers. After Sandy they were forced to choose between reopening their businesses quickly to generate income for paying rent and wages, and making critical repairs to their personal homes. Many individuals and companies chose to forestall much-needed home repairs in order to get their business up and running more quickly.

While business owners may not be responsible for insuring the structure they operate out of, they still struggle to access insurance coverage for their inventory and contents. NFIP policies are often too expensive and cumbersome to be practical for the average small retailer. Many businesses end up forgoing flood insurance entirely citing high costs and limited coverage. A RAND study conducted in 2013 surveying businesses impacted by Sandy found that only 20 percent of all commercial buildings, and fewer than 5 percent of small businesses, carried flood insurance policies¹.

Similarly, many property owners holding NFIP or private insurance policies found that the insurance coverage was insufficient since costs related to business disruption from power outages, loss of business, road closures, and many clean-up and repair related costs were not covered at all. While a fair number of larger commercial office buildings, many of whom have retail tenants as



Due its low-lying location, a large swath of southern Brooklyn falls with the floodplain. Many businesses are owned and operated by local residents who also live within the floodplain, and saw their homes impacted by Hurricane Sandy.

well, have the financial resources to purchase comprehensive insurance packages that include flood insurance, most commercial structures located within the city's neighborhood retail corridors and within lower density commercial districts lack the necessary finances to pay for needed coverage. Additionally, the lack of business interruption coverage disincentivizes flood insurance purchase and places added pressure on businesses in the immediate aftermath of a flood.

Grants and direct aid was limited, and many federal and private loans were often out of reach for businesses already strained by limited access to credit even before the storm hit. Requirements for qualifying available loans were often too expensive for business property owners to afford, or too onerous for businesses that may have had incomplete tax records, or documents destroyed by flooding. Those that did qualify many times found the ensuing debt more of a liability to recovery than a boon.

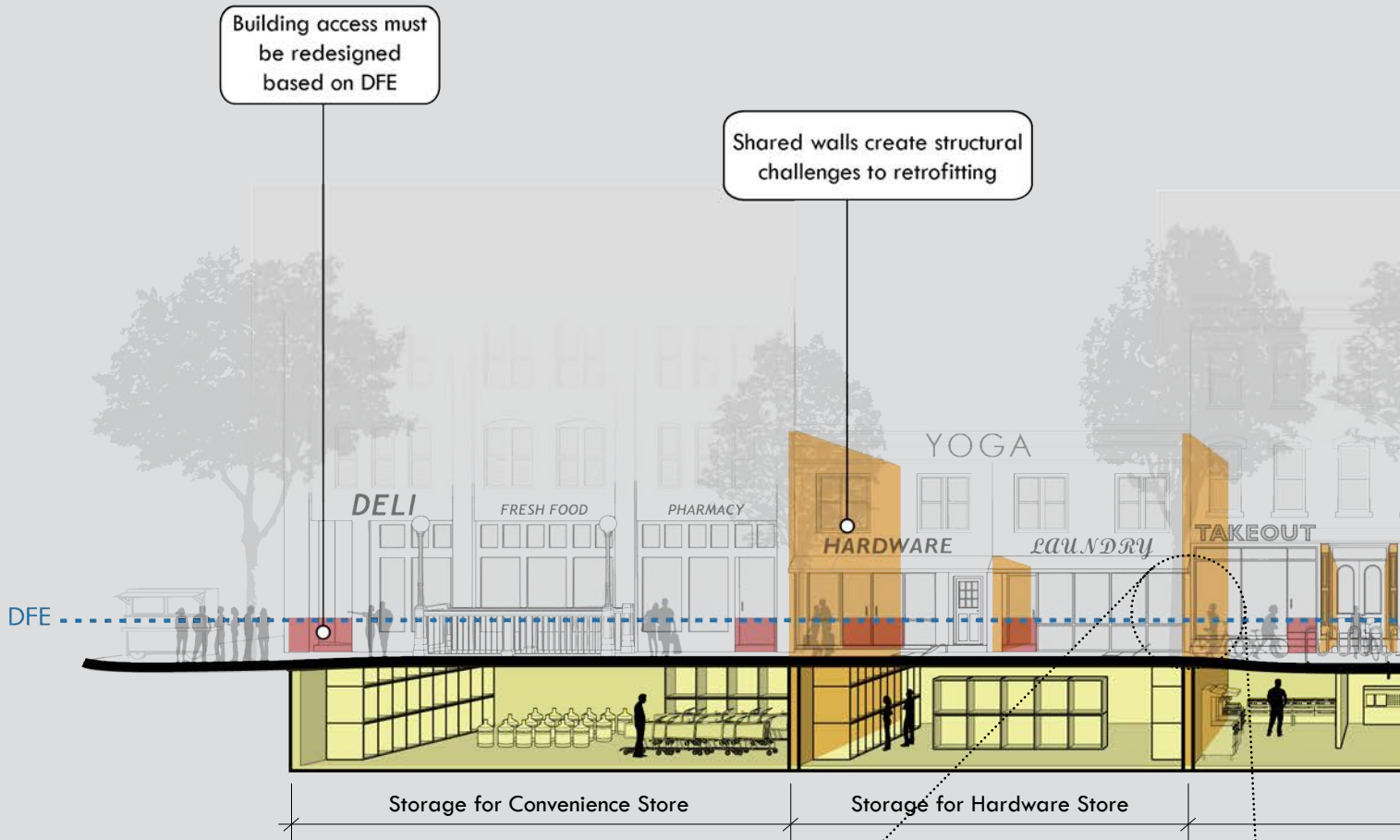
¹ RAND Center for Catastrophic Risk Management and Compensation, "Flood Insurance in New York City Following Hurricane Sandy," Prepared for the New York City Mayor's Office of Long-Term Planning and Sustainability, 2013

CHAPTER 3 CHALLENGES TO RETROFITTING BUILDINGS

The physical complexity of commercial and mixed-use buildings, many of which include sub-grade cellars, and the importance of connecting and organizing retail space that sits alongside other uses and is accessible to customers, creates numerous obstacles to flood mitigation. This chapter outlines the challenges of retrofitting buildings in an urban setting.



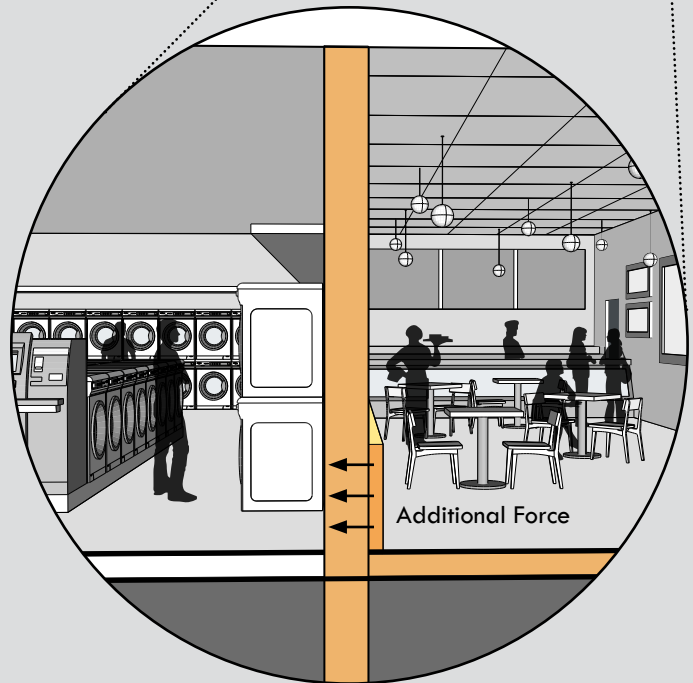
Mixed-use buildings along Mermaid Avenue in Coney Island, Brooklyn.



Flood Resiliency Challenges

The image above depicts flood resiliency challenges typically encountered by floodplain retail corridors. Constraints related to flood regulations are noted along the extent of the urban retail block and within the occupied commercial spaces beneath grade.

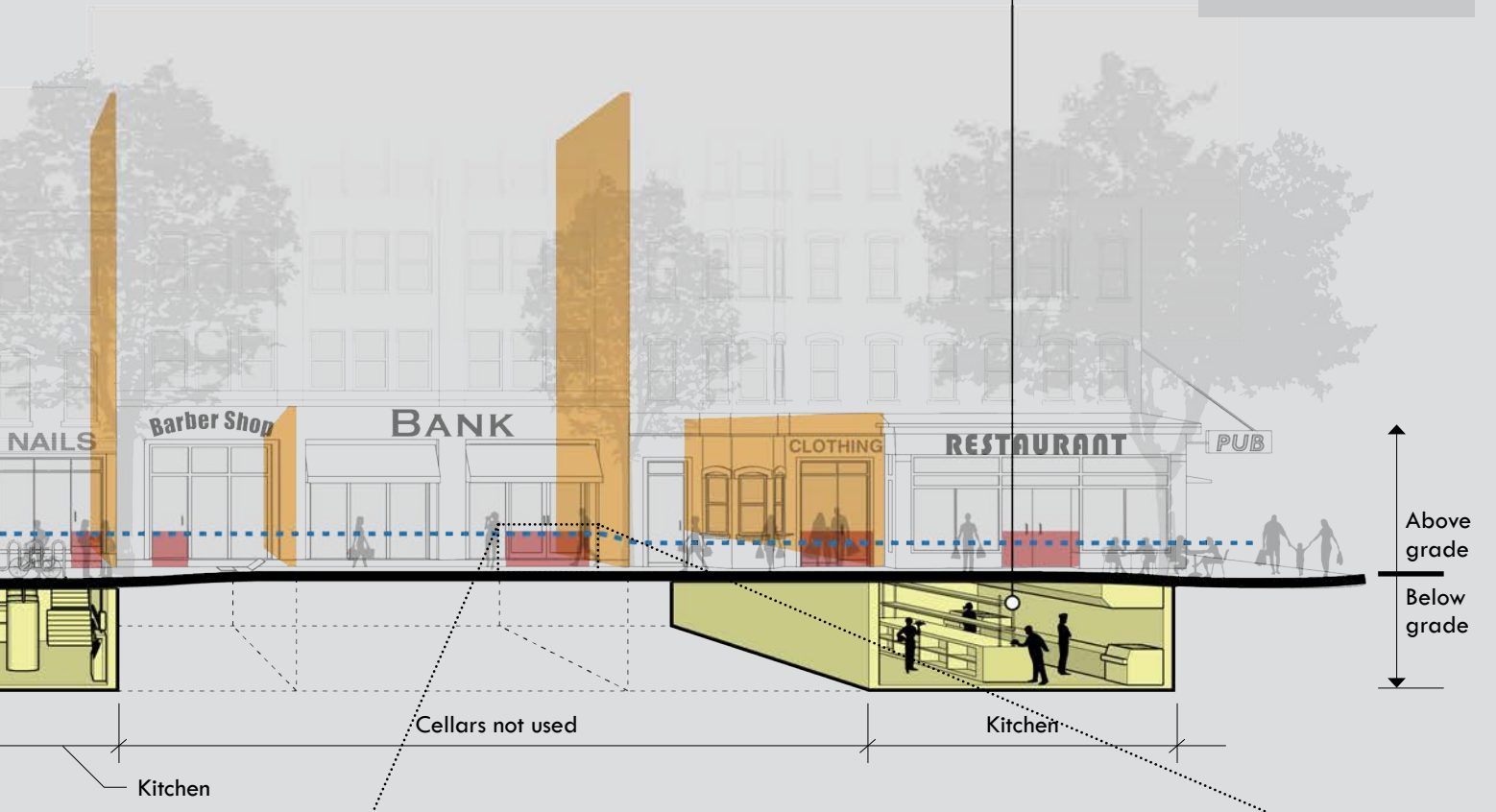
Each business is somehow impacted by the need for elevated access into the building, shared party walls or risk to cellar space. If any of these businesses were Substantially Damaged or were to trigger Substantial Improvement (see "Appendix") when retrofitting, they would be subject to stringent floodplain regulations that would limit options for flood mitigation and jeopardize the functionality of their businesses. While this diagram specifically highlights structural and design-related barriers, it is important to note that most businesses also face other challenges such as spatial constraints, difficulties financing building improvements, lease complications and lack of access to affordable flood insurance.



When dry floodproofing interior walls the added structural reinforcement puts pressure on existing shared party walls.

Subgrade uses must be dry floodproofed or abandoned to comply with FEMA regs

Existing Conditions
10 Retail Businesses
5 Residential Entries



ADA accessible ramps or lifts would be required

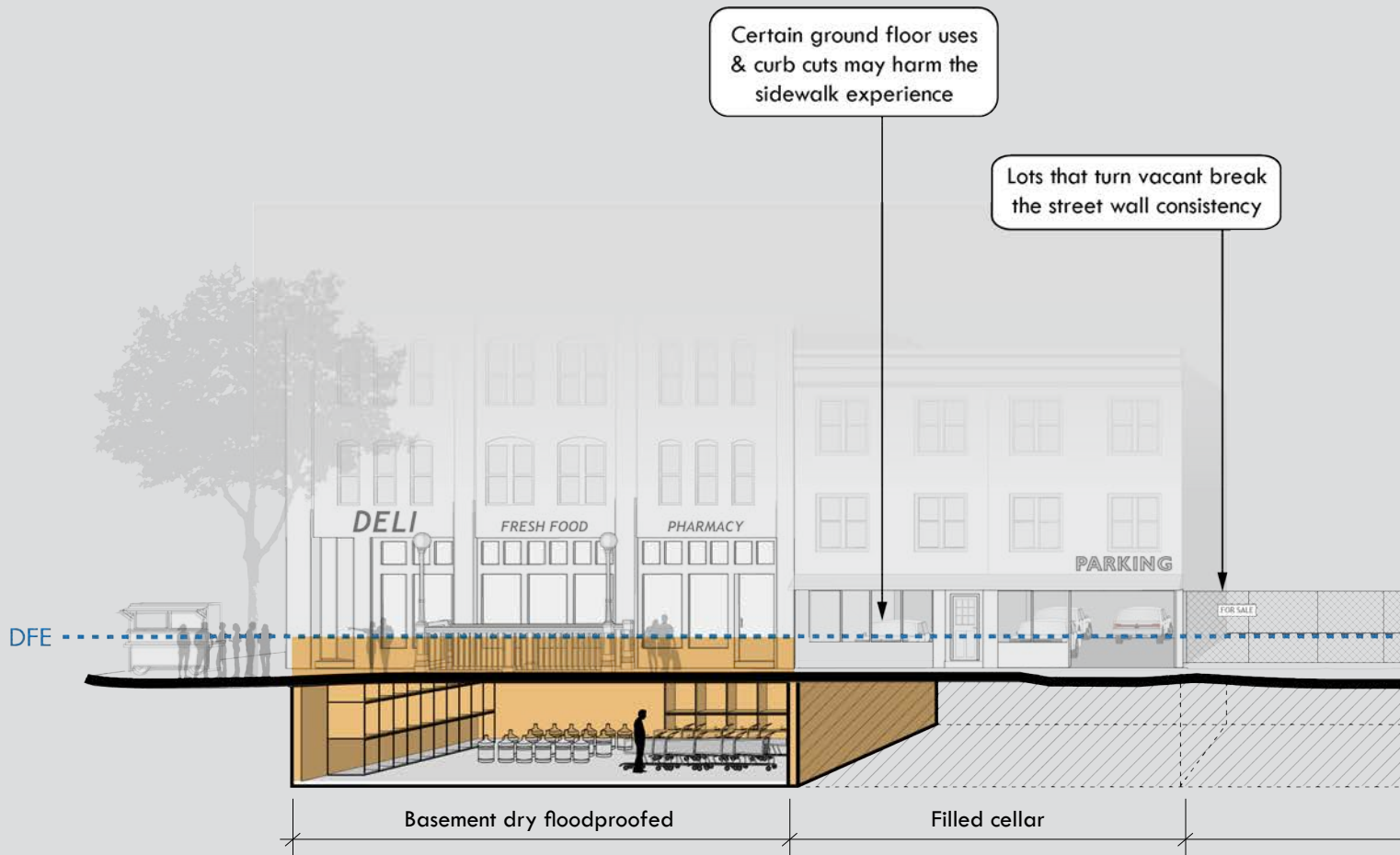
Minimal projections are permitted for entryways extending past property line: stairs (max 18") ramps (max 44")



Min. 8' of clearance required

Must reach height of DFE

Retail businesses in the floodplain must provide access to their space when raising their first floor to the DFE. Many of NYC's retail businesses have built to their property line, making it a significant challenge to provide required access.



Potential Implications

The magnitude of flood resiliency challenges along a typical corridor can result in significant impacts to the long-term physical fabric of neighborhoods in the floodplain. The image above illustrates some of the unintended side effects current floodplain regulations may have on neighborhood corridors. The most apparent physical impacts are steep drop-offs in the amount of ground floor activity, breaks in the street wall and a dramatic decrease in the variety of retailers. Each of these works against the core principles of what creates vibrant and diverse retail corridors throughout urban neighborhoods.

While dry floodproofing is an option for businesses intent on maintaining a presence at the ground floor, it may not be a viable solution for most small business owners for a number of reasons that are highlighted in this section and throughout the report. The only other

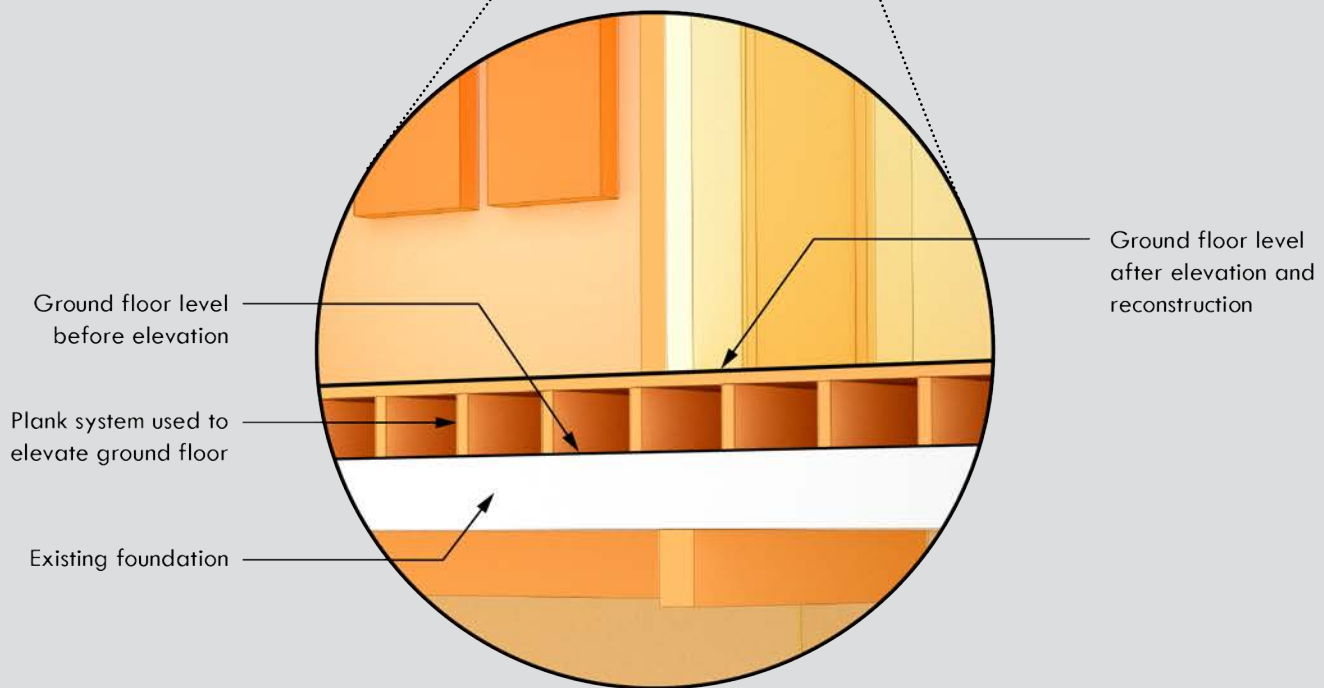
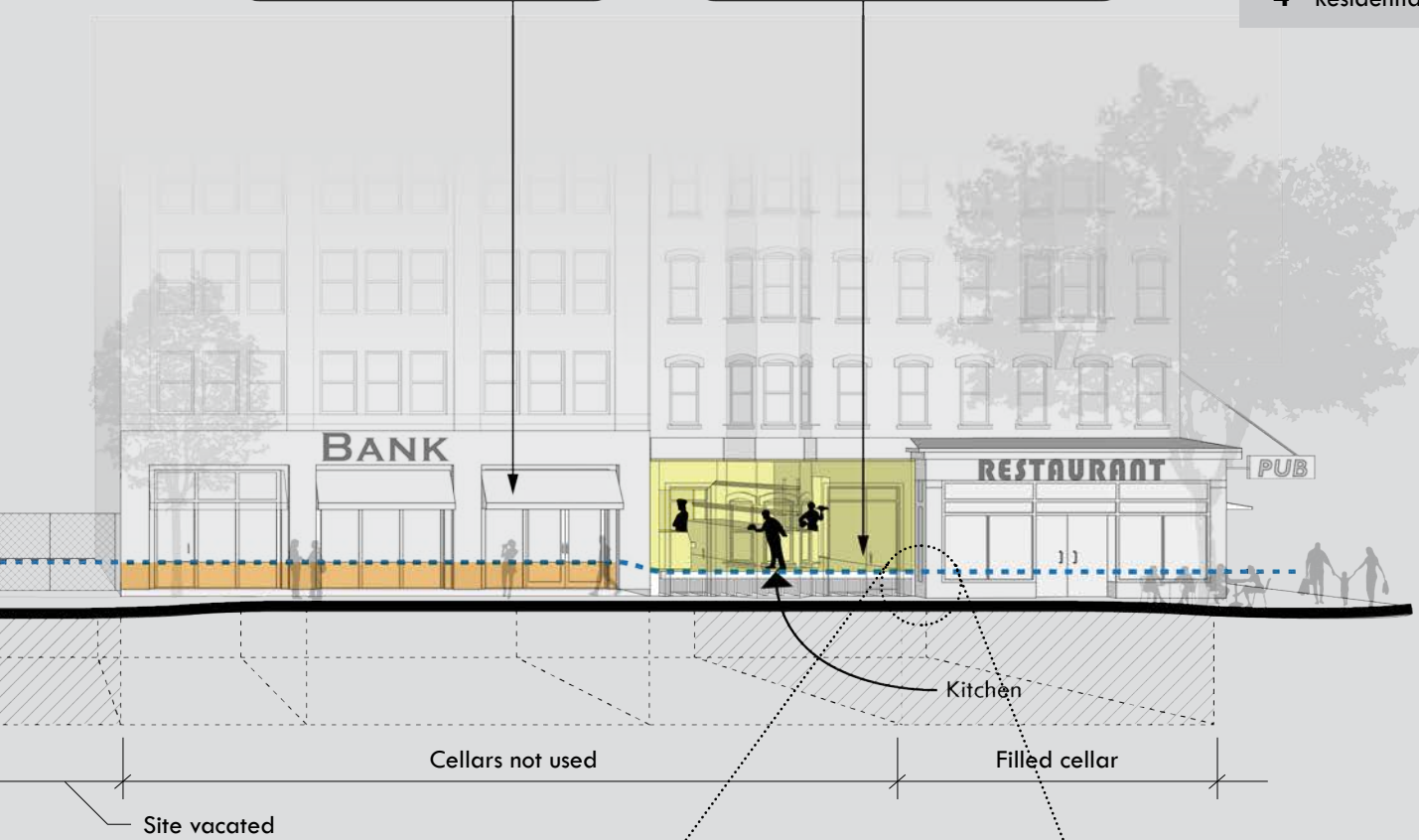
option remaining for commercial businesses that are Substantially Improved is to elevate above the Design Flood Elevation (dashed blue line above). These factors leave commercial corridors vulnerable to vacancy, loss of active ground floor use (only parking, access and storage are allowed by FEMA below the BFE), and tend to favor wealthier properties that are able to afford the added flood mitigation expenses.

The retail block pictured above has lost a number of retail services that may be essential to surrounding residents: a laundromat, hardware store, barber shop, etc. Moreover, the loss of retail storefronts through conversions to inactive uses such as parking, business relocations to properties outside the floodplain, or the closures of small businesses unable to finance flood recovery further erodes corridor character and accessibility.

Variety is lost when smaller shops can't afford the higher costs of doing businesses in the floodplain

When planks are installed the lower floor to ceiling heights result in less desirable, less marketable retail spaces

- Effect on Activity
- 3 Retail Businesses
 - 4 Residential Entries



Some businesses may have sufficient clearance to raise the floor within their existing space. However, they must still provide required access for customers.

Structural Challenges to Retrofitting

There are many structural challenges to retrofitting commercial buildings. With real estate at a premium in many cities, businesses tend to maximize available space and have little room for the relocation of mechanical and electrical systems.



For FEMA's publications refer to: <http://www.fema.gov/building-science>

- < FEMA's Building Science division provides technical design guidance for all categories of floodproofing construction standards through various publications, such as the Engineering Principles and Practices of Retrofitting Floodprone Residential Structures, Floodproofing Non-Residential Buildings, Coastal Construction Manual, and other resources.



"Retrofitting Buildings for Flood Risk" may be downloaded at: <http://www1.nyc.gov/site/planning/plans/retrofitting-buildings/retrofitting-buildings.page>

- < For a fuller review of how FEMA's federal standards affect building codes within the City, refer to the Appendix or the Department of City Planning's *Retrofitting Buildings for Flood Risk* manual.

ELEVATION OF STRUCTURE

While raising the lowest occupied floor of a building above flood elevations is a common best practice for residential buildings, it is not a practical solution for most commercial retail structures in cities (due to the range of practical, economic, and design challenges outlined within this report). Nonetheless, elevation can be accomplished by lifting the existing structure or by relocating the lowest floor to above the Design Flood Elevation (DFE) if the floor to ceiling clearance is sufficient.



DFE, or Design Flood Elevation, means:

the height to which a building in the 1% annual chance floodplain must be elevated or floodproofed in New York City. It is the Base Flood Elevation plus additional freeboard height required by the City's building code.

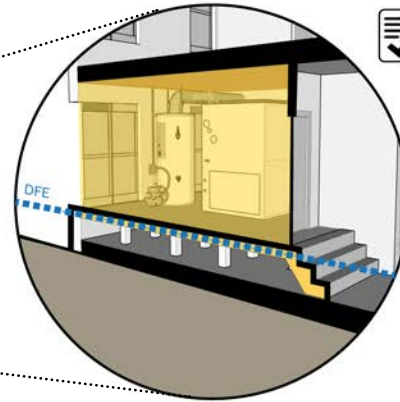
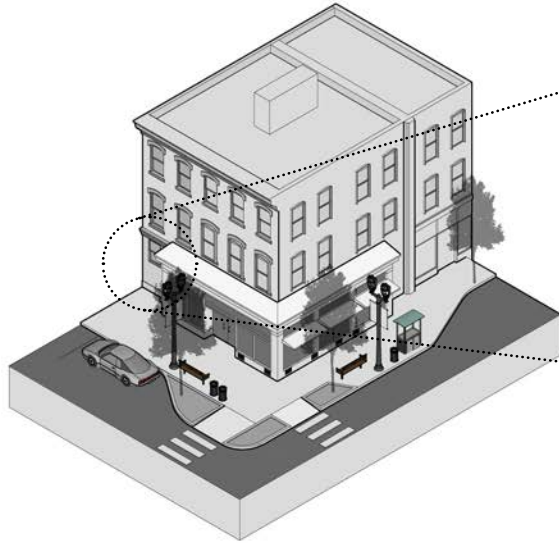
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When elevating a building, areas below the DFE can be used only for vehicular parking, building access, crawl space and storage, regardless of the uses elsewhere within the structure. Equipment, utility connections and all interior utility systems including ductwork must also be relocated above the DFE. In New York City, elevation is likely a limited strategy because of the existing structural adjacencies and engineering challenges related to the building typology. Because the uses under the lowest occupied floor are very limited, elevation also challenges New York's traditional relationship between buildings and the street, resulting in restricted access and urban design issues.

Unlike other uses such as residences where the functionality and viability of the space does not depend so heavily on convenience and ground-floor presence, raising retail spaces off the sidewalk and out of direct pedestrian view can be devastating to a business. This is demonstrated directly by the substantially lower rents charged for second-story retail spaces than for those on the first floor, and more indirectly by the general absence of second-story retail uses in all but the strongest commercial markets.

Where businesses occupy the ground floors of multi-story, attached buildings on small lots, elevation of existing buildings is all but impossible for an individual property owner to coordinate. Complications like having to structurally reinforce shared party walls when floodproofing are extraordinarily costly. Existing businesses and residents have to be relocated during the operation, eroding the delicate fabric of a community that may still be struggling to recover after Sandy, or who may not have the means or desire to return afterwards. Even if possible, the elevation of ground-floor retail spaces to several feet or even a whole story off the sidewalk would undermine the accessibility and viability of a commercial corridor. Lack of visibility, street presence, and obstacles to climbing stairs or navigating ADA accessible entries, hurts businesses in meaningful ways. In a competitive retail market with the aggregate customer base of most New York City neighborhoods, even marginal costs or inconvenience can tip favor from one business or corridor to another and contribute to successes and failures. Corridors incrementally retrofitting for elevation above a few feet may not be able to support retailers that depend on foot traffic and convenience shoppers.

Non-Structural Elevation of a Commercial Space



Wet Floodproofing Certification Required [G104.5.1]

- Required for buildings subject to Appendix G.
- Utilities must be located at or above the DFE
- The lowest occupiable floor must be above the DFE
- Enclosures below the DFE shall be used for parking, access or storage
- Materials below DFE must be flood damage-resistant [ASCE 24, 6.2]

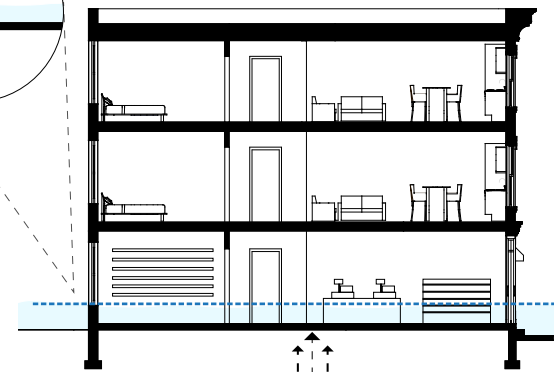
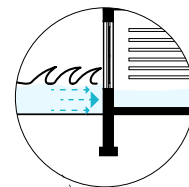
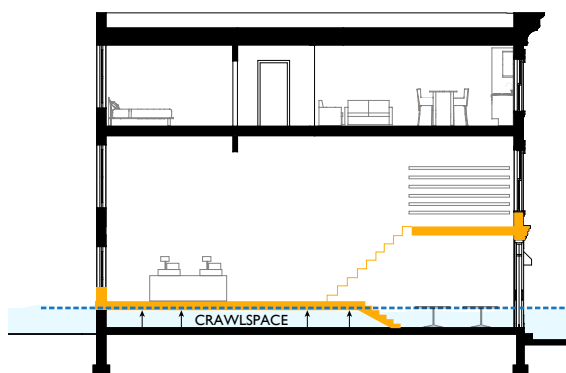
NON-STRUCTURAL ELEVATION

An alternative to the structural elevation of a building, called non-structural elevation, involves the relocation of active uses to above the DFE rather than physically lifting the superstructure to an appropriate elevation. Non-structural elevation in commercial buildings may be achieved by filling the below grade space and abandoning the remaining occupiable floor(s) below the DFE. If this strategy is taken, all enclosed spaces below the DFE must be wet floodproofed and remain only as space for vehicular parking, building access, crawl space and storage.

Structural challenges to elevating a building in place begin with ensuring that the superstructure and the foundation are able to adequately withstand flood related forces, including the pressures of wave action and flowing flood water (hydrodynamic),

as well as the pressures exerted by pooled or standing water (hydrostatic) that are expected during flood events. By wet floodproofing the area below the DFE, flood waters are able to flow in and out of the building, which helps to equally distribute pressures.

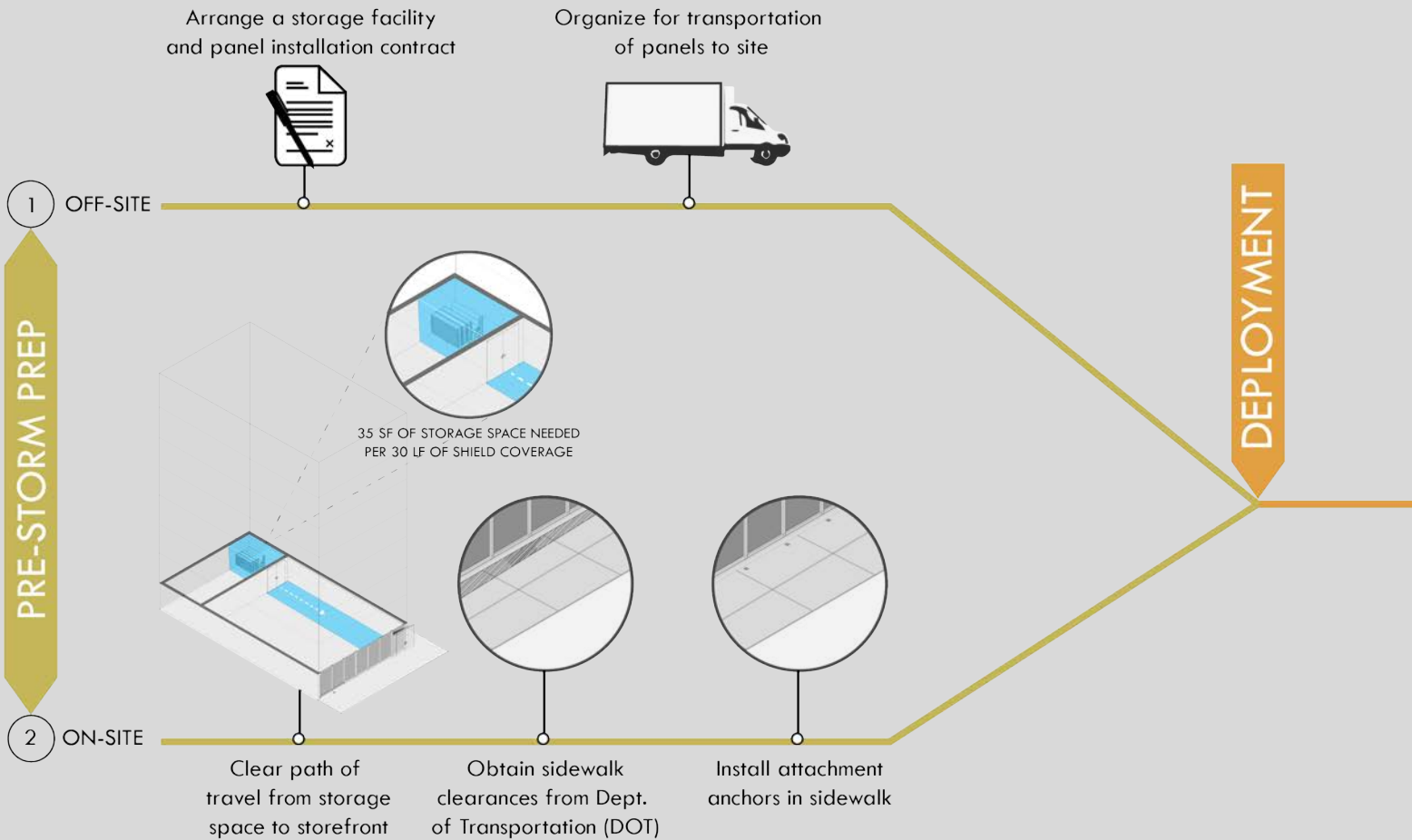
Filling a sub-grade basement or cellar would also be required to achieve the same effect as structural elevation from an insurance standpoint. This strategy may need to be combined with the elevation of utilities and mechanical systems. The filling of cellar space results in a significant loss of floor area for many retail businesses and can have a major impact if the space was occupied or generated rental income. When filling a sub-grade space that has one or more party-walls, the impact on its adjacent properties must be considered.



Businesses that have flexibility to do a non-structural elevation will need to provide access to their elevated space. While an elevated sub-platform installed at the DFE can maintain some ground floor activation, all space beneath would need to be vacated if the building must meet NYC Building Code floodplain requirements.

Hydrodynamic pressure on a building is caused by moving waters. In Coastal A & V Flood Zones, buildings are especially vulnerable to hydrodynamic forces. Hydrostatic pressure is caused when resting waters exert force on a building.

Deployable Dry Floodproofing | Illustrative Process



DRY FLOODPROOFING CHALLENGES

The other option for bringing buildings into NFIP compliance is to retrofit them to be dry floodproofed by reconstructing building walls and foundations that are flood-resistant. Floodproofing, including sealing any commercial uses below the Design Flood Elevation, enables businesses to remain at the sidewalk but is often prohibitively costly and physically infeasible to implement for the small retailers and property owners who define much of the city's floodprone corridors. The same characteristics of the built environment that complicate retrofitted elevation make dry floodproofing costly and logistically difficult; in addition to protecting the front and back of a building, shared interior walls have to be made watertight and reinforced against tremendous water pressure should the next-door neighbor flood. Basements too must be filled or protected against water entry. Business owners who may only lease their space need to arrange with property owners a way to deploy flood barriers in front of their doors with material and procedural costs negotiated between tenants and owners. In mixed-use buildings, residences would need to be provided unobstructed emergency egress over dry floodproofed walls out the building, or separate wet floodproofing of residential entryways would need to be developed.

When dry floodproofing a building, the superstructure and the foundation must be able to withstand the hydrodynamic and hydrostatic pressures expected during flood events. Other flood-related debris impact and drainage considerations must also be taken into account when designing dry floodproofing measures to ensure that the building's load-bearing and structural integrity is maintained throughout a flood event. Structures may need to be reinforced even before floodproofing work begins to properly withstand flooding and debris.

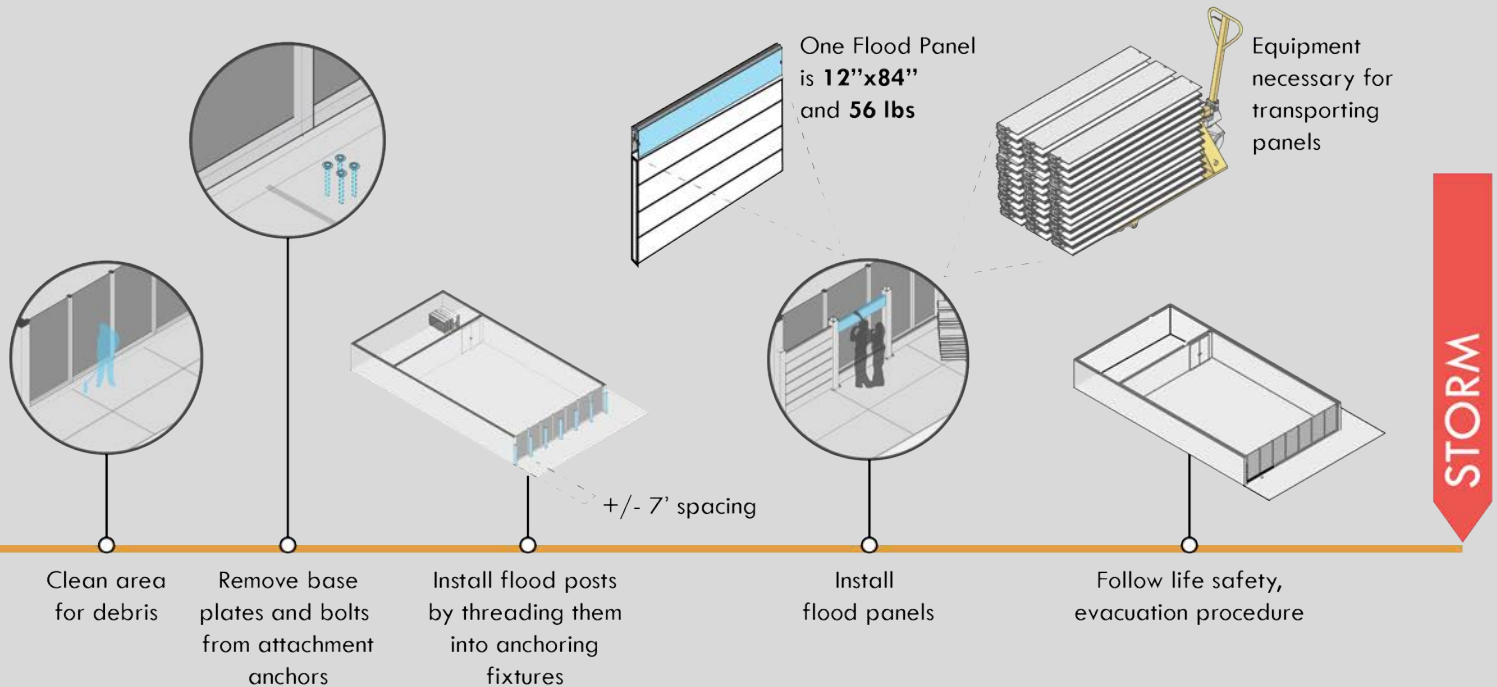


Diagram is for illustrative purposes only. Any deployable dry floodproofing treatment will have to be adapted to the respective building conditions following consultation with a licensed engineer or architect. Any retrofit strategy that must meet federal floodplain regulations would be required to be structurally connected to the building.

Dry floodproofing treatments must ensure that a building remains watertight below the DFE and substantially impermeable to the passage of flood water, defined by FEMA as not permitting the accumulation of more than 4 inches of water depth during a 24-hour period. Additionally, sump pumps are required to be installed to control water seepage. Building materials must also be flood resistant and all critical buildings systems, including electrical, plumbing, heating and ventilation/air conditioning systems must be designed or situated in such a way as to prevent water from entering during a flood event. Similar guidelines regulate the replacement of water supply and sanitary sewage systems. FEMA also stresses that dry floodproofing is not a recommended strategy when base flood heights exceed three feet or if flooding is expected to persist for more than twelve hours.

INSTALLATION OF FLOODPROOFING TECHNOLOGIES

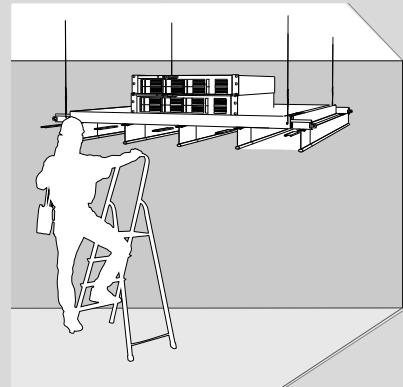
Floodproofing technologies always require active maintenance and operation. Some components must have a continuous source of electricity if required to operate during a flood event, including alternate power where primary power cannot be guaranteed. Dry floodproofing strategies that are not passive or self-deploying require warning time periods to activate, install or otherwise deploy. This can include time for evacuating residents, coordinating with building personnel, considering travel and transport times and logistics between the site and any off-site storage facilities, as well as time and resources required for the actual installation of flood panels or other barriers, staircases for required egress, or other measures. All critical buildings systems, including electrical, plumbing, heating and ventilation/air conditioning systems must be designed or situated in such a way as to prevent water from entering during flooding.

Short-term Adaptation Measures

Developing a retrofitting solution that works for each building and business takes time and money, as well as communication between tenants, landlords, and often also neighbors. However, business owners can take the small but significant steps to adapt their spaces to minimize exposure to flood risk. Below is a series of best practices prepared by the Department of City Planning, in conjunction with NYC Emergency Management, and based on guidance from FEMA. It represents a series of strategies that businesses can employ in the near term to protect contents and limit flood damage. However these actions do not as of yet result in insurance savings for business or commercial property owners.

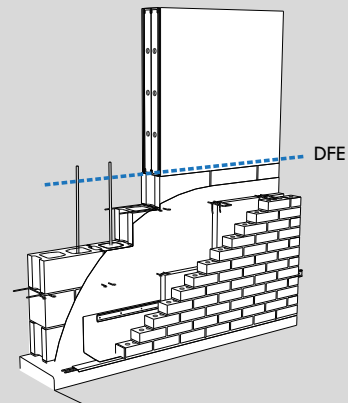
Protect contents

Servers, computers, back up systems, electronic devices and telecommunication lines can be stored above base flood heights. The example illustrated shows a platform suspended from the ceiling storing equipment. Such a platform may not be suitable for any devices required to be readily accessible as per electric code.



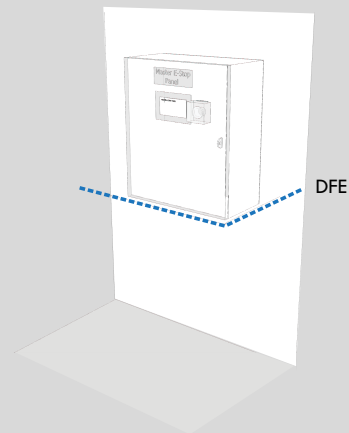
Use flood resistant materials

Wall assembly (including interior walls) designed with flood damage resistant materials can survive with little or no damage. After a flood, it can be cleaned out and dried quickly enough to avoid decay and reduce mold growth. Walls may be constructed of flood-damage resistant materials (with reinforcement if dry floodproofing), at least up to the DFE as a means to reduce costs.

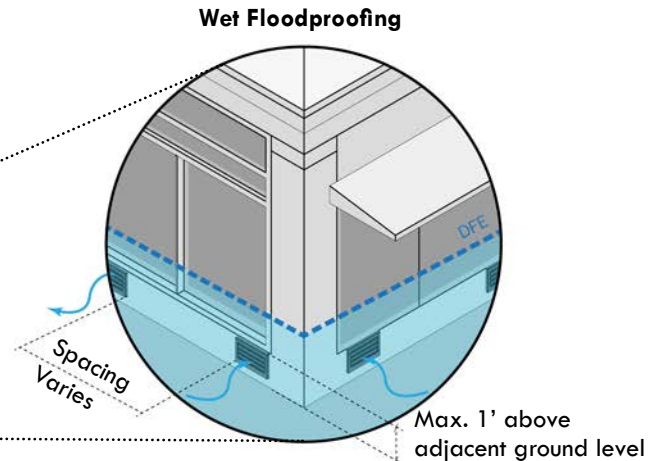
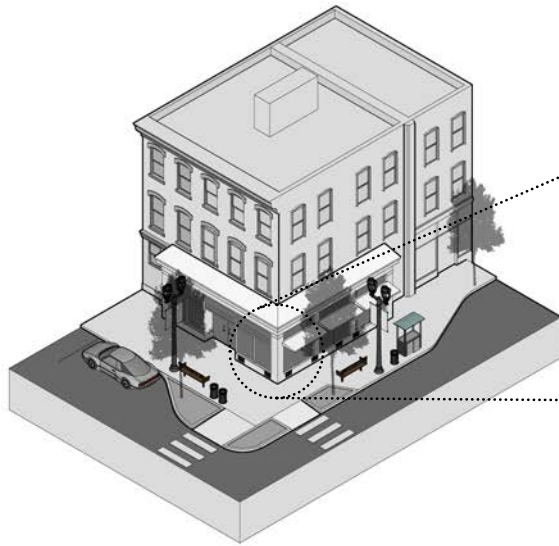


Elevate or protect critical systems in place

Elevate critical building systems and raise electrical panels and outlets at or above the Design Flood Elevation. When relocating is not a feasible option, critical building systems can be encapsulated in a dry floodproofed enclosure, which may need to be fire-rated. Because buoyancy of enclosures is a concern, significant engineering can be required to ensure the walls and floor are secure. Additionally there are requirements in the electric code for certain equipment to remain readily accessible.



Wet Floodproofing Commercial Spaces



- Not currently permitted as a flood mitigation for non-residential buildings with active ground floor uses subject to Appendix G.
- Requires a minimum of two openings per wall of enclosed area in order to more accurately balance level of flood waters

Partial Mitigation Strategies

In addition to the short-term adaptation measures highlighted on the previous page and below, there are several alternative or partial mitigation strategies that allow business and property owners additional flexibility in reducing structural and contents damages while remaining connected to the street, accessible to customers, and able to program floor space to suit business needs.

These strategies remain “partial” because they are not generally compliant with current floodplain construction requirements and may not be permitted by local building code in buildings subject to Appendix G. Nor would they likely result in decreased flood insurance premiums for insuring the building or enclosed business contents.

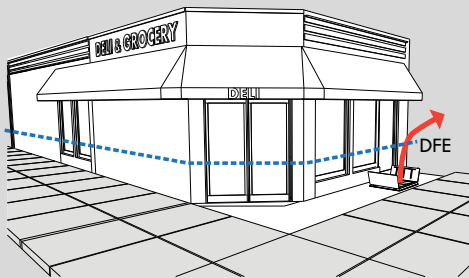
WET FLOODPROOFING RETAIL SPACE

Wet floodproofing the ground floor of a commercial space subject to Appendix G, particularly for masonry built buildings that are structurally sound, by installing flood vents and constructing interior spaces with flood-resistant materials, can mitigate damage from flooding with fewer costs or needed structural modifications.

While cellars and other below-grade spaces may still need to be filled, businesses can remain active on the ground floor by incorporating store designs that elevate or seal shut outlets, electrical equipment, and non-water resistant inventory above the BFE. Such wet floodproofed designs have already been developed informally throughout New York City, and are

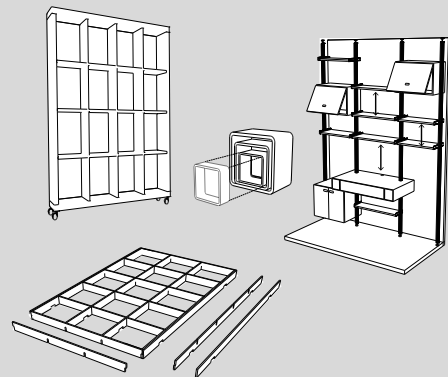
Review storage and logistics practices

Make a plan for protecting inventory in place or moving it out of harm's way in case of flooding. Consider time, value of merchandise, weight and operating costs. Stock up on supplies and packaging material.

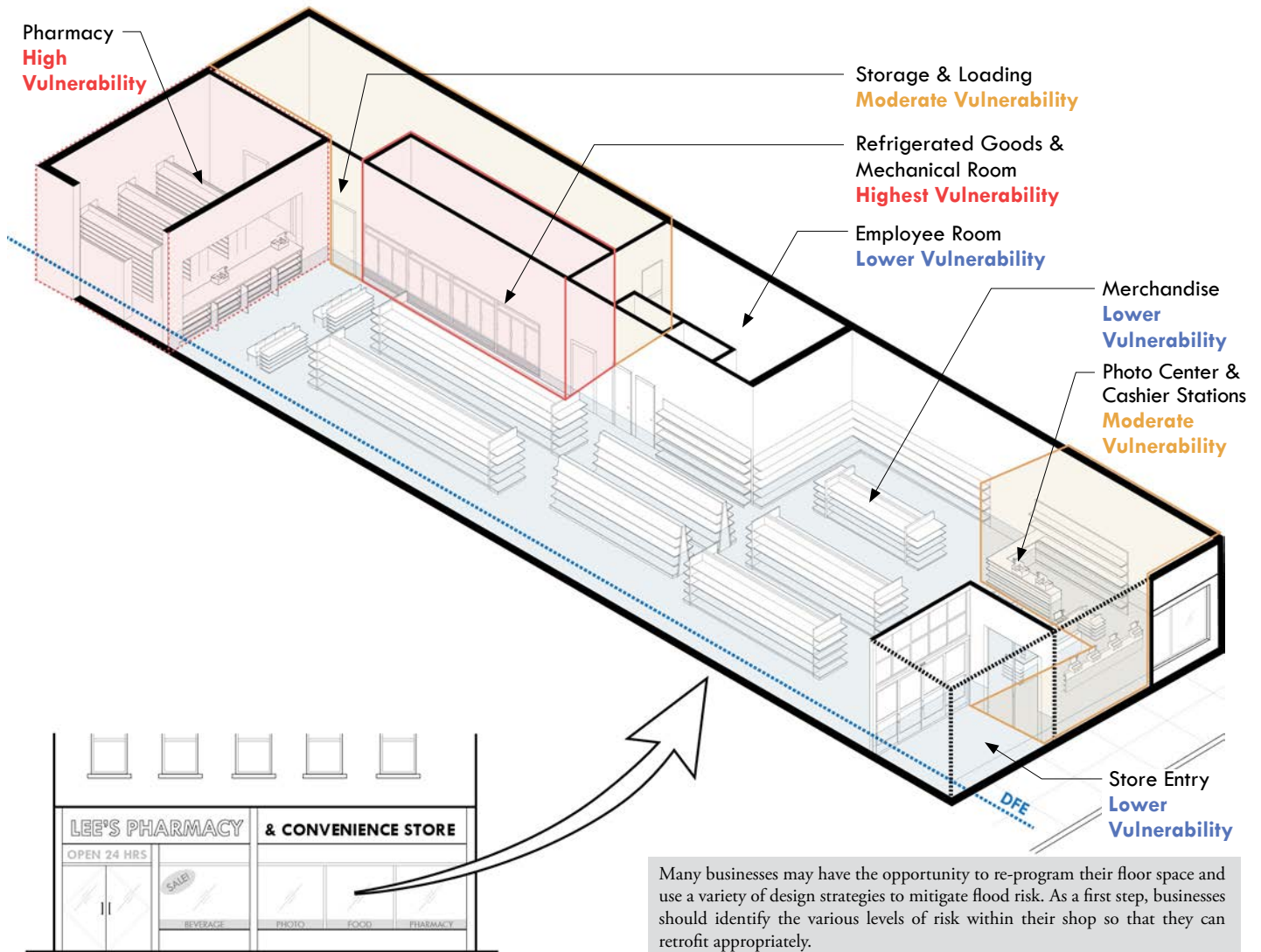


Plan for flexibility

Flexible furniture and storage solutions can facilitate quick and easy dismantling for relocation to higher ground areas or to a dry floodproofed enclosure.



Designing for Partial Mitigation



commonly implemented in other flood-prone cities worldwide. If federal floodplain regulators allowed this as a flood mitigation strategy and NFIP recognized the effect of wet floodproofing on minimizing losses from floods, then business owners would have a much greater incentive to develop the creative solutions necessary to lower flood damage risk while maintaining functional, year-round retail services.

DRY FLOODPROOFING MECHANICALS

Dry floodproofing mechanical systems in place below the BFE or below grade can be another strategy for providing critical flood protection to the electrical and mechanical systems businesses, and overhead residential units in mixed-use buildings, rely on for operation. As noted earlier, local floodplain regulations, based on federal codes, require such systems be elevated to the DFE, though such actions alone do not generally provide insurance reductions. However, there is often no place within existing buildings for relocation with residences located immediately above ground floor shops. Encasing mechanical systems in dry floodproofed enclosures can provide important flood protection while preserving usable space elsewhere. While still a difficult and costly engineering task, it is often a more feasible alternative and should be recognized for insurance credit and floodplain compliance.

CHAPTER 4 CORRIDOR CASE STUDIES

The five boroughs are comprised of unique retail corridors that reflect their diverse communities, and vary in their built fabric and mix of businesses and uses. This chapter highlights specific challenges some of the city's key retail corridors have experienced in recovering from Sandy and considering flood mitigation strategies to prepare for future storms.





Avenue C (East Village, Manhattan)

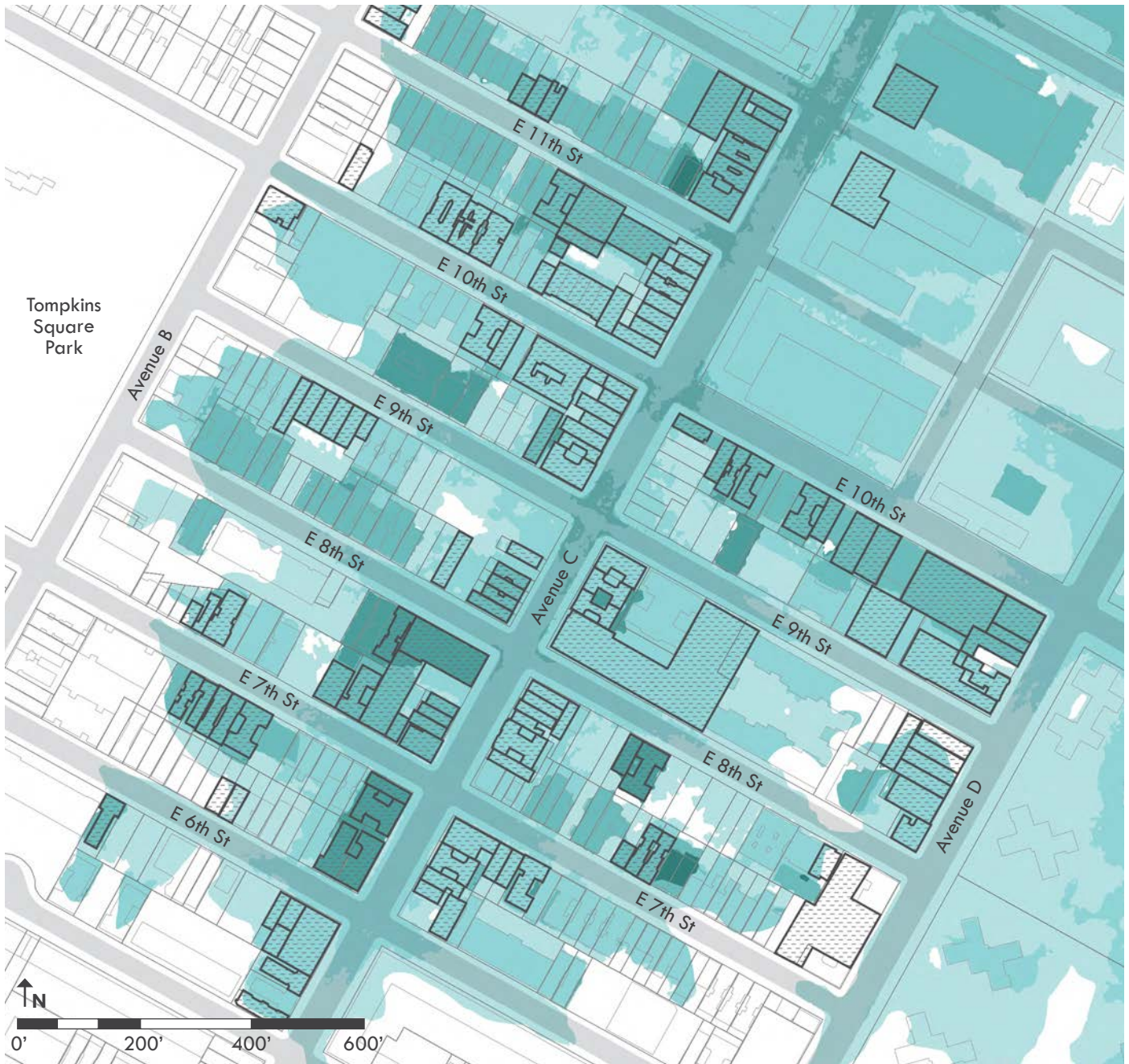
TYPE A: DENSE, MIXED-USE AND PEDESTRIAN ORIENTED

Avenue C in Manhattan's East Village is a major commercial artery filled with restaurants, bars, groceries, laundromats and other businesses that serve the surrounding community, including many residents living within the NYC Housing Authority's surrounding buildings. The corridor employs nearly 250 people working across 42 different retail businesses.

The stretch of Avenue C between East 5th Street and East 14th sits entirely within the 100-year floodplain and was heavily flooded during Sandy. Many sidewalk vaults, such as pictured above, were flooded, damaging mechanical systems, inventory and accessory office facilities. With an older building stock and little new construction, few buildings along the corridor are required to carry flood insurance and NFIP take-up rates remain low. The total number of flood claims filed was also

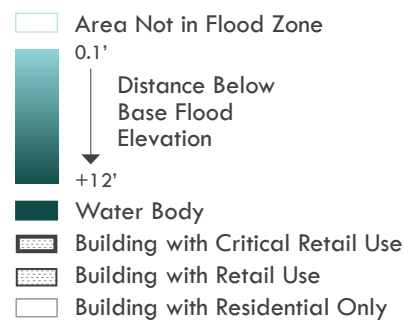
low. But claims averaged nearly \$100,000 per building, and annual premiums for commercial and multifamily buildings with ground floor retail are relatively high at \$4,000.

Businesses are generally located on the ground floor of residential walk-up apartment buildings, most of which are only 20 - 45 feet wide. Any street-level non-residential spaces must be dry floodproofed, while the adjoining narrow lobby stairwells connecting upstairs must be wet floodproofed. This creates a number of engineering hardships for property owners who have to integrate the two to be compliant with floodplain regulations. The costs of doing this, along with the likely need to temporarily displace business and residential tenants, highlight the need to broaden the strategies available for such mixed-used buildings weighing flood mitigation.



Retail Corridor Profile*
 East 5th Street through East 14th Street

	Businesses	Jobs	Annual Wages
Cafes, Restaurants & Bars	26	147	\$3,725,000
Laundromats, Salons and Barber Shops	5	15	\$200,000
Supermarkets and Convenience Stores	7	55	\$1,425,000
Other Retail Businesses	4	30	\$950,000
Grand Total	42	247	\$6,300,000



*Retail businesses included in this profile are those that fall within the 1% annual chance floodplain



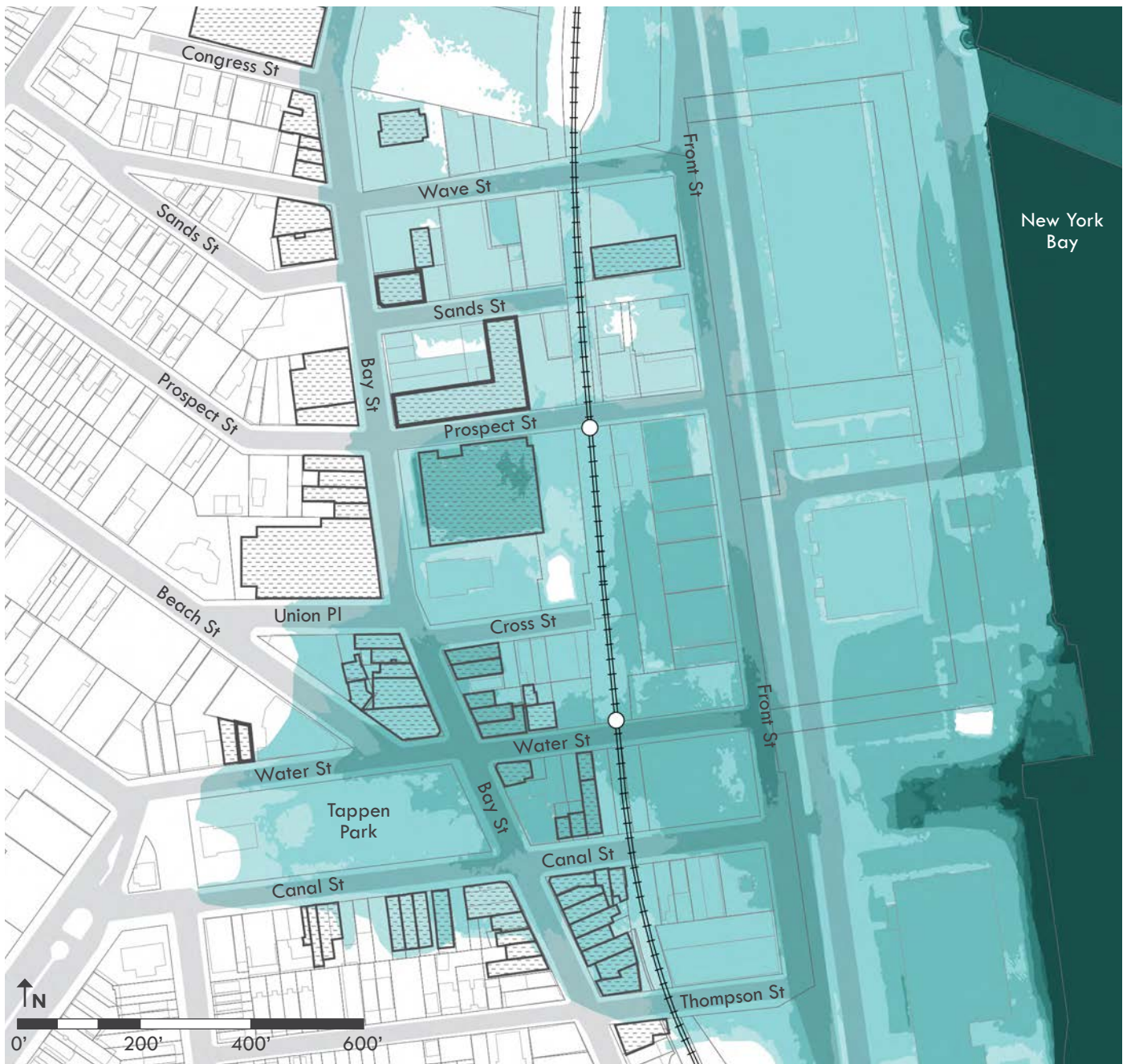
Bay Street (Stapleton, Staten Island) TYPE A: DENSE, MIXED-USE AND PEDESTRIAN ORIENTED

Bay Street is the commercial center of Staten Island’s Stapleton neighborhood, and exemplifies many of the challenges facing corridors struggling to come back post-Sandy. Cutting across one of the lower-lying sections of the North Shore, Bay Street experienced heavy flooding by the Tappen Park area. The neighborhood was still in the midst of recovering from the recent housing recession when the storms struck a blow. Since then, many storefronts have yet to be repaired and re-tenanted.

Few NFIP claims were filed in the area, reflecting how few policies are held along the corridor despite the significant flood risk. Actual numbers of impacted businesses were higher than the number of claims suggest. Conversations with local merchant groups and area business owners indicated a lack of awareness of flood risk and high NFIP premiums deterred many from purchasing policies.

The increased costs of floodplain compliance, in the form of repairs and retrofits, or within new construction, are expected to translate into higher rents for businesses. In corridors already struggling through a weaker market, this compounds the difficulty of attracting tenants and locating key retail services that may prefer to go elsewhere. Without a stronger market to support higher rents and offset the higher costs of floodproofing, Bay Street may require additional support in rehabilitating commercial store fronts.

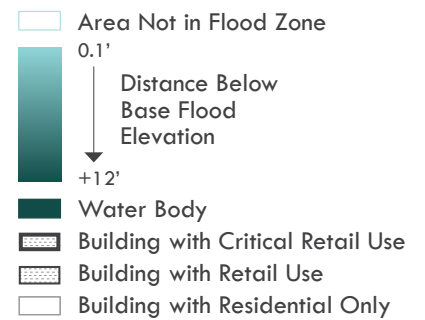
The Department of City Planning has been working with area businesses to identify how to foster an active, pedestrian-friendly streets front that is both better able meet market needs and incorporates floodproofed construction.



Retail Corridor Profile*
 Grant Street through Broad Street

	Businesses	Jobs	Annual Wages
Cafes, Restaurants & Bars	8	67	\$1,000,000
Banking Services	3	28	\$1,000,000
Laundromats, Salons and Barber Shops	8	20	\$250,000
Other Retail Businesses	13	200	\$4,300,000
Grand Total	32	315	\$6,550,000

*Retail businesses included in this profile are those that fall within the 1% annual chance floodplain





Sheepshead Bay Road (Sheepshead Bay, Brooklyn)

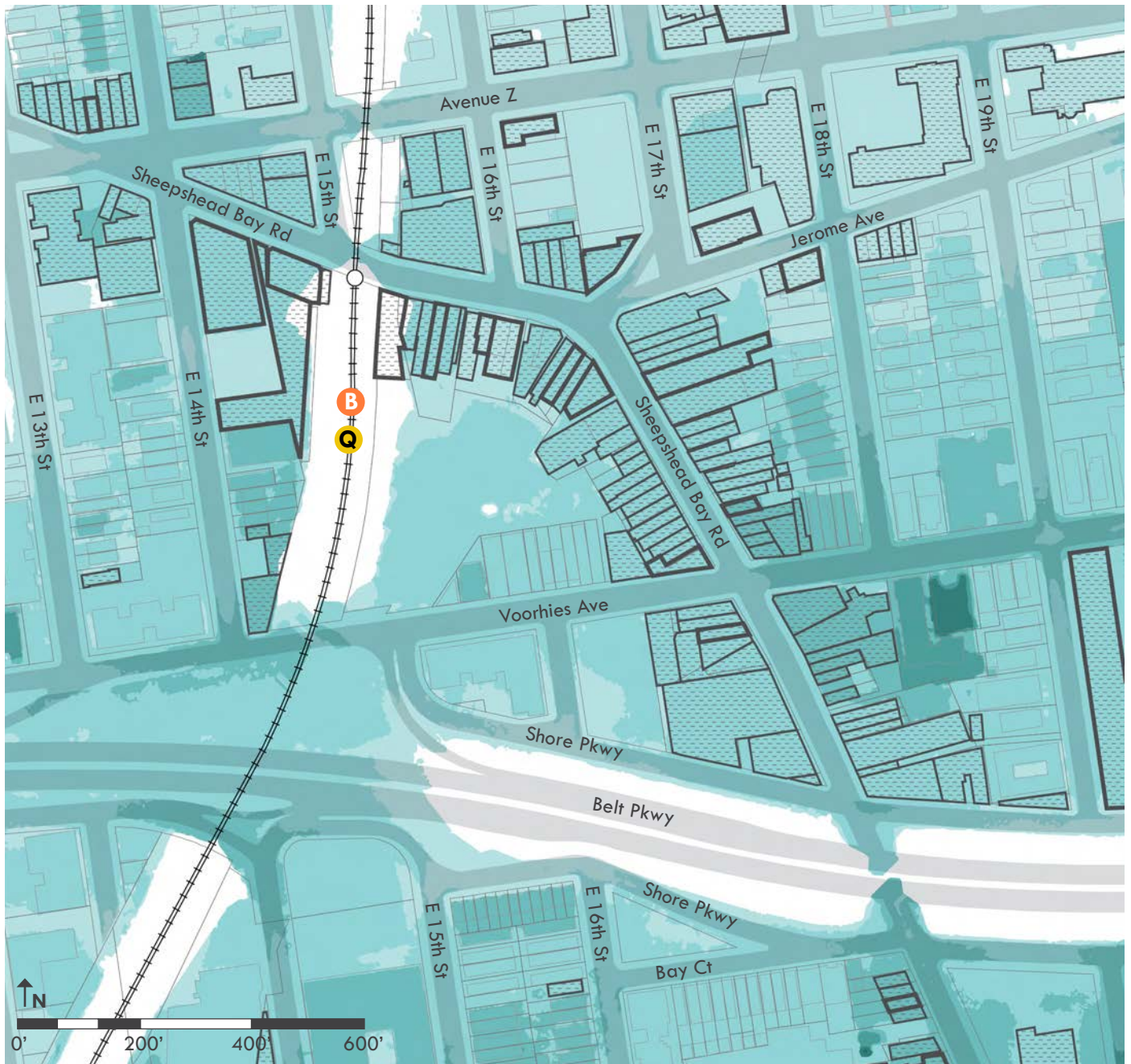
TYPE A: DENSE, MIXED-USE AND PEDESTRIAN ORIENTED

Sheepshead Bay Road has been serving the surrounding Sheepshead Bay neighborhood in Southern Brooklyn since the early 20th century as a key commercial and transit hub. Like much of Brooklyn's commercial areas, the corridor has adjusted to reflect changing demographics as new generations of residents, particularly immigrant communities from the former Soviet Union and across Asia, settle and open new businesses that service area needs.

Sandy devastated the corridor and left many businesses unable to reopen. Over \$4 million of damages were claimed through NFIP alone, one of the largest sums in the city, and three years later several storefronts still remain vacant. The corridor's reliance on sidewalk vaults for inventory storage, commercial loading, and location for mechanical systems has made recovery

slower due to ongoing challenges to elevation of the mechanical and electrical systems out of the basement and above the BFE. A number of basements continue to be unrepaired, with shop owners having to find room in already cramped ground floor retail spaces for inventory and accessory space, or choosing to forgo product storage entirely.

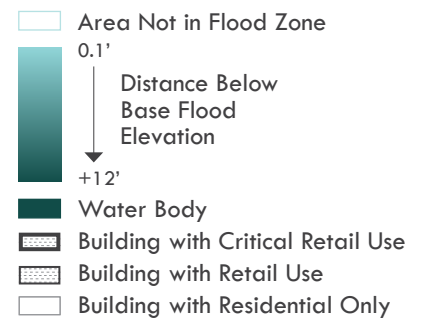
The fragile market is exacerbated by rising costs associated with flood insurance requirements for property and business owners. In addition to leaving Sheepshead Bay Road less desirable a place to do business by creating gaps in the streetscape, disinvestment has left surrounding communities with fewer options to purchase retail goods and services.



Retail Corridor Profile*

Emmons Avenue through Avenue Z

	Businesses	Jobs	Annual Wages
Cafes, Restaurants & Bars	30	154	\$2,800,000
Banking Services	8	67	\$3,225,000
Laundromats, Salons and Barber Shops	12	23	\$425,000
Clothing/Clothing Accessory Shops	10	20	\$275,000
Electronics and Appliance Stores	5	6	\$100,000
Supermarkets and Convenience Stores	13	81	\$1,100,000
Pharmacies and Personal Care Stores	8	75	\$1,725,000
Other Retail Businesses	7	13	\$250,000
Grand Total	93	439	\$9,900,000



*Retail businesses included in this profile are those that fall within the 1% annual chance floodplain

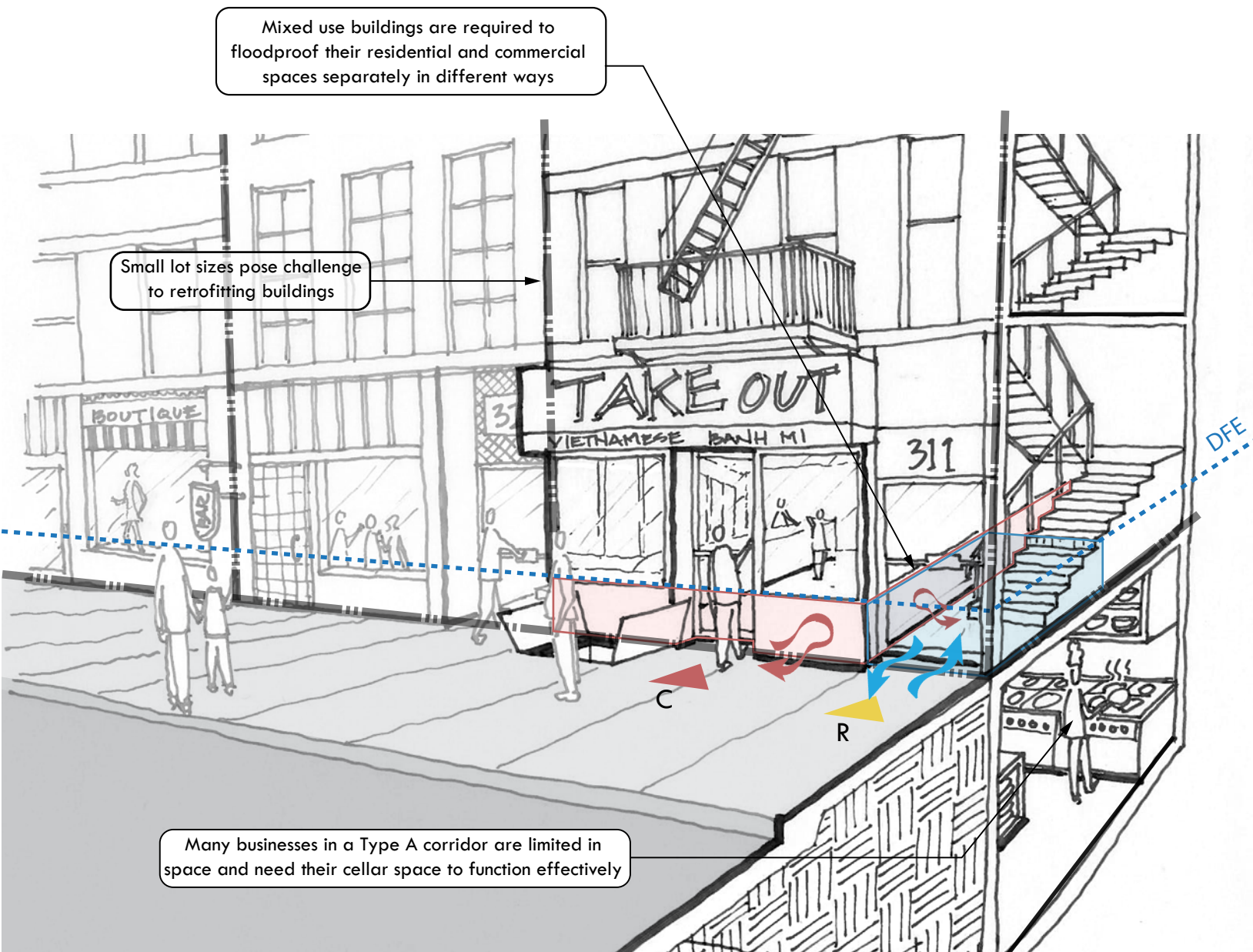
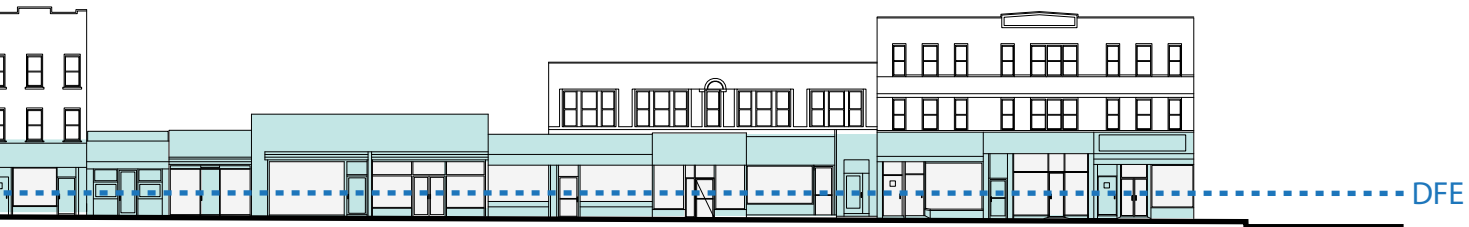
Type A: Dense, Mixed-use and Pedestrian Oriented

- Residential or Office Space
- Retail Space



Buildings that mix residential and commercial uses face challenges in incorporating both compliant dry and wet floodproofing measures. Additionally, there are many basement and cellar-occupied commercial spaces within this typology that would need to be either dry floodproofed or filled-in entirely to meet floodplain building requirements.

The loss of cellar space impacts business functionality, and relocation of area to above grade within the building or elsewhere within the lot is often not feasible. Many lots are fully built out, while the proximity of residential dwelling units directly above commercial ground floors means there is often little room available within the building or on the roof.





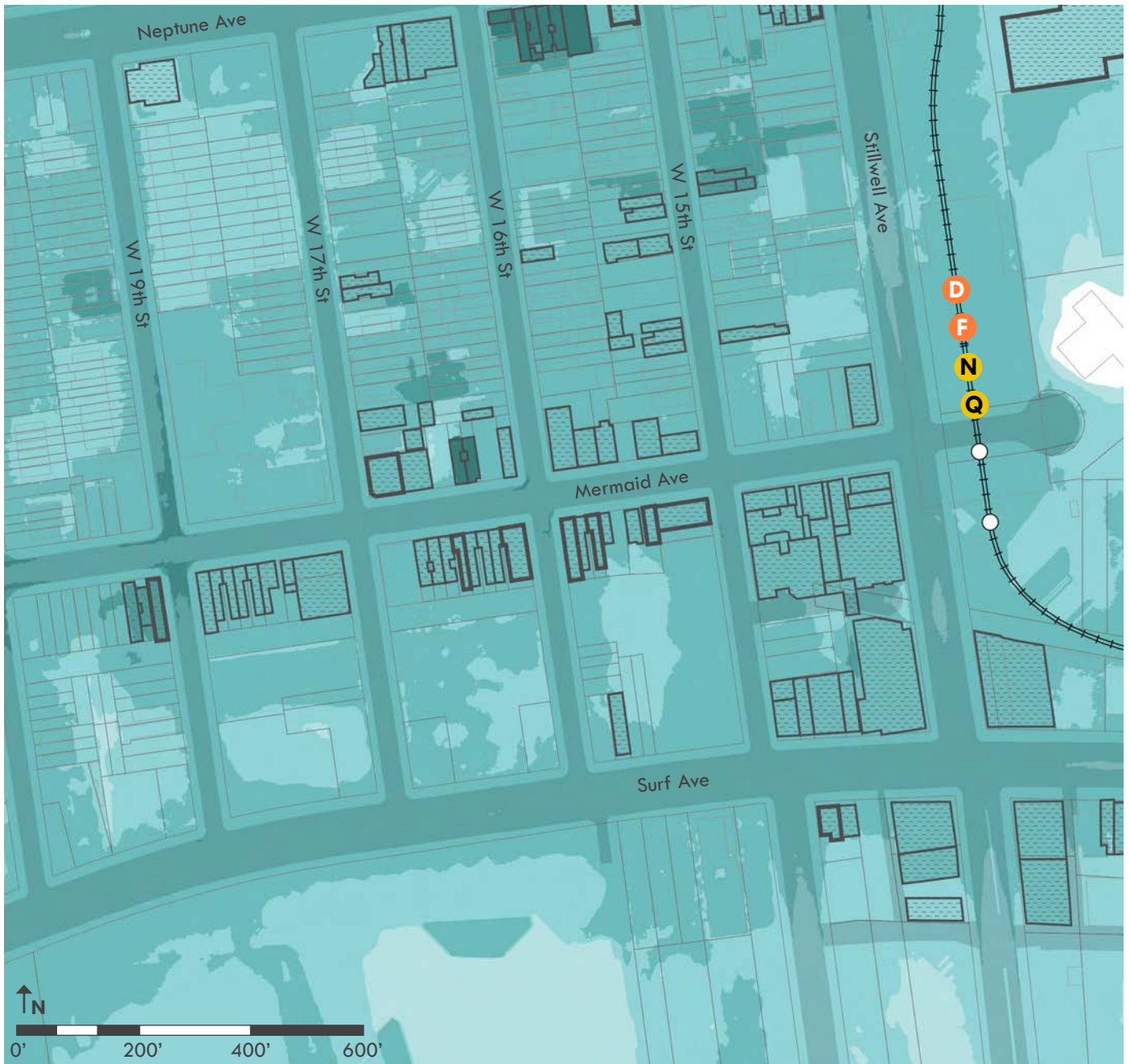
Mermaid Avenue (Coney Island, Brooklyn) TYPE B: VARIED BUILDING TYPOLOGIES, LOT SIZES + USES

Mermaid Avenue is the commercial heart of Coney Island's diverse community. Located on the Coney Island peninsula, and formerly an island in its own right with a high groundwater table, the corridor witnessed a barrage of flooding from the neighboring bay, Coney Island Creek, sewer backflow, and storm surge coming off the ocean. NFIP claims alone from commercial businesses totaled over \$6 million, though total damages were likely higher and don't reflect the many businesses that had no flood insurance.

Unlike some nearby commercial nodes that cater primarily to seasonal visitors from outside the neighborhood, Mermaid Avenue provides daily goods and services to the surrounding communities. With limited transit access, particularly at the

western end of the peninsula, and a high concentration of low-income residents, this neighborhood is particularly vulnerable to the loss of critical goods should a supermarket or pharmacy close due to flooding, or relocate to a location outside the flood zone.

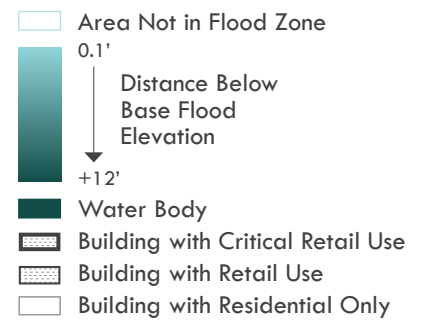
As a corridor that was struggling even before Sandy, the increased costs of retrofitting existing buildings or dry floodproofing new ones adds urgency to the need to think more creatively about supporting businesses in the floodplain. A wider range of partial mitigation strategies can reduce the costs of compliance and ensure that key community retail anchors are able to minimize damage and remain available to residents during floods and storms.



Retail Corridor Profile*

Stillwell Avenue through West 33rd Street

	Businesses	Jobs	Annual Wages
Cafes, Restaurants & Bars	17	134	\$2,600,000
Banking Services	4	24	\$800,000
Laundromats, Salons and Barber Shops	4	11	\$125,000
Supermarkets and Convenience Stores	20	88	\$1,850,000
Pharmacies and Personal Care Stores	9	58	\$1,600,000
Other Retail Businesses	4	15	\$145,000
Grand Total	58	330	\$7,120,000



*Retail businesses included in this profile are those that fall within the 1% annual chance floodplain



Midland Avenue (Midland Beach, Staten Island)

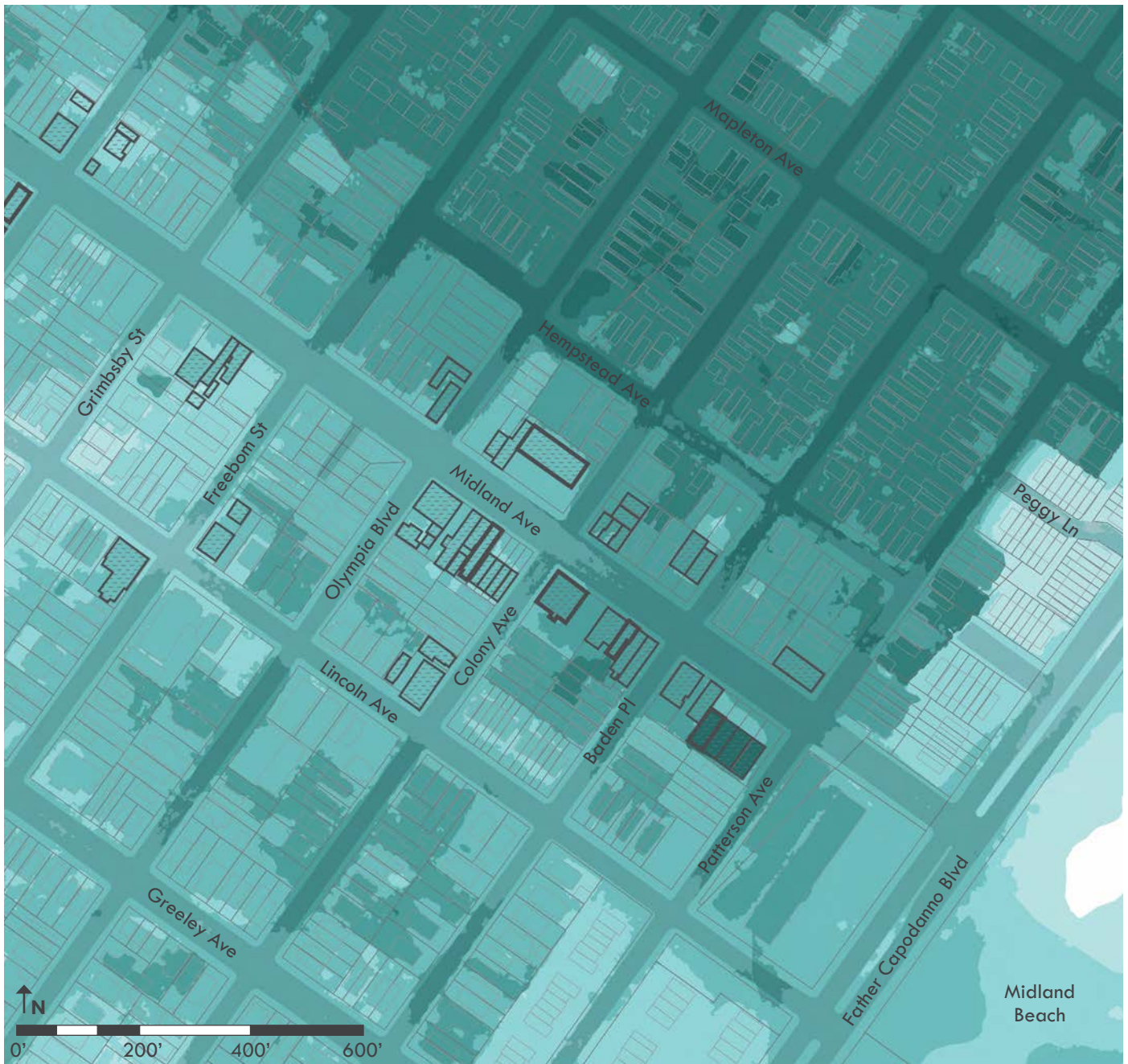
TYPE B: VARIED BUILDING TYPOLOGIES, LOT SIZES + USES

Midland Avenue is a small retail corridor that anchors the Midland Beach neighborhood on Staten Island's East Shore. The street contains a mix of detached single family homes interspersed with aging street-front retail and strip malls. Collectively they provide a range of retail services that complement those offered along Hylan Boulevard further inland. Buildings are mostly one or two stories and match the lower density character of the surrounding residential streets.

Sandy severely impacted Midland Beach, and many businesses along Midland Avenue are still vacant today. A lack of retail continuity, with commercial frontages interrupted by parking and residential uses, has made establishing a vibrant pedestrian environment difficult. Businesses and corridors that rely more heavily on shoppers arriving by car are especially vulnerable

to market and economic challenges, as customers are typically more flexible in where they are able to shop and may simply go elsewhere if an anchor tenant leaves, or if the shopping experience suffers as a result of corridor disinvestment.

Midland Avenue's lower density character and very high base flood heights mean that increased costs associated with resilient design may not be supported by the market. The higher costs of insuring spaces where flood elevations can rise to 12 feet in some cases drive up rents and may compel retailers to locate elsewhere, further hampering recovery. Building mixes that are better able to integrate floodplain code-compliant dry floodproofing may be required to address future commercial needs while mitigating the impacts of flood events.

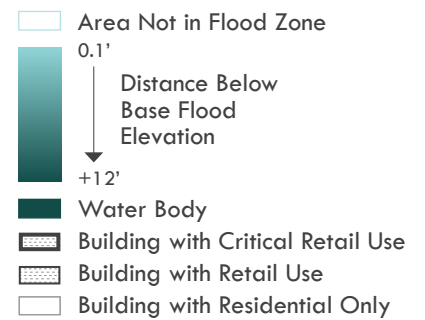


Retail Corridor Profile*

Father Capodanno Boulevard through Nugent Avenue

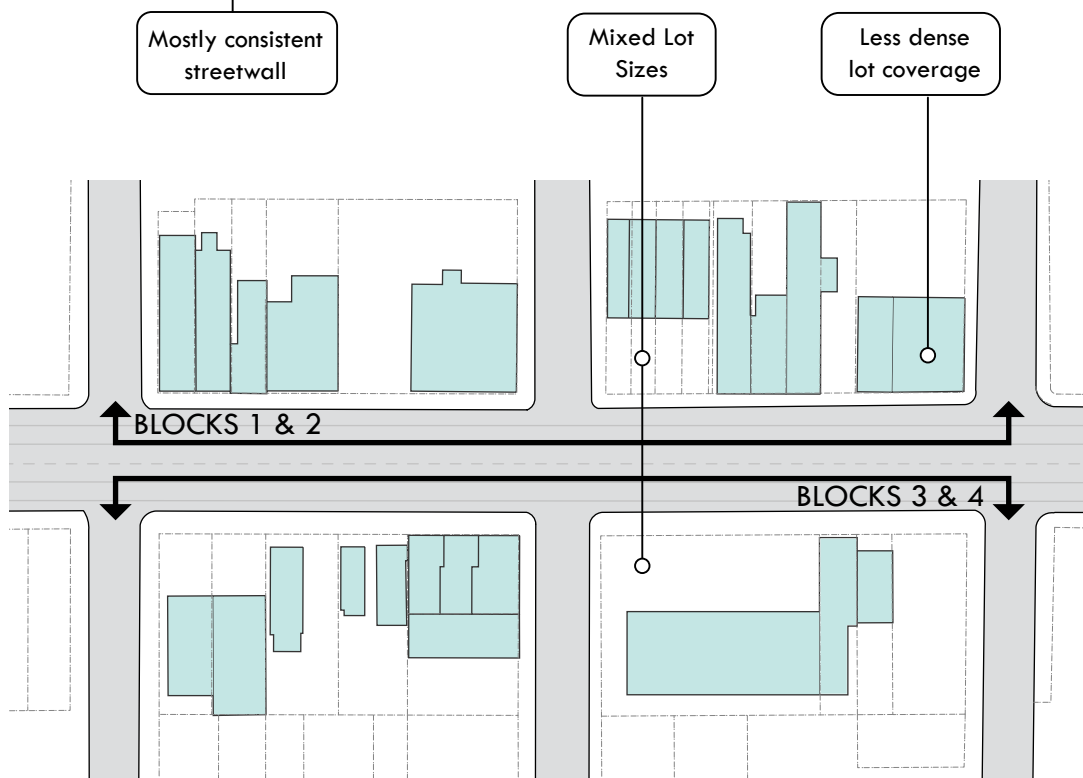
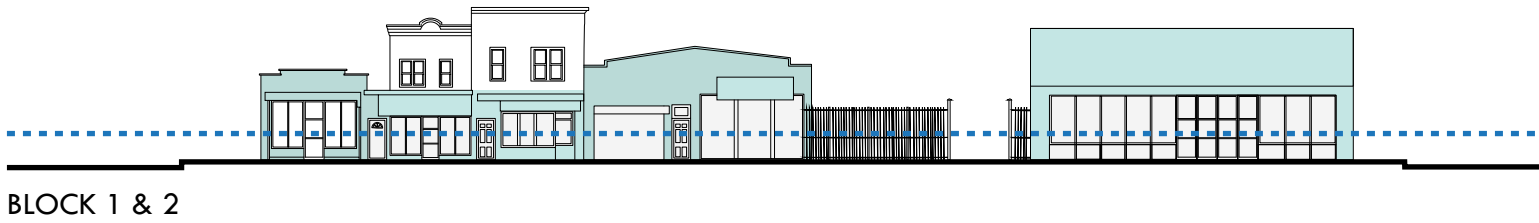
	Businesses	Jobs	Annual Wages
Cafes, Restaurants & Bars	4	16	\$320,000
Supermarkets and Convenience Stores	5	7	\$120,000
Other Retail Businesses	3	5	\$90,000
Grand Total	12	28	\$530,000

*Retail businesses included in this profile are those that fall within the 1% annual chance floodplain



Type B: Varied Building Typologies, Lot Sizes and Uses

- Residential or Office Space
- Retail Space



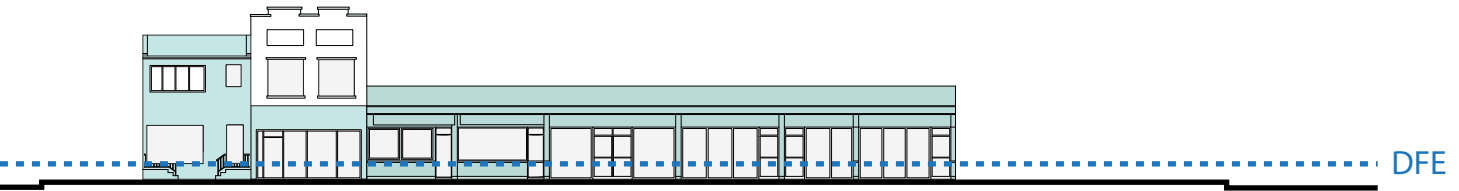
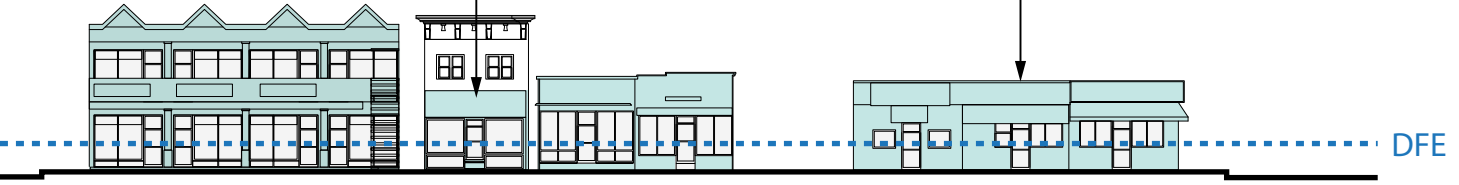
Inconsistent retail continuity and lower residential densities, resulting in fewer pedestrians and customers living nearby or in the immediate vicinity, contribute to a commercial market that may be unable to support the costs of integrating dry floodproofing mitigations. Mixed-use buildings, despite costing more to floodproof, have the benefit of providing a steady customer base living upstairs which can help offset costs.

Corridors that are more automobile-oriented may also be more vulnerable to changing consumer desires and demands. Businesses in these corridors depend on customers who tend to be more flexible in where they are able to shop and who can simply go elsewhere if an anchor tenant leaves, or if the shopping experience suffers.

Mostly serving neighborhood

Mostly single story

30 Commercial Entries
7 Residential Entries



Elevating businesses in the floodplain would significantly impact sidewalk activity & may jeopardize business viability



Many businesses in a Type B corridor depend on their ground floor visibility to attract customers



Cross Bay Boulevard (Howard Beach, Queens)

TYPE C: LARGE FORMAT, SINGLE-USE

Cross Bay Boulevard, located in the Howard Beach neighborhood of South Queens, is characterized by one- and two-story commercial buildings with a range of large and smaller businesses. Existing businesses generally rely on customers with automobiles. Buildings tend to be larger and widely spaced with substantial surface parking, even though half the lots along this stretch would need to provide even more parking if built pursuant to today's zoning.

Among freestanding buildings, particularly new construction, it is typically easier to employ strategies such as structural elevation of floor space to above the BFE while providing parking at grade beneath. However, very shallow lot conditions

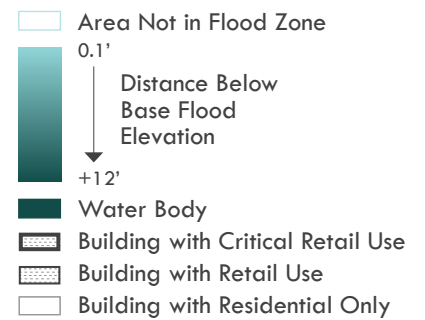
along the east side of Cross Bay Boulevard complicate building adaptation efforts. More so than the earlier types, these corridors depend on automobile access, and customers who can drive elsewhere add a layer of vulnerability to businesses struggling to recover and continue operations following a storm.

During Sandy, Cross Bay Boulevard suffered significant damage. Nearly \$4 million was claimed on commercial NFIP policies alone, with more financial damage likely being suffered by uninsured businesses. The Department of City Planning has been working with local businesses and community members to develop strategies for incentivizing floodproofing of buildings on the constrained lots while encouraging pedestrian connections to Shellbank Basin.



Retail Corridor Profile*
 156th Avenue through 165th Avenue

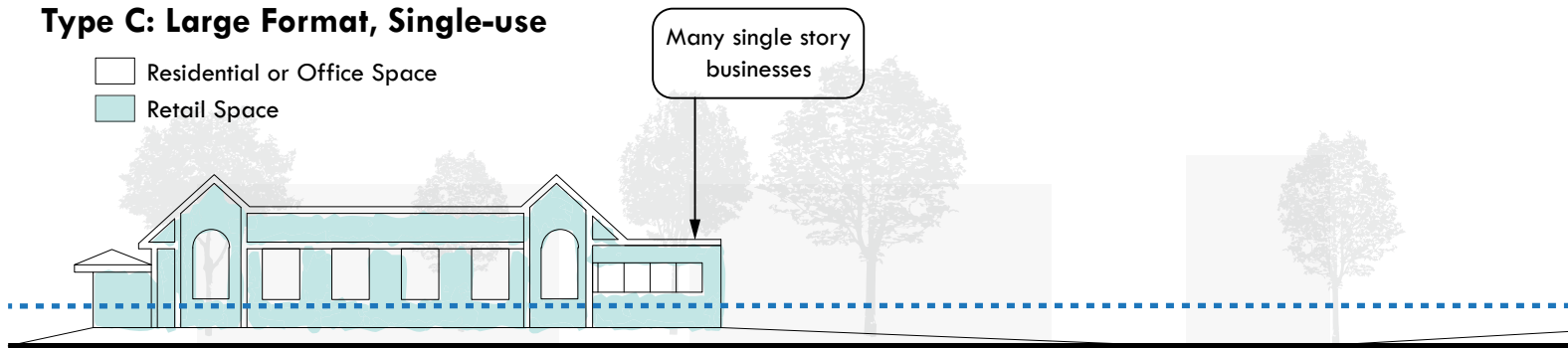
	Businesses	Jobs	Annual Wages
Cafes, Restaurants & Bars	36	793	\$13,000,000
Banking Services	7	73	\$3,400,000
Laundromats, Salons and Barber Shops	16	43	\$600,000
Clothing/Clothing Accessory Shops	5	26	\$400,000
Electronics and Appliance Stores	3	10	\$1,500,000
Supermarkets and Convenience Stores	8	162	\$3,900,000
Pharmacies and Personal Care Stores	8	128	\$3,800,000
Gas Stations	3	9	\$80,000
Other Retail Businesses	15	127	\$2,400,000
Grand Total	101	1371	\$29,080,000



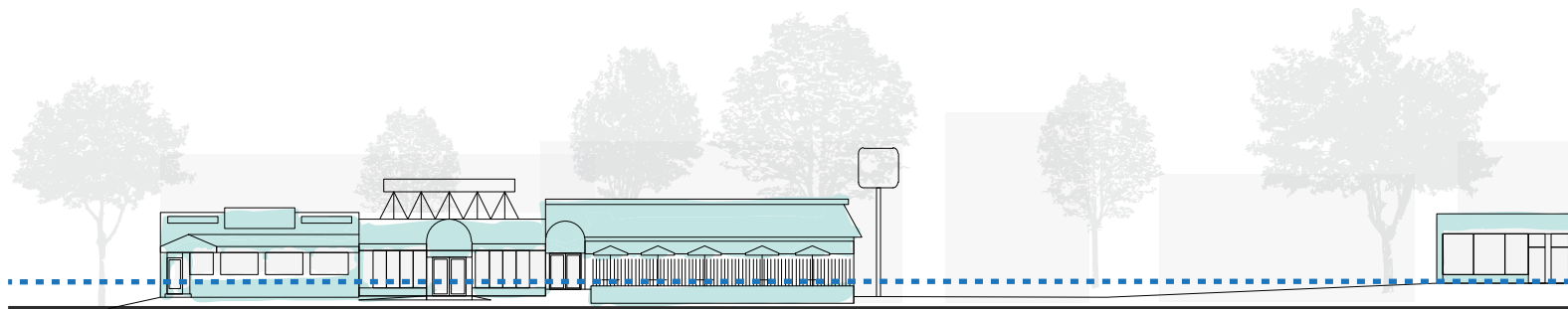
*Retail businesses included in this profile are those that fall within the 1% annual chance floodplain

Type C: Large Format, Single-use

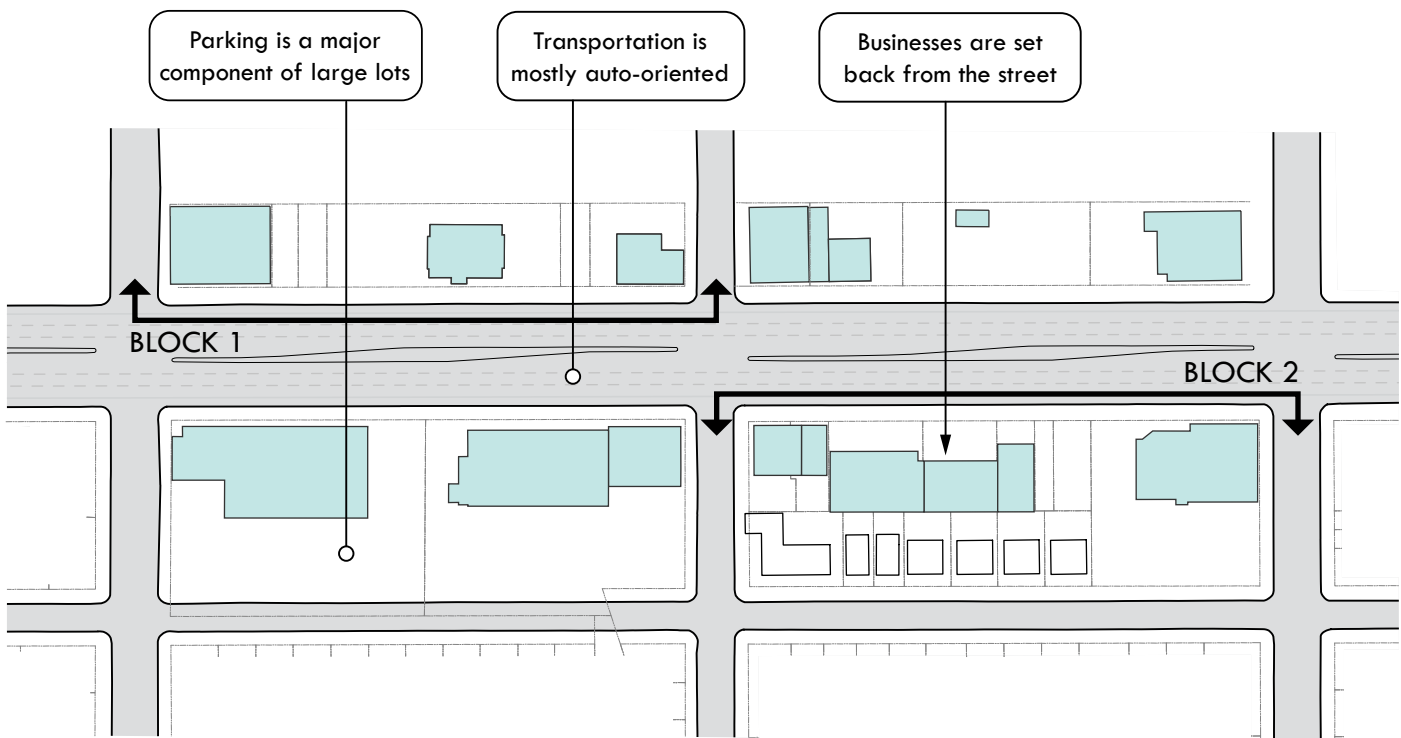
- Residential or Office Space
- Retail Space



BLOCK 1



BLOCK 2



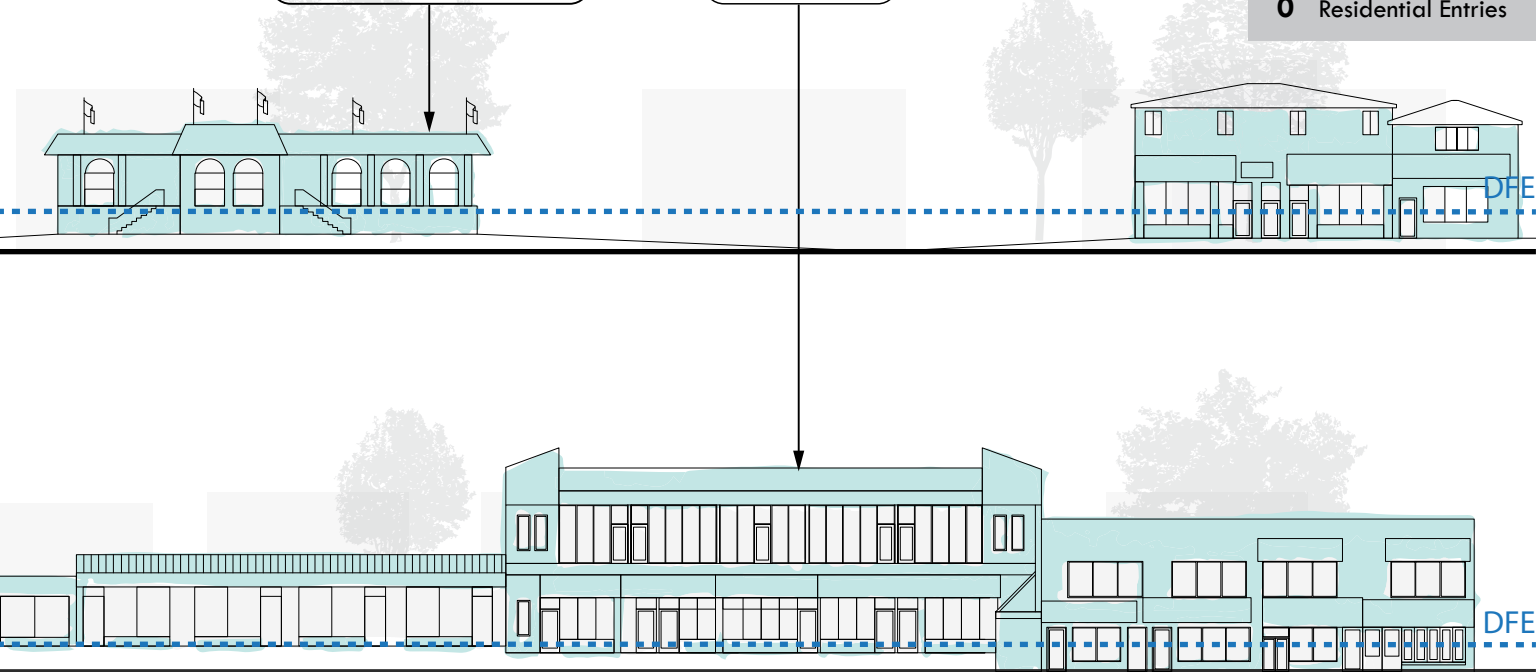
While larger lots and smaller building footprints may make it easier to adopt certain resiliency measures, major work still typically requires a business to close during renovations. Along many corridors, property owners may be hesitant to invest in retrofitting existing structures when those buildings may be cheaper to reconstruct after a storm than to retrofit.

Such corridors may also rely heavily on an anchor tenant to support smaller businesses that are unable to draw sufficient customers on their own. A greater reliance on car access can also be a challenge immediately after storms, when connecting shoppers and employees to retail corridors becomes especially critical to community recovery.

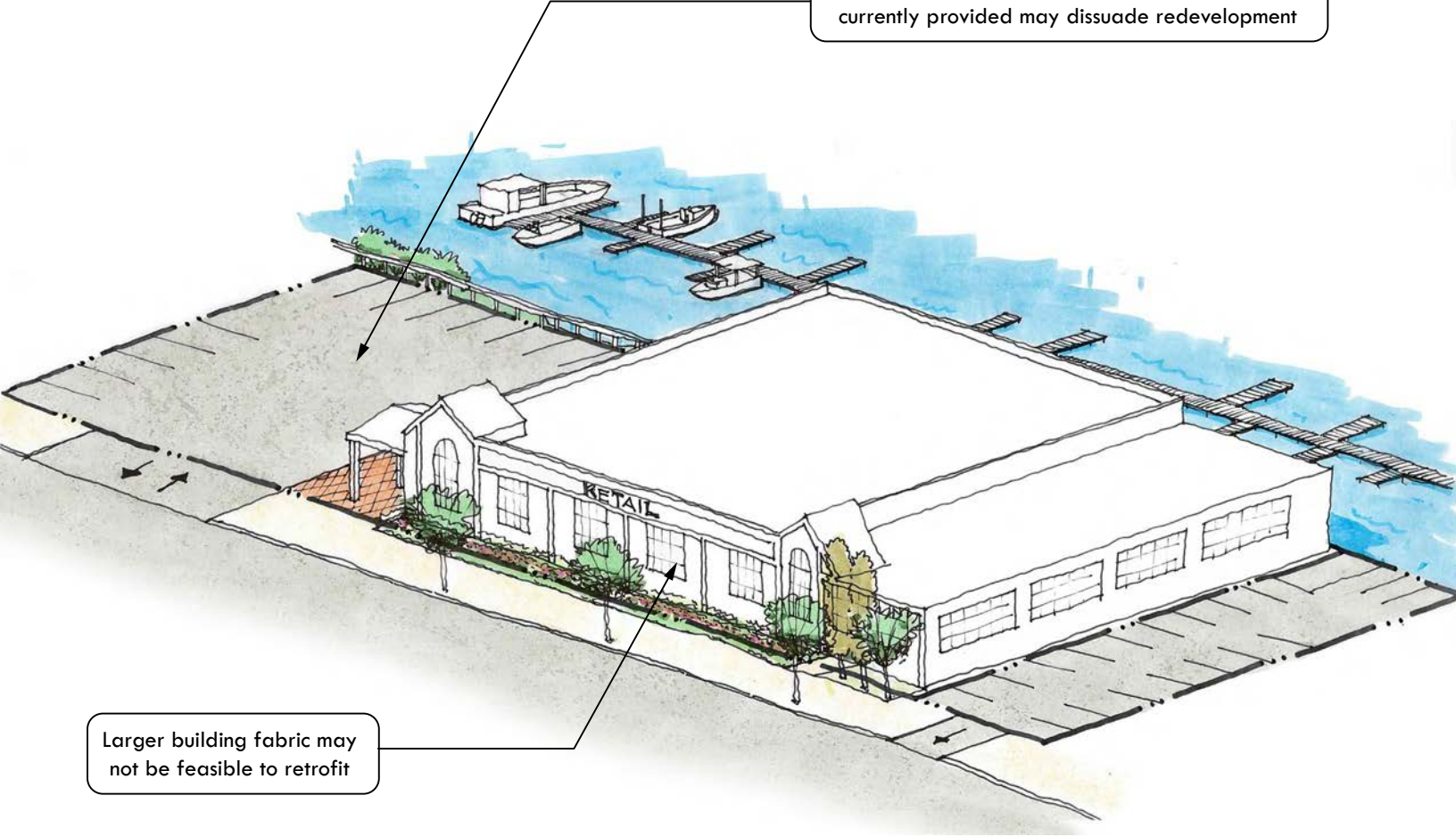
Many buildings are detached or semi-detached

Mostly single-use buildings

21 Commercial Entries
0 Residential Entries



Regulations to accommodate more parking than currently provided may dissuade redevelopment



Larger building fabric may not be feasible to retrofit

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CHAPTER 5 ENSURING RESILIENT RETAIL

To ensure that New York City's coastal communities continue to have access to the supermarkets, drug stores, eateries and other retailer services relied on for daily needs, as well sustaining the many thousands of jobs created by existing businesses, this study recommends a series of local and federal strategies to support the long-term resilience of commercial corridors throughout the city's waterfront neighborhoods.



Restaurants and bars along Avenue C in the East Village of Manhattan attract customers from all over the city that may remain in the neighborhood for a day of shopping. It is essential to sustain these kind of retail corridors in order to maintain character and vibrancy in NYC's neighborhoods.

Local Strategies

As part of its continuing work on coastal flood resiliency, the Department of City Planning is considering how zoning regulations can support and encourage improved flood resilience in existing and new retail spaces while still enabling businesses to meet operational needs and contributing to a desirable streetscape for pedestrians.

As demonstrated through this study, the structural, operational and financial challenges associated with retrofitting existing buildings and improving the design standards of new developments go beyond what zoning alone can address. Nevertheless, there are ways that zoning may unnecessarily restrict or inhibit resilient design. For example, businesses that have historically relied on basements and cellars for accessory space have few practical options for resiliency improvements when zoning regulations would not allow the replacement of below-grade space at a location above the DFE in an existing building. Similarly, the loss of below-grade space requires property owners to site critical mechanical systems and accessory facilities, normally located below-grade, alongside an active ground-floor retail presence that is meant to serve customers; relocation above to floors with residences is not possible even in a case where it might be desirable.

Though updating such zoning measures alone may not induce owners to bring structures up to federal floodplain construction standards, it could allow property owners to substantially reduce exposure to flooding through better design, support business operations and reduce recovery costs from future storms. No single approach will meet the physical, operational and financial needs of all property owners and businesses, therefore a range of reasonable and practical solutions should be available.

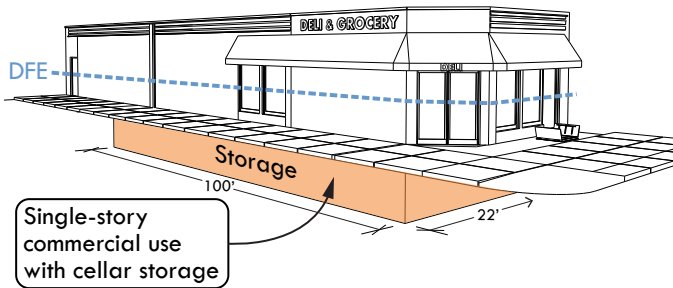
Flood Resilience Zoning Text Amendment

As a first step towards addressing zoning challenges to rebuilding in the 1% annual chance floodplain in the wake of Sandy, the City adopted the Flood Resilience Zoning Text Amendment in October 2013 to make it possible for existing buildings to retrofit. The adopted changes were needed in order to remove certain zoning barriers that would hinder or prevent the reconstruction of storm-damaged properties, and included modest provisions to encourage resiliency within the city's building stock.

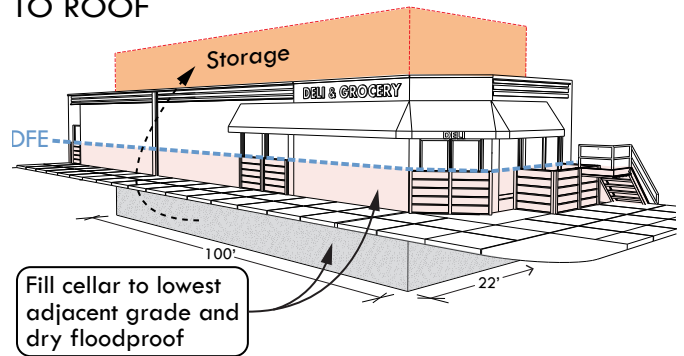
The Flood Resilience Zoning Text Amendment:

- **Encouraged dry floodproofing** by exempting up to 10,000 square feet of dry floodproofed floor area below the DFE from floor area calculations within existing buildings in low and mid-density zoning districts.
- **Exempted all wet floodproofed** floor space below the DFE from floor area calculations within existing buildings.
- Made it significantly easier to locate **enclosed mechanical equipment** elevated above the DFE within courts, open space, accessory structures, and taller rooftop bulkheads.
- Allowed **deployable flood panels** as permitted obstructions within yards and open areas.
- Allowed commercial structures to **elevate finished first floors** up to 12 feet if the DFE was between five and 12 feet in order to maintain a usable ground floor compliant with Appendix G Building Codes, subject to transparency requirements.
- Provided a range of **streetscape, plantings and design** requirements to ensure that flood resistant construction reinforced vibrant streetscapes.

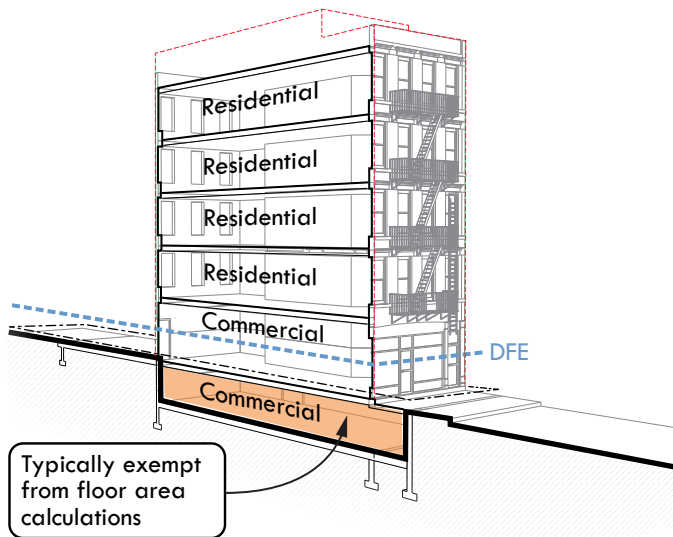
EXISTING CONDITION



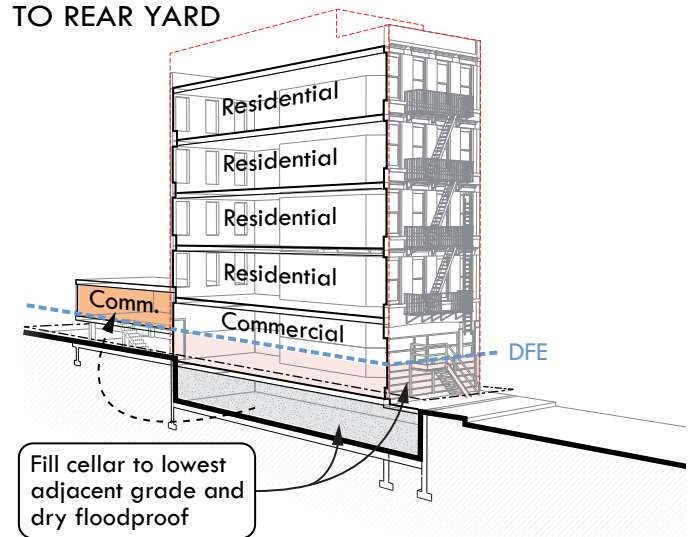
ACCESSORY USE RELOCATED TO ROOF



EXISTING CONDITION



ACCESSORY USE RELOCATED TO REAR YARD



Future Land Use Strategies

The 2013 Flood Resilience Zoning Text Amendment was adopted as a temporary, emergency measure. Another text amendment will be required once the City formally adopts any new FIRMs. In expectation of the eventual adoption of new maps, and with the acknowledgment that there may be more that the Department of City Planning can do to support flood resilience, the agency is exploring further opportunities for refining the flood text’s provisions and potential additional measures to address long-term challenges to retrofitting. The considerations fall within three categories: Bulk, which regulates the shape and size of a building; Use, which establishes what activities can occur within a building; and Parking, with requirements that vary by zoning district and use.

BULK

In order to help commercial businesses and property owners better implement structural changes to building forms, DCP is looking at how existing bulk regulations may hinder resiliency.

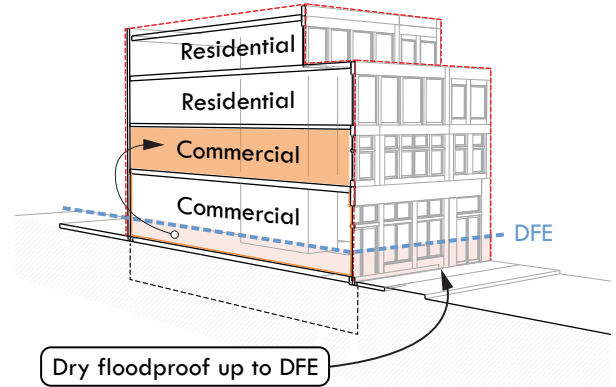
Identify Alternate Locations For Below-Grade Activities

Existing commercial cellars located below the Base Flood Elevation may need to be filled, with space relocated elsewhere, such as in a rear yard. Sub-grade cellars and basements provide valuable back-of-house space across commercial corridors within New York City. From providing valuable room for storing supplies, to housing critical building mechanical systems, providing oft-needed office space, serving as kitchens and food preparation areas, and allowing for service and supply deliveries that do not disrupt ground floor area dedicated to retailing services, ample, usable cellar space plays an important role in making these businesses function.

The potential loss of critical sub-grade floor space due to floodplain regulations makes it important to identify potential ways to relocate this supportive space elsewhere to minimize negative impacts on businesses. Allowing for the construction of floodproofed accessory floor area in the rear of buildings,

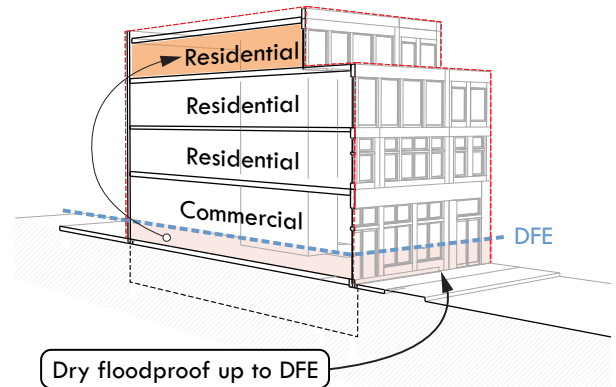
LOCAL STRATEGIES | Bulk & Use

These illustrated options may support the higher cost of dry floodproofing commercial ground floors, while maintaining active street-level floor space for businesses.



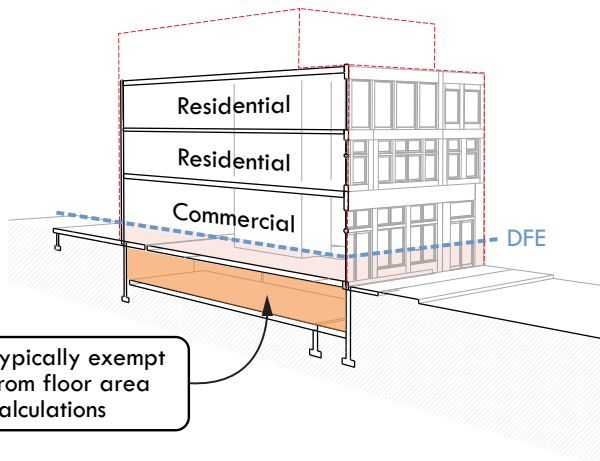
EXEMPTED FLOOR AREA MAY BE USED FOR 2ND-STORY RETAIL

Floor space lost as a result of floodplain construction standards may be recaptured by allowing second story commercial uses.



EXEMPTED FLOOR AREA MAY BE USED TO CREATE ADDITIONAL RESIDENTIAL SPACE

Alternatively, the lost below-grade space can be constructed as an additional story of residential area.



EXISTING ZONING ALLOWANCE (New Construction)

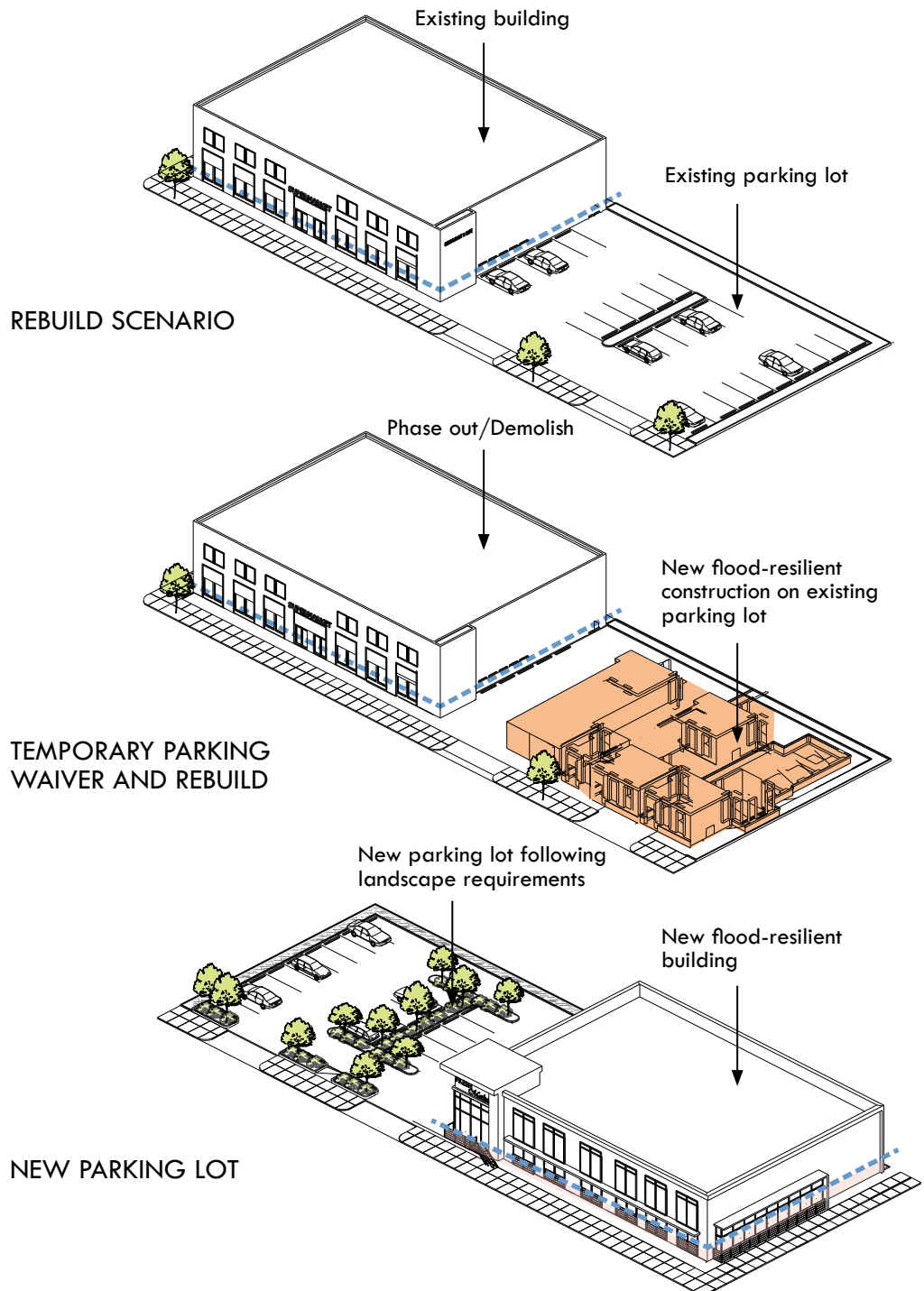
Any below-grade space in a newly constructed building in the floodplain must be dry floodproofed.

and/or facilitating the creation of additional stories to the building where appropriate, could provide commercial property owners with more options for relocating activity that has historically occurred below-grade to a flood-resistant location on the lot.

USE

2nd-Story Commercial In Mixed Use Buildings

Similarly, expanding the ability to locate commercial services on a second story in parts of the floodplain could provide new buildings more flexibility in accommodating supporting commercial space above the DFE while remaining compliant with federal floodplain regulations. A second story with commercial square footage could allow some commercial activity, as well as lobby, storage or circulation space, while accommodating key retail and consumer services above the flood elevation.



Such a strategy would allow businesses to maintain a valuable ground floor presence that retains some functionality and activity, while moving critical inventory and customer interaction areas to above the DFE. Alternatively, a second story could be occupied as accessory space for a commercial tenant required or choosing to vacate and fill any cellars. A second commercial story could also make it feasible in some circumstances for a commercial building to dry floodproof the ground floor.

PARKING

Despite current parking requirements, many existing businesses are in buildings where no parking is provided, either because their development predated current zoning, or because the lot or building size did not trigger a parking requirement. Nevertheless, enlargements or major renovations can

trigger additional parking requirements. DCP is reviewing zoning provisions to ensure that parking requirements do not unduly hamper investments in resilient retrofits of existing buildings.

Identify Where Parking Regulations Hinder Resilient Building

Many strong, well-functioning corridors consist of buildings that do not include parking. New construction can trigger significant parking requirements that add cost and complexity to a project, making it virtually infeasible or reshape buildings in a way that does not fit into their neighborhood context. Appropriate modifications to requirements could support resilience and strengthen retail corridors while still ensuring that local parking needs are met.

Another potential challenge when replacing an existing building is providing parking during an interim period of construction. A potential measure would be to provide temporary parking waivers to properties constructing new flood-resilient buildings alongside existing structures. In order to allow for sufficient room for construction staging, it may make sense to waive parking at least in part on a temporary basis until the new construction and subsequent demolition of the former building is complete (see diagram pg. 66). Any required parking can then be provided on site in place of where the former building stood or integrated into the new floodproofed structure.

Critical Uses

Hurricane Sandy reiterated how crucial access to essential retail goods and services was following the disaster. While storm damage, power failures, gas shortages, and limited public transportation service hindered the movement of every New Yorker after the storm hit, residents in flooded neighborhoods were largely cut off from the rest of the city, with the elderly, disabled, and populations facing linguistic barriers and unfamiliarity with other neighborhoods experiencing the greatest isolation. Neighborhood businesses that were able to reopen quickly provided goods and services locally when other areas were inaccessible, highlighting the critical need for providers of the most essential goods and services to continue to view the floodplain as a viable place to do business and are able to bounce back following flooding or a storm.



Food stores, including this fruit market selling fresh foods to local residents, are essential services for neighborhoods vulnerable to flooding. It is important to ensure that floodplain communities maintain access to critical goods and services year-round, including in the aftermath of a storm or significant flood event.

While all retail corridors should be resilient, ensuring those businesses that people depend on for health and safety, like grocery stores and pharmacies, and those that are necessary for post-storm rebuilding, like hardware stores and banks, are able to withstand flooding and remain operational is key to recovery. Without these uses, neighborhoods and the range of other retail businesses that complement a retail street begin to disintegrate.

In order to ensure that the businesses most essential after a disaster can overcome the physical and financial challenges associated with locating and operating in the floodplain, local agencies must work closely with these commercial sectors to explore zoning and financial incentive programs specifically oriented towards their short- and long-term needs within a community. Existing floor area incentive programs have been utilized to support uses like supermarkets in high-need areas across the city, while Federal, State and local financial support programs exist widely to incentivize building improvements, improve safety, and preserve facilities and industries. Developing the right models to support our commercial main streets will be an important priority.

Federal Regulatory Reform

For the reasons described throughout this report, local strategies alone will likely be insufficient to enable small businesses to meet rigorous federal floodplain regulations. Updates to those standards that expand the menu of retrofit strategies available to support creative solutions could open a much wider range of practical avenues for businesses to protect themselves from future flood damage.

Partial Mitigation and NFIP Reform

Current federal regulations guiding floodproofing measures for non-residential buildings in the 1% annual chance floodplain are highly restrictive and do not recognize the full range of achievable, less costly and less onerous opportunities available to businesses to mitigate flooding. They imply the wholesale redevelopment of existing neighborhood retail streets, which would be highly disruptive and impractical for businesses and the communities relying on them for goods and services.

Expanding permitted partial mitigation strategies, such as by crediting property owners who safeguard higher-value components like mechanical systems and areas where chemicals or perishable goods are stored, could encourage a more cost-effective redesign of retail space that still minimizes flood damage. Despite acknowledging such alternative mitigation investments may reduce costs and damages associated with floods, FEMA does not reciprocate these investments with partial credit towards lower NFIP premiums for businesses and property owners. Thus, many legitimate mitigation pathways remain closed to property owners without any financial or regulatory incentive at the federal level.

Alternative strategies for partial credit at the building-scale include the following:

- **Dry floodproofing mechanical systems** in place below the Base Flood Elevation (BFE) or **elevating critical systems** to above the BFE;
- **Wet floodproofing community facility or commercial space** below the BFE using flood damage-resistant materials and filling basement to lowest adjacent grade;
- **Wet floodproofing the cellar when positive drainage** allows water to flow away from the structure.

(Continued on Page 71)

DESIGN STRATEGIES | Assessing Risk

The operational and spatial needs of retail spaces pose unique resiliency challenges, but by implementing practical measures for adaptation, damage and disruption resulting from a flood event can be greatly reduced. The first step is to identify operations that are critical to business function and evaluate potential flood damage.

- High Priority
- Medium Priority
- Low Priority



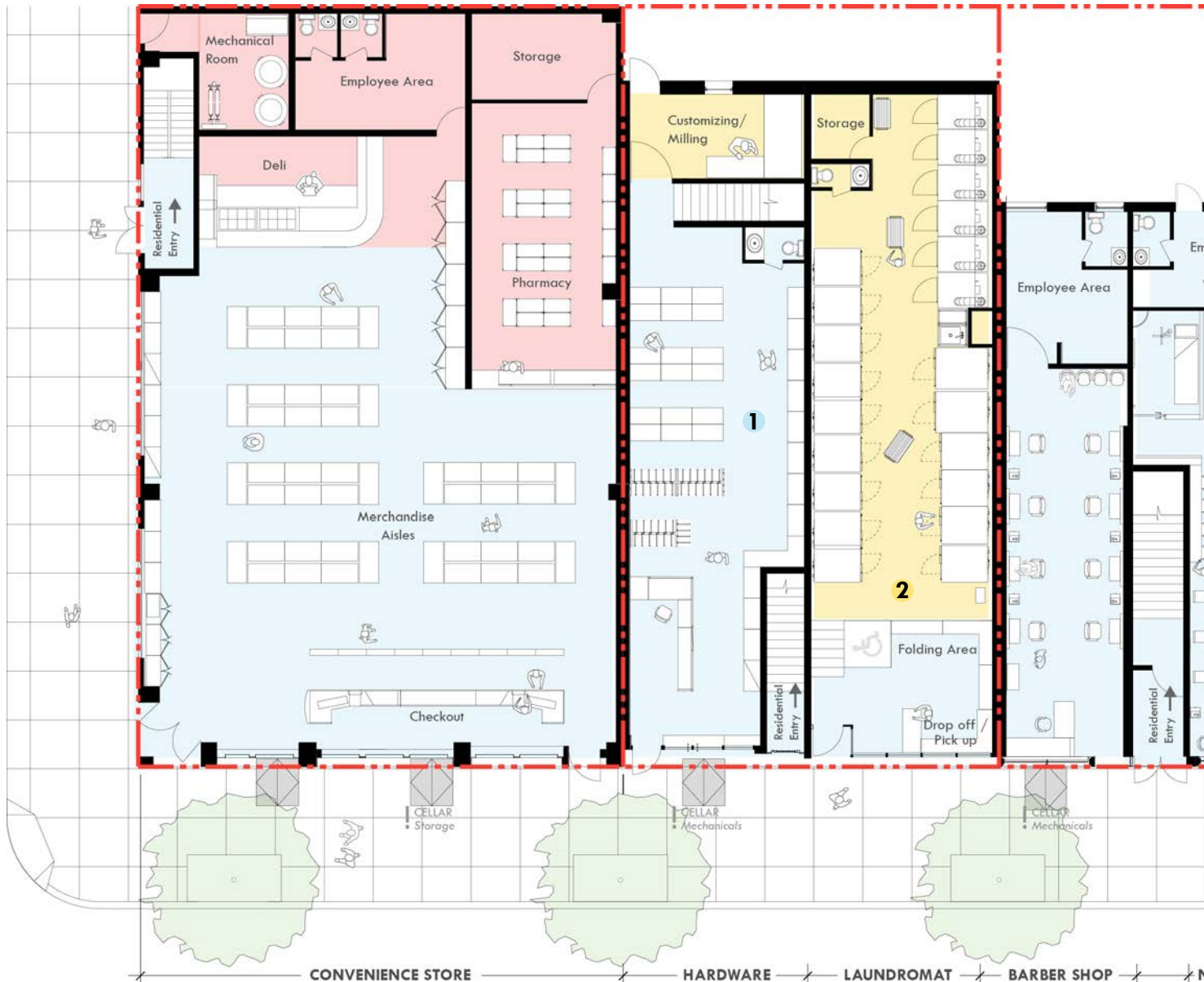


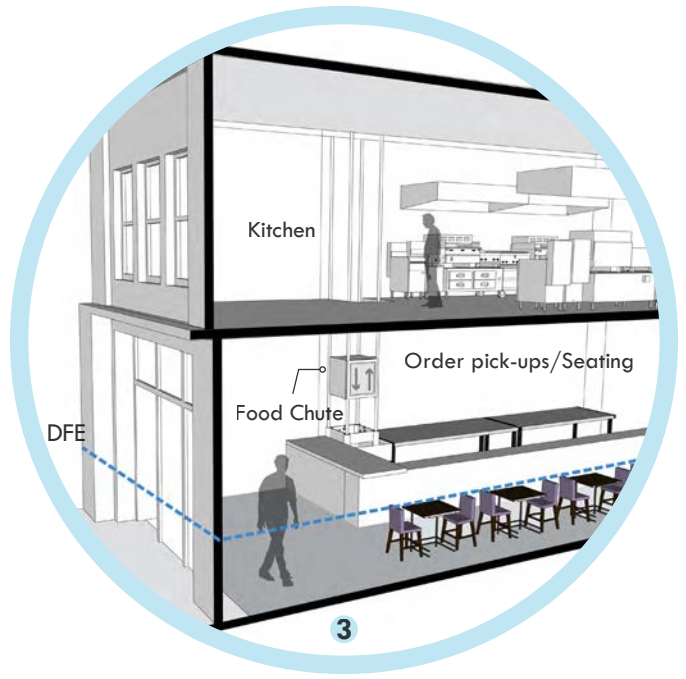
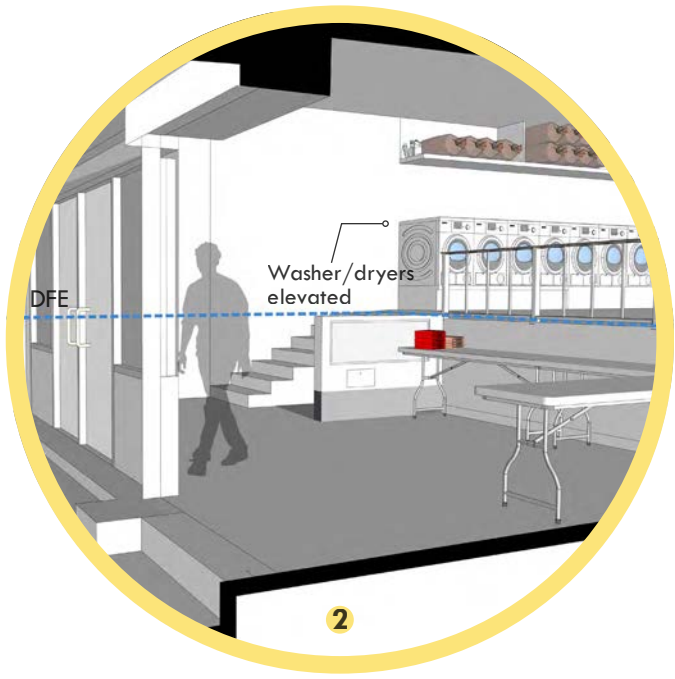
DESIGN STRATEGIES | Mitigation Concepts

Illustrated here are practical strategies to mitigate damage from flooding. The recommendations comprise physical retrofits of the spaces and buildings, as well as suggestions to integrate flood resiliency into everyday operations.

Operational strategies, such as those referenced on pages 37 and 38, that do not require changes to a building's structure can also be effective strategies for mitigating risk by ensuring that vulnerable inventory, electronic systems and business records are protected from flooding and power outages.

- Dry floodproof
- Elevate
- Wet floodproof





(Continued from Page 66)

Allowing commercial buildings to wet floodproof portions of their space that would be negligibly impacted by floodwaters would add tremendous flexibility for businesses to upgrade their spaces in ways that minimally affects day to day operations. Retrofits would have to comply with federal building standards for wet floodproofed areas located below the BFE by allowing for water to pass freely through flood panels, minimizing the impacts of hydrostatic and hydrodynamic pressures on the building structure. Flood-resistant construction materials could be installed to prevent seepage, mold and other damage to structural building components, and would minimize business interruption through faster clean up. Because commercial spaces are strictly regulated to not allow residential use, an effectively wet floodproofed commercial space would not be a threat to life safety.

Other Opportunities for Federal Reform

Because so many of New York City's retail, office, and community facility spaces are located within mixed-use buildings that include residential uses above, implementing dry- and wet- floodproofing requirements for the separate non-residential areas and residential access points create conflicts that compromise the ability to implement either. This is particularly true on smaller sites and in narrower buildings which are abundant in New York City. Similarly, limited floor-to-ceiling ground-floor heights complicates the installation of stairwells that can accommodate safe passage for residents over and above flood walls. Federal mitigation guidance should address the extreme difficulties of retrofitting such buildings, particularly on narrow lots where residential entryways with stairwells leading upstairs are adjacent to businesses.

Insurance rates and design standards should also consider the inherent durability of the masonry and steel frame construction techniques that characterize much of New York's building stock. Sandy only minimally affected such building structures. Most of the damage was to electrical, mechanical, and other accessory support systems located in cellars, basements, and elsewhere below the BFE, as well as to building contents and exterior facades. Further illustrating their structural resilience, very few buildings were deemed Substantially Damaged and required to rebuild anew, as opposed to the many homes that were destroyed by the storm.

DCP will continue working with partner agencies and community stakeholders to review local zoning and other land use policies that support communities to mitigate flood risk. At the same time the City will push for revisions in federal floodplain regulations that provide greater flexibility in reducing flood risk. Ultimately, towns and cities throughout the nation's floodplains, be they large coastal metropolises or smaller riverine towns, will need to develop strategies to ensure that their commercial corridors are comprised of buildings that are able to manage future storms, floods and other coastal impacts related to rising sea levels while ensuring that retailers and other businesses are connected to the surrounding neighborhoods that rely on them for goods and services. This requires recognizing the unique historical factors that make today's federal floodplain regulations unsuitable to solving many of the challenges that urban and semi-urban localities face with an older building stock, site constraints and market factors that require corridors to be competitive, accessible and resilient to disruptions.

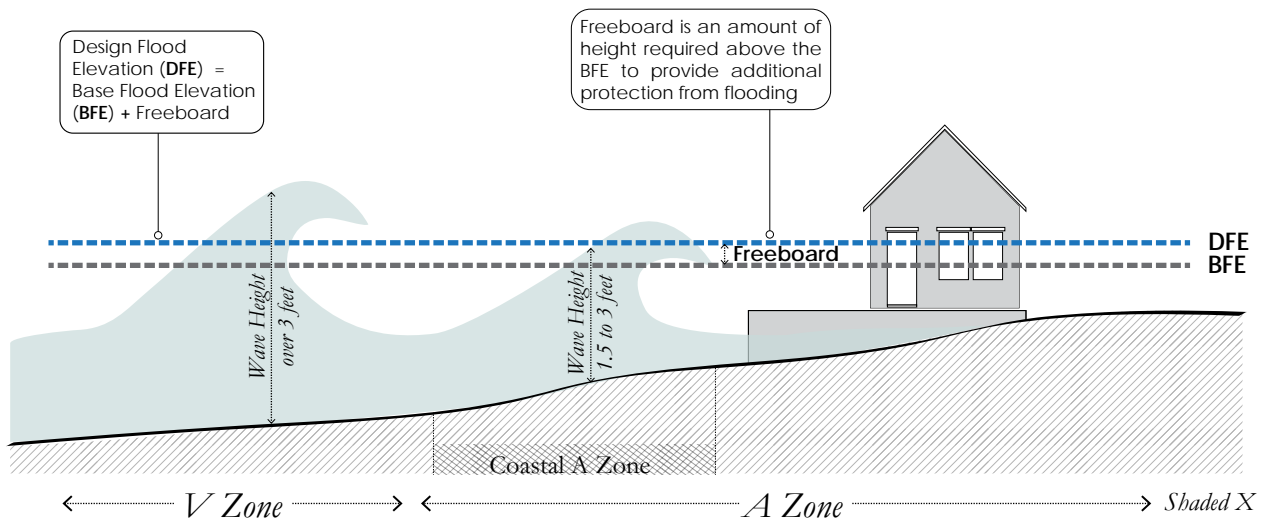
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APPENDIX **RESILIENT RETAIL**

Floodplain Regulations

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.



	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><i>Bottom of <u>lowest horizontal structural member</u> to be at or above Design Flood Elevation</i></p>	<p><i><u>Lowest occupiable floor</u> to be at or above Design Flood Elevation</i></p>	<p><i><u>Lowest occupiable floor</u> allowed to be excavated below grade. (Not permitted for residential buildings)</i></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

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 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 maps also heighten Base Flood Elevations for much of the city. The City has filed an appeal of the PFIRMs because they overstate the size of the city's 1% annual chance floodplain due to inaccuracies in FEMA's underlying analysis. The City is committed to resolving the appeal and adopting accurate flood maps as quickly as possible.

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" 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 in the aftermath of 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. The City Council adopted many of these changes as the Flood Resilience Zoning Text Amendment in October 2013. 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 mitigate adverse streetscape impacts. The rules, still in effect, apply to all buildings in the PFIRM 1% annual chance floodplain.

The 2013 Flood Resilience Zoning Text Amendment was adopted as an emergency measure to facilitate ongoing rebuilding and retrofitting following Sandy. The amendment included a sunset provision and 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.

RETROFITTING METHODOLOGY

To best understand a building's flood risk and opportunities for adaptation, one must be able to identify applicable flood zones, the construction methods best suited to protect the structure, and appropriate codes and regulations that control adaptation techniques. The graphic to the right summarizes a methodology that intends to facilitate informed decision-making.

Information presented here on building retrofit strategies is adapted from the *Retrofitting Buildings for Flood Risk* manual. To read more, please visit:

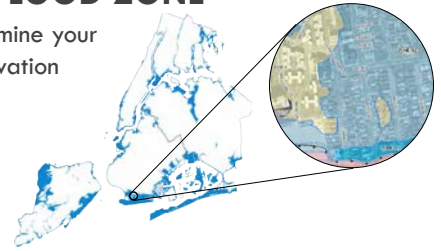
<http://www1.nyc.gov/site/planning/plans/retrofitting-buildings/retrofitting-buildings.page>

STEP 1

IDENTIFY YOUR FLOOD ZONE

Use FEMA maps to determine your flood zone and flood elevation

V Zone
Coastal A Zone
A Zone
X Zone

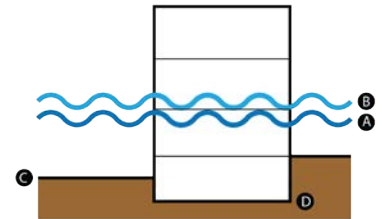


STEP 2

IDENTIFY YOUR FLOOD ELEVATION

Determine critical elevations for your building

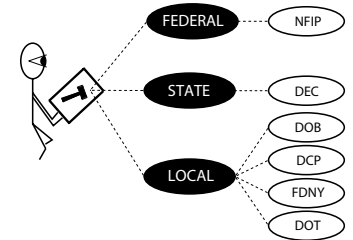
- A** Base Flood Elevation (BFE)
- B** Design Flood Elevation (DFE)
=BFE + Freeboard
- C** Lowest Adjacent Grade Elevation
- D** Lowest Floor Elevation



STEP 3

REVIEW RELEVANT CODES & REGULATIONS

Understand how Federal, State and city floodplain regulations impact your options



STEP 4

IDENTIFY YOUR MITIGATION STRATEGY

Become familiar with resilient retrofit standards and methodologies



Elevate



Wet Floodproof



Dry Floodproof



Relocate

STEP 5

DESIGN YOUR STRATEGY

Identify the physical and operational characteristics to inform design decisions and best practices

Identify Building Type



Select Approach

Substantial Damage
Substantial Improvement



Alternative Strategies

Assess Feasibility



Insurance and Filing



Individual or Communal

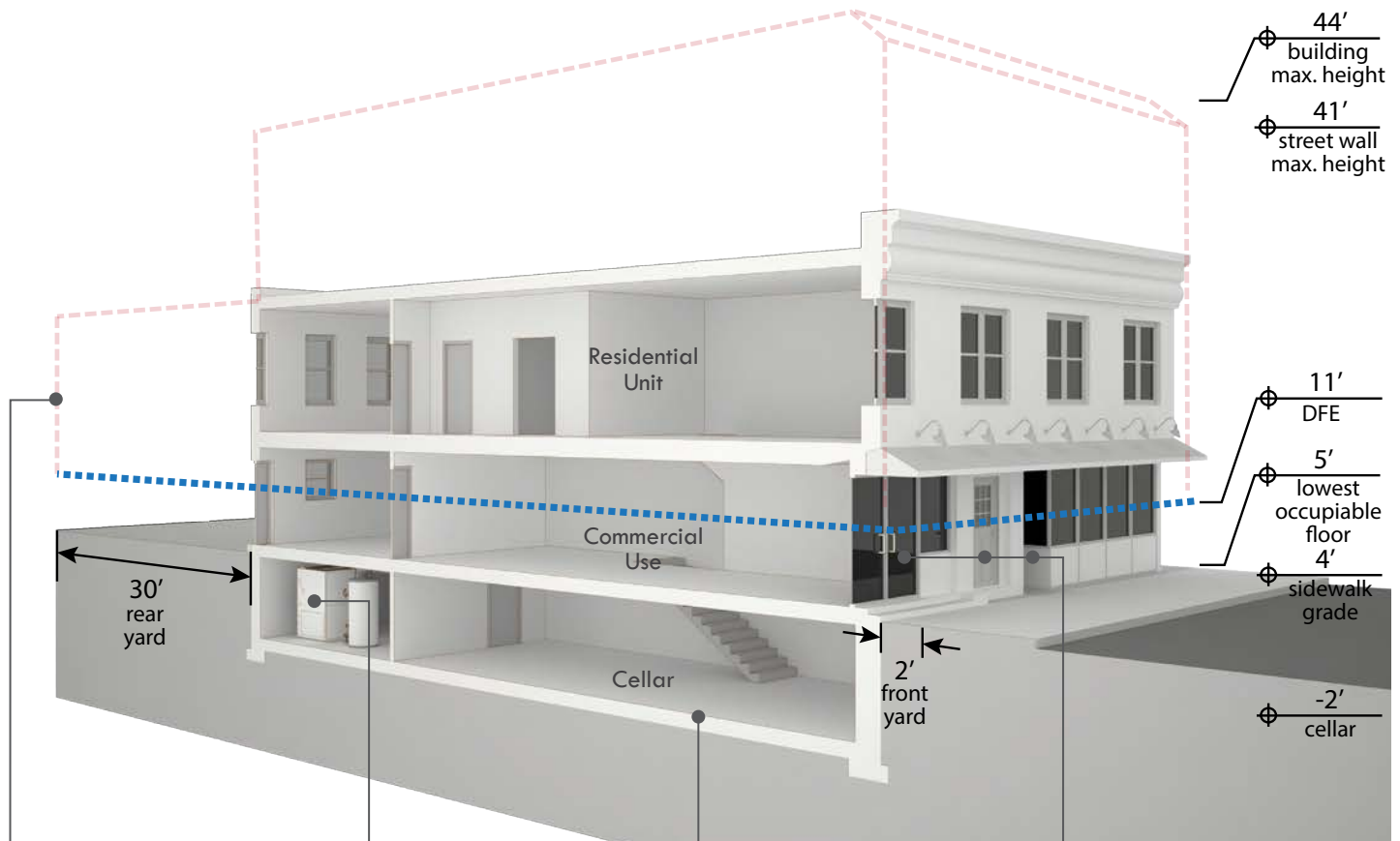


Fees and Construction Cost

EXISTING CONDITIONS

FLOOD ELEVATION

11' DFE = BFE + freeboard
 = 6' above lowest occupiable floor
 = 7' above lowest property grade



ZONING

The allowable building height is measured from the DFE. The building has a non-compliant rear yard. The building is built to the maximum allowable floor area. In compliance with zoning, the floor area below the DFE can be relocated within the adjusted bulk envelope.



CRITICAL SYSTEMS

All systems are located in a mechanical room in the cellar.



STRUCTURAL SYSTEMS

Two-story combustible construction with wood frame party-wall and wood joists on a rubble foundation.



ACCESS

Building access is provided at three front entry locations - two commercial uses and one residential lobby - at 1' above the sidewalk grade. The building access at the rear yard is provided at two locations, both 1' above the rear yard grade.

ILLUSTRATIVE RETROFIT STRATEGY

MIXED-USE
SEMI-DETACHED



ELEVATE & WET FLOODPROOF

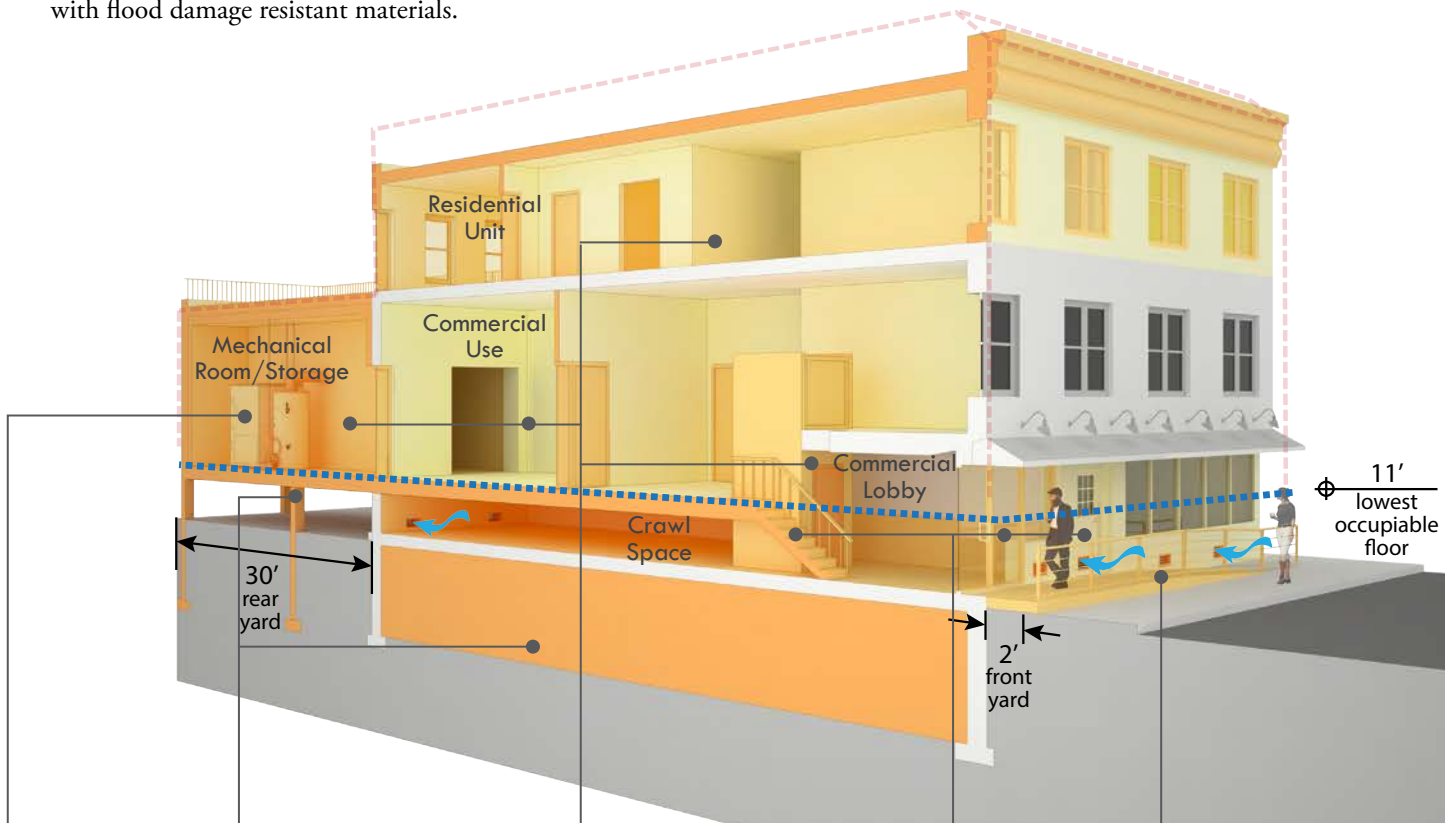
Elevate the commercial floor to the DFE by relocating a portion of the floorplate, creating a double height space and mezzanine level for both commercial spaces.

Fill cellar to lowest adjacent grade

Elevate critical systems above the DFE at rear addition.

Relocate residential unit to new addition at third story

Wet floodproof area below the DFE by installing flood vents located at all exterior and interior walls and replacing all windows, doors, structure and finishes with flood damage resistant materials.



CRITICAL SYSTEMS

Relocate systems to rear addition within fireproof and vented mechanical room.

Tie all systems back into building systems following re-location.

Install isolation and/or vibration pads as required.

STRUCTURAL SYSTEMS

Fill cellar to grade. Reinforce foundation walls and modify floor slab, as required, in cellar where fill is added. If adjacent properties are not infilling their sub-grade spaces, reinforce foundation walls to account for new load.

Reinforce foundation for new addition on roof.

Add new foundation system for addition at rear.

Relocate existing joists from the existing second story to the new lowest floor level and add support as required.

USE

Relocate the two commercial spaces to elevated floor with one entrance lobby and showpit area for both commercial spaces. Addition at rear for critical systems and storage. This addition results in loss of rear yard and addition of terrace for residential use.

Relocate residential space to new third story addition.

There is a total loss of 400 s.f. of commercial use plus 2,400 s.f. of storage and systems use in the cellar. Gain of 1,000 s.f. for systems and storage at the new rear addition.

ACCESS

Residential lobby to remain. Reconfigure if necessary for wet floodproofing requirements. New access for commercial uses in new interior lobby accessible via ramp at streetwall entry. Commercial spaces accessible by stair or lift at commercial lobby.

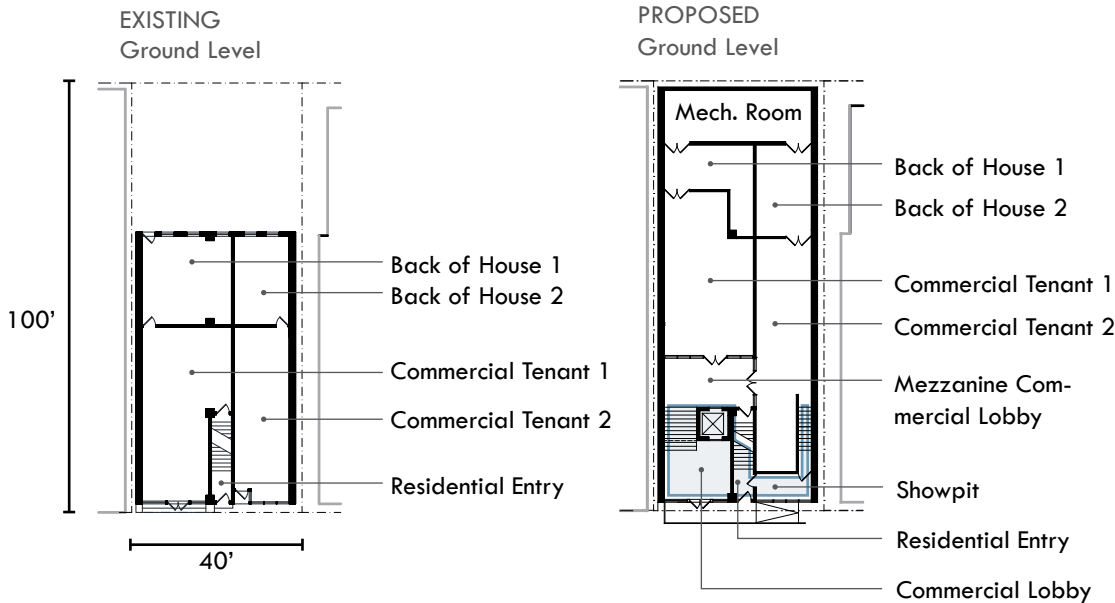
STREETSCAPE

Add ramp to commercial and residential entries. Convert one commercial entry to showpit area and replace all windows, doors and finishes with flood damage-resistant materials.

RETROFIT FLOOR PLAN



CHANGE OF USE



- Cellar Level**
Fill to lowest adjacent grade. Loss of mechanical room and commercial storage.
- Lower Ground Level**
New commercial lobby, egress path and showpit area. Residential lobby remains, reconfigure per wet floodproofing requirements.
- Upper Ground Level**
The raised ground level story becomes the lowest occupiable floor. Relocate commercial units to elevated floor. Relocate mechanical room and commercial storage to new commercial addition at rear.
- Level Two (New)**
Relocate residential units.

ADAPTATION CONSIDERATIONS



ACCESS & STREETScape

Active streetscapes along retail corridors are key to their economic vitality. While adhering to new flood regulations can present obstacles to maintaining active ground floors, there are a number of ways property owners can still provide transparency and activity at the ground level.

In this example, the illustrated alternative strategy wet floodproofs the space below the DFE with flood damage-resistant materials. However, the use of this area for seating remains non-compliant with floodplain regulations.









ACCESS & STREETScape












NON-SUBSTANTIAL DAMAGE/IMPROVEMENT STRATEGIES





Non-substantially improved buildings within the floodplain are not required to comply with Appendix G of the NYC Building Code. This allows for greater flexibility in adapting buildings for flood resiliency. The alternatives illustrated below lower the risk for buildings and provide practical pathways for adaptation. Under current NFIP regulations, these measures may not lower insurance premiums. The blue icons below illustrate adaptive measures that receive full reduction of NFIP premiums. Icons in gray indicate strategies that improve building resilience, but receive no or partial reduction of NFIP premiums. If the lowest occupiable floor is left below the DFE, life safety must be considered. Residents should always follow evacuation procedures.


-  Occupied Space
-  Critical Systems
-  Dry Floodproof
-  Wet Floodproof
-  Open Structure
-  NFIP Premium Reduction

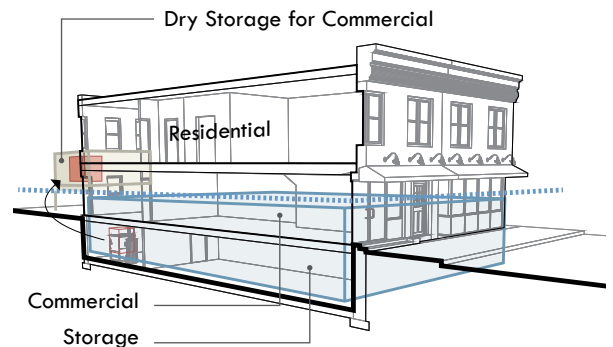
-  Dry floodproof commercial space. Install deployable flood shields at front and rear openings below the DFE. Provide alternate means of egress through residential lobby.
-  Wet floodproof residential lobby. Install flood vents and replace all windows, doors, and finishes with flood damage-resistant materials.
-  Fill the cellar to lowest adjacent grade. Elevate the critical systems above the DFE.
-  Loss of use at the cellar. Existing commercial space and residential lobby uses below the DFE are to remain.
-  Fill cellar to the lowest adjacent grade, remove cellar slab and add reinforcement. Ensure changes to party-walls do not impact neighboring property's structural integrity. Add support at roof for relocated systems.
-  Relocate critical systems to the roof within a fire-rated and vented enclosure. Raise electrical utilities above DFE within an electrical closet on the ground level.





 Full NFIP premium reduction.




-  Wet floodproof below the DFE. Install flood vents and replace all windows, doors and finishes with flood-damage-resistant materials.
-  New addition at rear used as mechanical room and dry storage. Existing commercial, storage and residential lobby uses below the DFE are to remain. Cellar to remain.
-  Relocate critical systems within fire-rated and vented enclosure at rear-yard addition above the DFE.
-  Commercial entrances and residential lobby to remain, Reconfigure residential lobby as required per wet floodproofing engineering requirements.

 No or partial reduction in NFIP premiums. The structure is not filled to the lowest adjacent grade. **Wet floodproofing is not permitted at commercial use.**



-  Dry floodproof below the DFE by strengthening the foundation, floors and walls and sealing all penetrations. Install deployable flood shields, front and rear windows, and doors.
-  Existing commercial, residential lobby and cellar uses below the DFE are to remain. Provide egress route up and over flood shields at commercial and residential uses.
-  Add reinforcement to party walls, exterior walls and foundation slab at dry floodproof enclosure, and ensure changes do not impact neighboring property's structural integrity.
-  Critical systems to remain in place within dry floodproofed enclosure. Provide emergency shut off above the DFE.

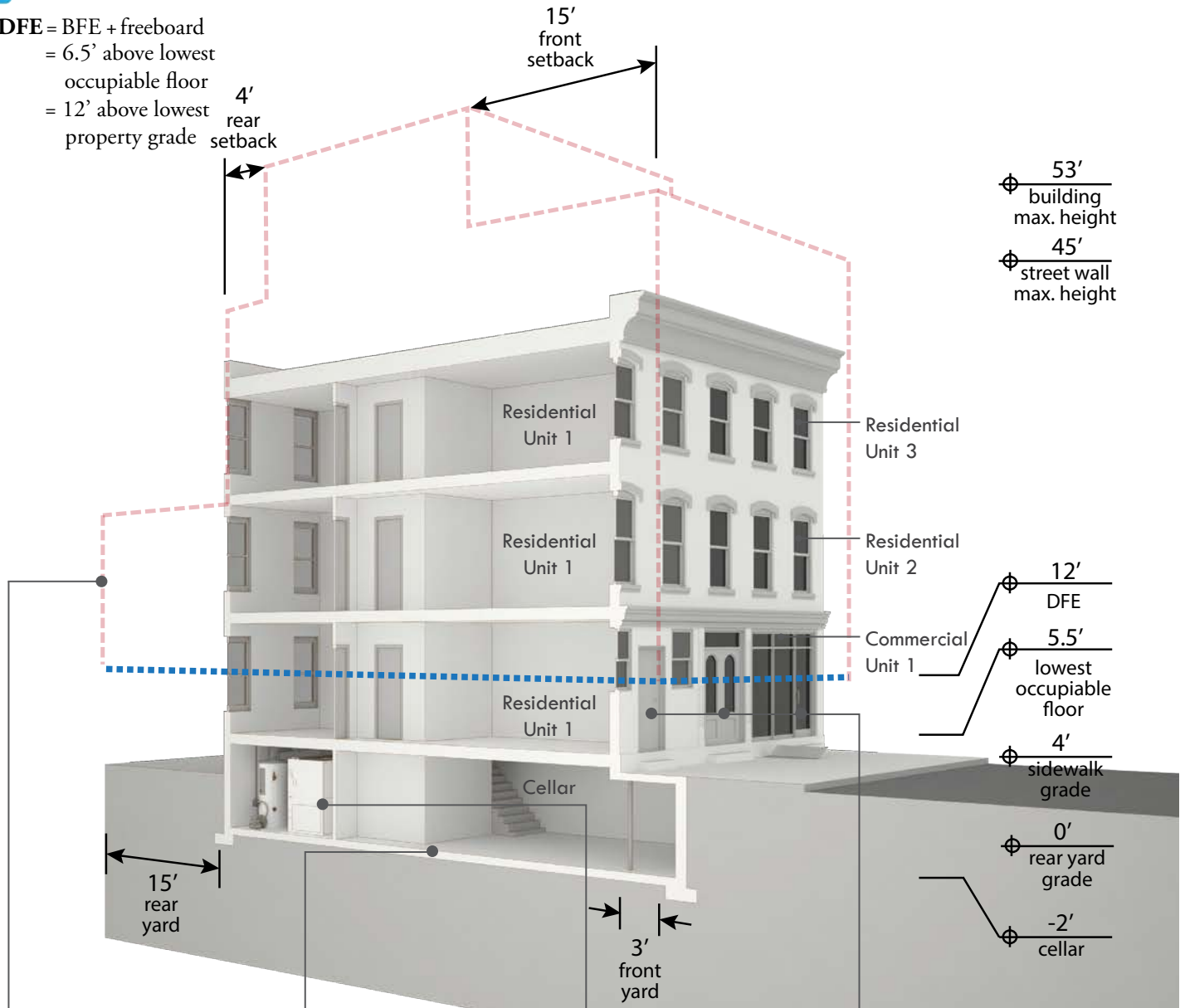
 No or partial reduction in NFIP premiums. The critical systems remain located below the DFE and the structure is not filled to the lowest adjacent grade. **Dry floodproofing below the lowest adjacent grade is not recognized.**



EXISTING CONDITIONS

FLOOD ELEVATION

12' DFE = BFE + freeboard
 = 6.5' above lowest occupiable floor
 = 12' above lowest property grade



ZONING

The allowable building height is measured from the DFE. The building is built to the maximum allowable floor area. In compliance with zoning, the floor area below the DFE can be relocated within the adjusted bulk envelope.

STRUCTURAL SYSTEMS

Three-story combustible construction with unreinforced masonry bearing party-walls and wood joists on a rubble foundation.

CRITICAL SYSTEMS

All systems are located in a mechanical room in the cellar.

ACCESS

Building access is provided at three front locations - one commercial entrance, one residential lobby and one residential entrance, all at 1.5' above the sidewalk grade. The building access at the rear yard is provided at two locations - one 4' above and the second 5' below the rear yard grade.



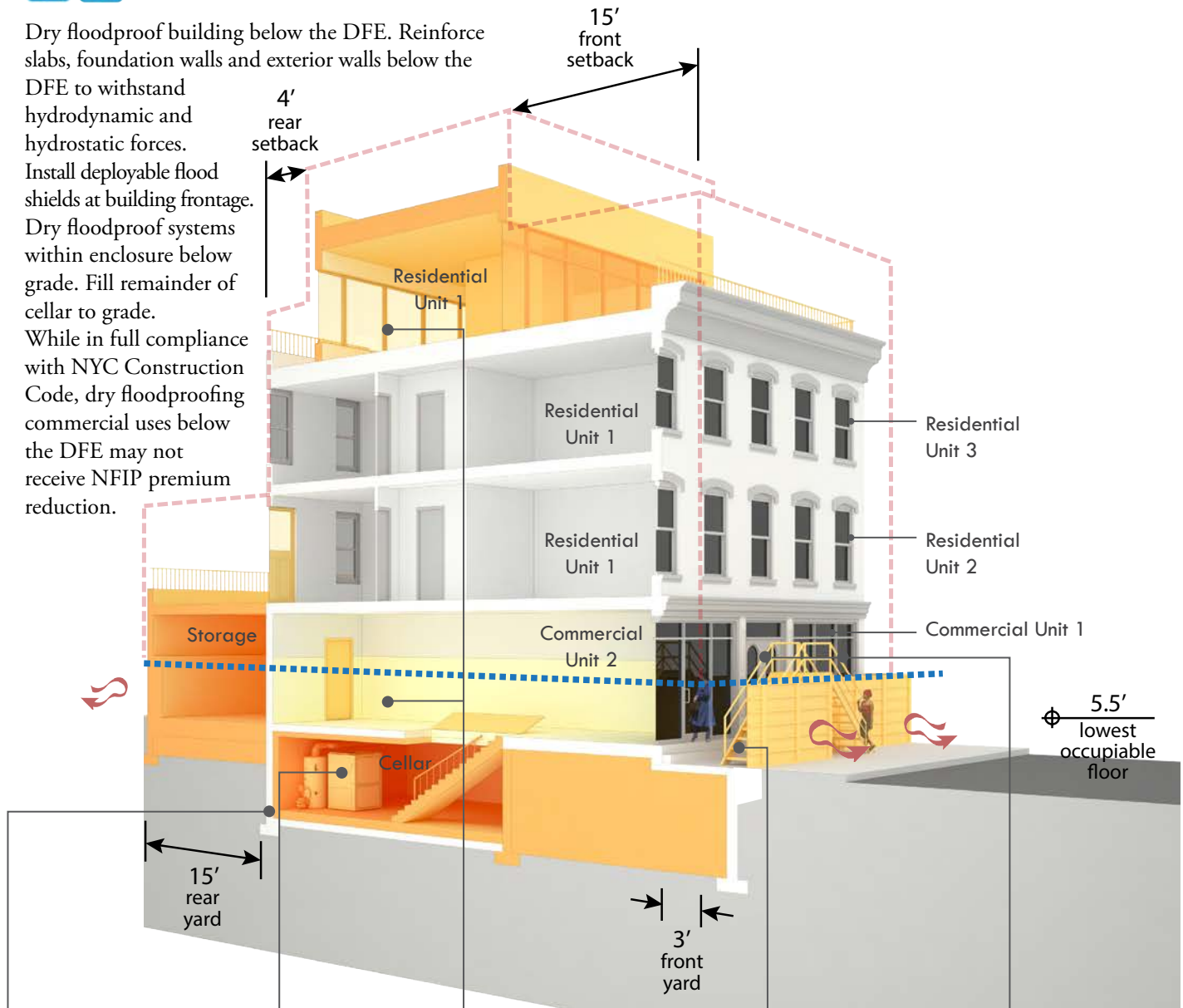
ELEVATE & DRY FLOODPROOF

Dry floodproof building below the DFE. Reinforce slabs, foundation walls and exterior walls below the DFE to withstand hydrodynamic and hydrostatic forces.

Install deployable flood shields at building frontage.

Dry floodproof systems within enclosure below grade. Fill remainder of cellar to grade.

While in full compliance with NYC Construction Code, dry floodproofing commercial uses below the DFE may not receive NFIP premium reduction.



STRUCTURAL SYSTEMS

Fill partial cellar to lowest adjacent grade. Infilling and dry floodproofing all areas below the DFE requires reinforcing the foundation walls and slab. If adjacent properties are not infilling their sub-grade spaces, reinforce foundation walls to account for new load. Add new foundation system for addition at rear. Add reinforcement at foundation wall below the sidewalk and at the building facade for flood shields.



CRITICAL SYSTEMS

Systems to remain in place within dry floodproofed enclosure. Provide new stair access from commercial space. Locate remote emergency shut-off above the DFE. Install waterproof damper at the combustible air intake in mechanical room.



USE

Convert residential use below the DFE to commercial use and maximize the allowable floor area with a new addition at the rear. New addition involves loss of rear yard. Loss of use of the cellar with the exception of the mechanical room. Relocate the residential area below the DFE to the new 4th story addition. Gain 600 s.f. of commercial space.



STREETSCAPE

Existing residential lobby access to remain. Provide accessible entry at new commercial entries. Convert facade design of old residential use to comply with commercial streetscape mitigation requirements. Deployable flood shields and temporary stairs installed in public right of way per DOT revocable consent regulations.



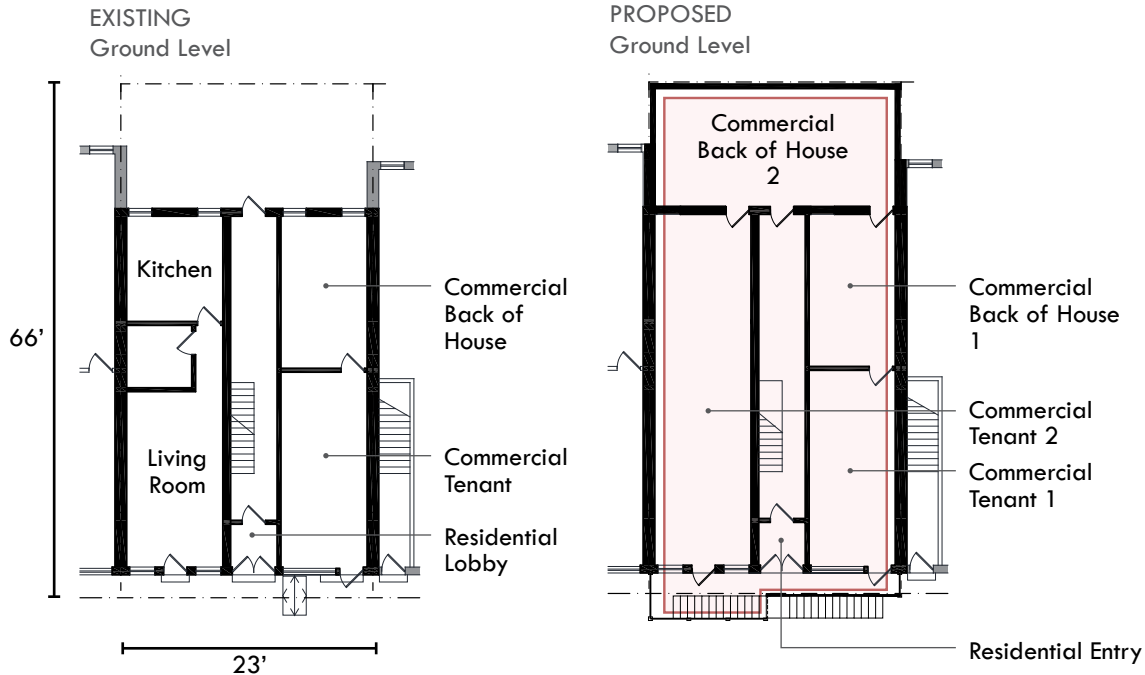
ACCESS

Residential lobby to remain. Provide accessible entry at new commercial storefront. When deployable flood shields are in use, all egress paths must be provided via temporary stairs up and over the gates. Obtain DOT permit as required.

RETROFIT FLOOR PLAN



CHANGE OF USE



Cellar Level
Mechanical room to remain.
Fill storage area to lowest adjacent grade.
Loss of storage.

Ground Level
Convert residential to commercial use.
Residential lobby remains.
New commercial dry storage at rear addition.

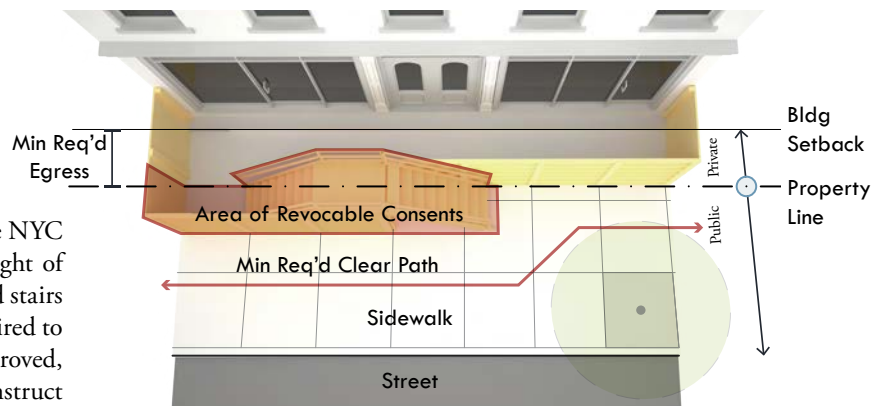
Level Four (New)
Relocate lost ground floor residential use.

ADAPTATION CONSIDERATIONS



DRY FLOODPROOFING

Temporary flood shields and egress stairs deployed in front of a building are subject to building code and DOT requirements where shields and/or stairs are partially or fully in the public right of way. NYC DOB requirements for building access, width of egress, structural stability, headroom, and clearance height are tied to the building's occupancy and use, while NYC DOT has requirements and clearances for the public right of way. Given that a portion of the flood shield assembly and stairs falls into the sidewalk, the property owner would be required to apply for revocable consents from the City which, if approved, grants the right to an individual or organization to construct and maintain certain structures on, over or under the inalienable property of the City – the streets and sidewalks.



ACCESS & STREETScape





NON-SUBSTANTIAL DAMAGE/IMPROVEMENT STRATEGIES

Non-substantially improved buildings within the floodplain are not required to comply with Appendix G of the NYC Building Code. This allows for greater flexibility in adapting buildings for flood resiliency. The alternatives illustrated below lower the risk for buildings and provide practical pathways for adaptation. Under current NFIP regulations, these measures may not lower insurance premiums. The blue icons below illustrate adaptive measures that receive full reduction of NFIP premiums. Icons in gray indicate strategies that improve building resilience, but receive no or partial reduction of NFIP premiums. If the lowest occupiable floor is left below the DFE, life safety must be considered. Residents should always follow evacuation procedures.

- Occupied Space
- Critical Systems
- Dry Floodproof
- Wet Floodproof
- Open Structure
- NFIP Premium Reduction

- Dry floodproof below DFE. Install deployable flood shields at front and rear prior to flood event. Provide alternate means of egress over flood shields.
- Existing residential, residential lobby, commercial and storage use below DFE are to remain. Cellar below lowest adjacent grade to remain.
- Add reinforcement to party walls, exterior walls and foundation slab at dry floodproof enclosure and ensure changes do not impact neighboring property's structural integrity.
- Critical systems to remain in place within dry floodproofed enclosure. Provide emergency shut off above the DFE.

No or partial reduction in NFIP premiums. Critical systems and residential uses remain below the DFE. Cellar remains. **Dry floodproofing is not permitted at residential use.** Lowest occupiable floor is below the DFE.



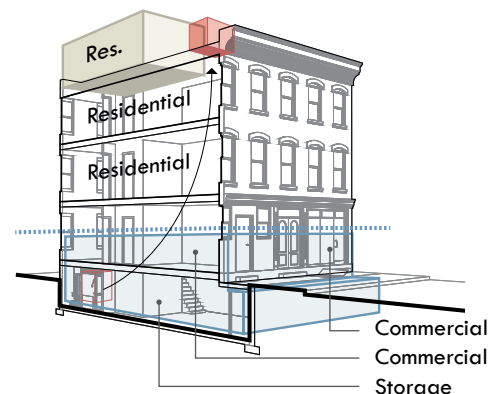
- Relocate residential and commercial systems within fire-rated and vented enclosure in rear-yard addition above the DFE.
- Addition in rear for mechanical room and dry storage. Cellar below lowest adjacent grade to remain. Residential, commercial, and storage uses below the DFE remain.

No or partial reduction in NFIP premiums. Residential use remains located below the DFE and the structure is not filled to the lowest adjacent grade. Lowest occupiable floor is below the DFE.



- Wet floodproof below the DFE. Install flood vents and replace all windows, doors and finishes with flood damage-resistant materials.
- Convert residential space below the DFE to commercial use. Cellar below lowest adjacent grade to remain. Relocated residential use and critical systems to roof addition.
- Relocate critical systems to the roof within a fire-rated and vented enclosure. Raise electrical utilities above DFE within electrical closet on the ground level.

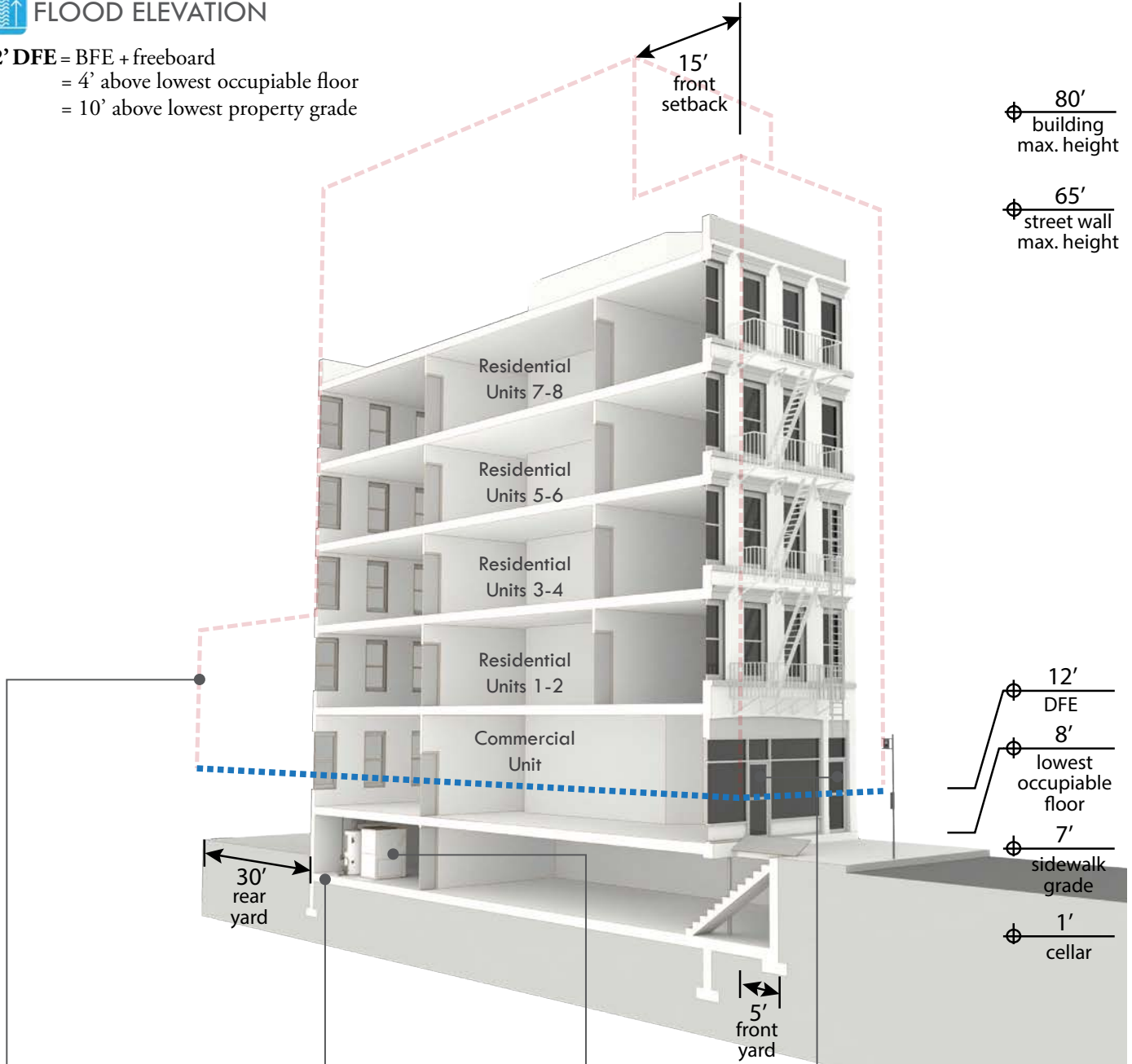
No or partial reduction in NFIP premiums. The structure is not filled to the lowest adjacent grade. **Wet floodproofing is not permitted at commercial use.**



EXISTING CONDITIONS

FLOOD ELEVATION

12' DFE = BFE + freeboard
 = 4' above lowest occupiable floor
 = 10' above lowest property grade



ZONING

The allowable building height is measured from the DFE. The building is built to the maximum allowable floor area. In compliance with zoning, the floor area below the DFE can be relocated within the adjusted bulk envelope.

STRUCTURAL SYSTEMS

Five-story combustible construction with unreinforced masonry bearing party-walls and wood joists on a rubble foundation.

CRITICAL SYSTEMS

All systems are located in a mechanical room in the basement.

ACCESS

Building access is provided at two front locations - one for commercial use and one residential lobby, both 1' above the sidewalk grade. The building access at the rear yard is provided at two locations, one 5' above rear yard grade and the other 3' below the rear yard grade.

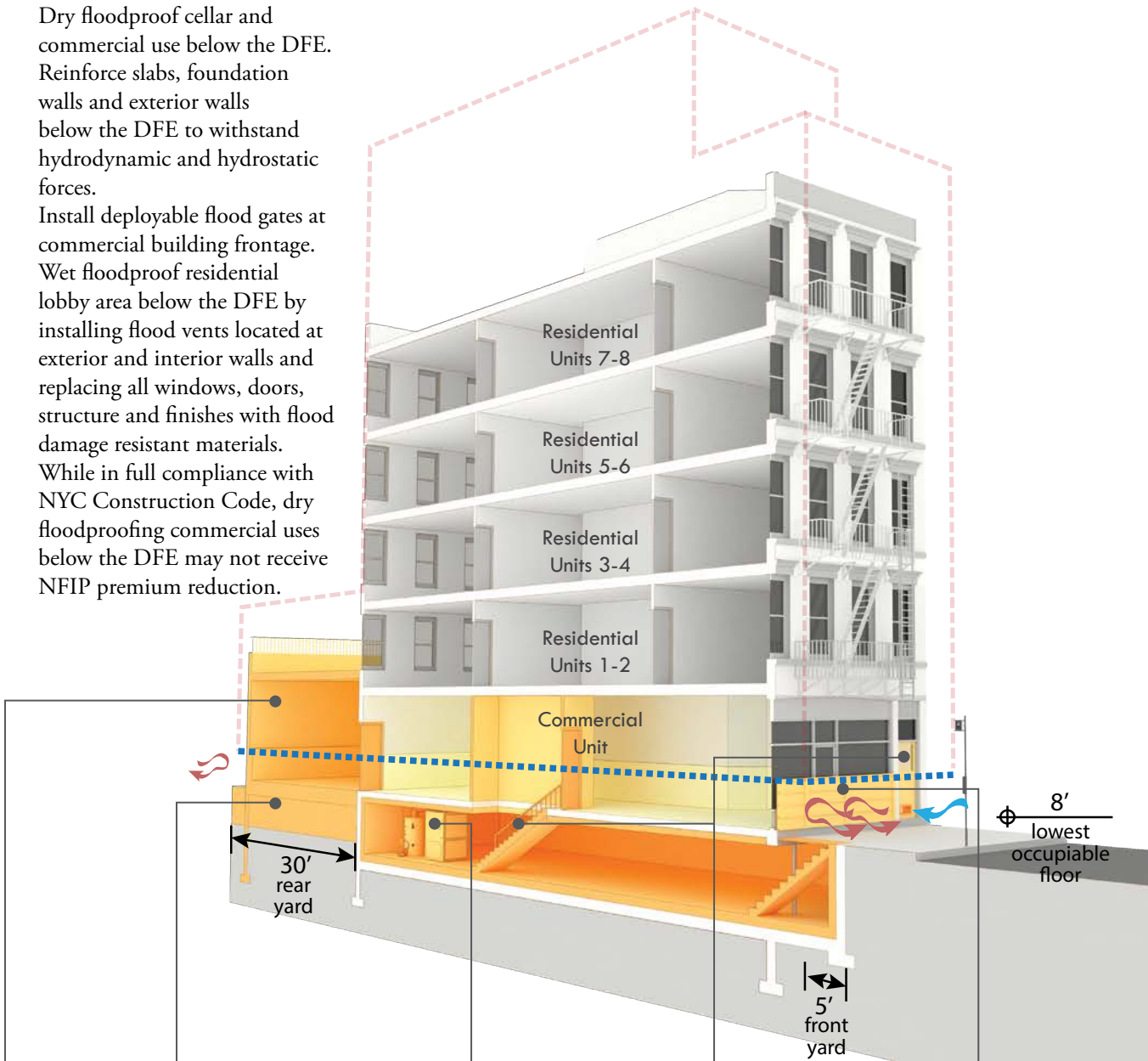
ILLUSTRATIVE RETROFIT STRATEGY

MIXED-USE
MID-RISE WALK-UP



DRY & WET FLOODPROOF

Dry floodproof cellar and commercial use below the DFE. Reinforce slabs, foundation walls and exterior walls below the DFE to withstand hydrodynamic and hydrostatic forces. Install deployable flood gates at commercial building frontage. Wet floodproof residential lobby area below the DFE by installing flood vents located at exterior and interior walls and replacing all windows, doors, structure and finishes with flood damage resistant materials. While in full compliance with NYC Construction Code, dry floodproofing commercial uses below the DFE may not receive NFIP premium reduction.



USE

Maximize commercial use with new addition at rear. There is a total gain of 700 s.f. of commercial use.

STRUCTURAL SYSTEMS

Dry floodproofing all areas below the DFE requires reinforcing the foundation walls and slab. Underpin slab with helical piles. Repoint stone walls and fill all voids prior to membrane application. Fill all voids between joists with approved insulation membrane. New reinforced concrete slabs and walls poured over membranes. Reinforce interior and exterior walls above grade to withstand flood loads and flood gates. Reinforce interior walls separating wet and dry floodproof areas.

CRITICAL SYSTEMS

Systems to remain in place within dry floodproofed cellar. Provide new stair access from commercial space. Locate remote emergency shut-off above the DFE. Install waterproof damper at the combustible air intake in mechanical room.

ACCESS

Reconfigure residential lobby per wet floodproofing requirements. Provide new interior access to cellar. Replace access hatch at sidewalk with floodproof compliant model. When deployable flood shields are in use all egress paths must be provided via temporary stairs up and over the gates. Obtain DOT permit as required.

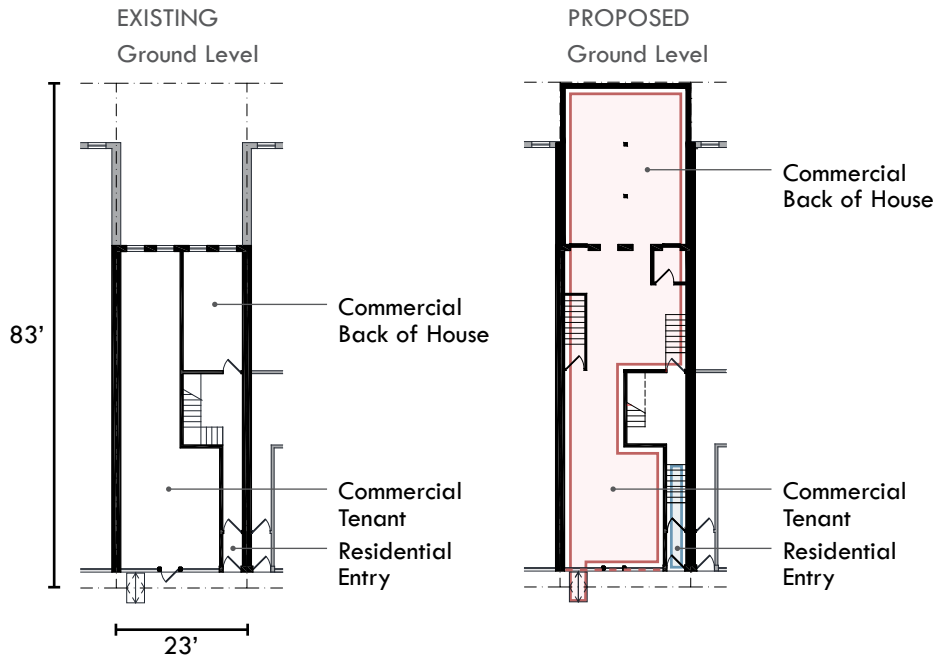
STREETScape

Residential and commercial storefront entries to remain. Deployable flood shields and temporary stairs installed per DOT revocable consent regulations.

RETROFIT FLOOR PLAN



CHANGE OF USE



Cellar Level

Storage and mechanical room to remain.

Ground Level

Commercial use remains. Reconfigure to accommodate egress and mechanical access requirements.

New commercial storage at rear addition.

Residential lobby remains; reconfigure per wet floodproofing requirements.

ADAPTATION CONSIDERATIONS



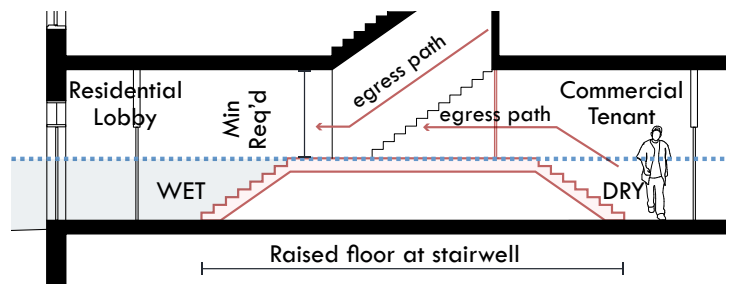
ACCESS

Emergency ingress and egress must be provided when use of temporary flood shields have been deployed. Temporary stairs provide such access if they meet code requirements for stair width, step rise and run, landing, head room height and access doorway clearances. Tie downs are required as well to ensure the stairs and platform resist buoyancy in a flood event.



WET & DRY FLOODPROOFING

A raised floor and stair in the residential lobby space connects to the existing stair for residential units above while providing a new egress route for the commercial tenant. The lobby space adjacent to the entry is wet floodproofed while the rest of the ground floor commercial space is dry floodproofed.









ACCESS & STREETScape










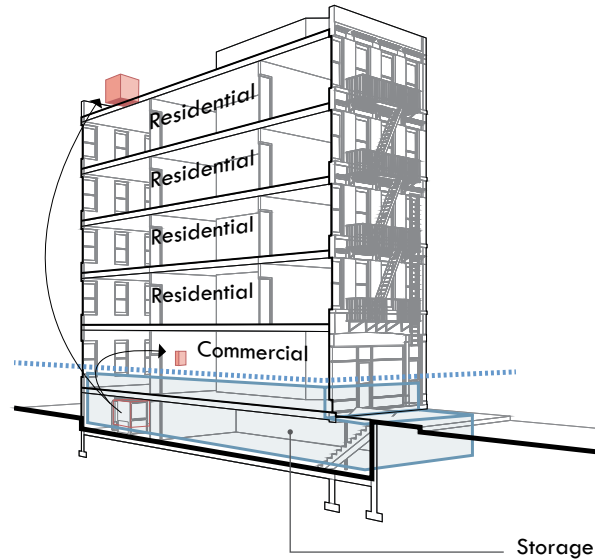
NON-SUBSTANTIAL DAMAGE/IMPROVEMENT STRATEGIES





Non-substantially improved buildings within the floodplain are not required to comply with Appendix G of the NYC Building Code. This allows for greater flexibility in adapting buildings for flood resiliency. The alternatives illustrated below lower the risk for buildings and provide practical pathways for adaptation. Under current NFIP regulations, these measures may not lower insurance premiums. The blue icons below illustrate adaptive measures that receive full reduction of NFIP premiums. Icons in gray indicate strategies that improve building resilience, but receive no or partial reduction of NFIP premiums. If the lowest occupiable floor is left below the DFE, life safety must be considered. Residents should always follow evacuation procedures.


-  Occupied Space
-  Critical Systems
-  Dry Floodproof
-  Wet Floodproof
-  Open Structure
-  NFIP Premium Reduction

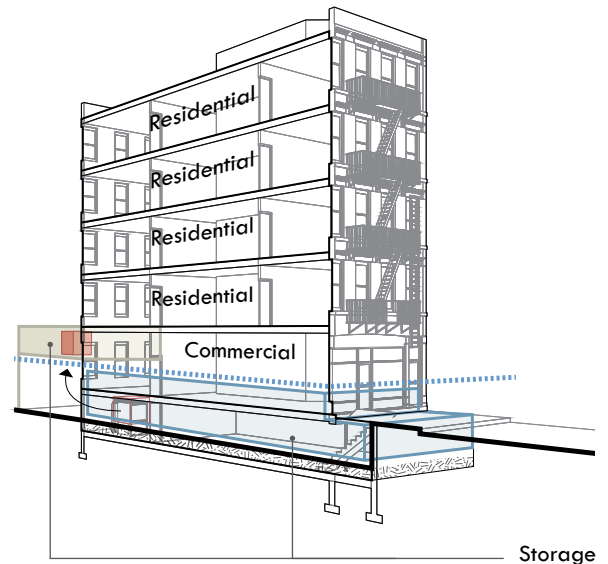
-  Wet floodproof below the DFE. Install flood vents and replace all windows, doors and finishes with flood damage-resistant materials.
-  Restrict cellar use to storage. Ground floor commercial and residential lobby uses remain.
-  Add reinforcement for relocated systems on roof.
-  Relocate critical systems to the roof within a fireproof and vented enclosure. Raise electrical utilities above the DFE.

 No or partial reduction in NFIP premiums. The structure is not filled to the lowest adjacent grade. **Wet floodproofing is not permitted at commercial use or below the lowest adjacent grade.**



-  Wet floodproof below the DFE. Install flood vents and replace all windows, doors and finishes with flood damage-resistant materials.
-  Addition in rear for mechanical room and dry storage. Existing commercial, storage and residential lobby uses below the DFE remain. Basement filled to lowest adjacent grade and converted to crawl space.
-  Fill basement to the lowest adjacent grade. Ensure changes to party-walls do not impact neighboring property's structural integrity.
-  Relocate systems to rear addition.

 No or partial reduction in NFIP premiums. **Wet floodproofing is not permitted at commercial use or below the lowest adjacent grade.**



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Data Sources

Federal Emergency Management Agency
NYC Panel on Climate Change
NYS Department of Labor, *Quarterly Census of Employment and Wages*

External Contributors

Mayor's Office of Recovery & Resiliency (ORR)
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North Shore Business Association
Rockaway Development and Revitalization Corp.
Southwest Brooklyn IDC
Staten Island Chamber of Commerce
Staten Island Economic Development Corporation
Two Bridges Neighborhood Council

RESOURCES

TECHNICAL GUIDANCE

New York City Department of City Planning

Retrofitting Buildings for Flood Risk

nyc.gov/retrofittingforfloordrisk

Designing for Flood Risk

nyc.gov/designingforfloordrisk

Urban Waterfront Adaptive Strategies

nyc.gov/uwas

Flood Resilience Zoning Text Amendment

nyc.gov/assets/planning/download/pdf/plans/flood-resiliency/flood-resiliency.pdf

Special Regulations for Neighborhood Recovery

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

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

