

Southern Manhattan

Since the Dutch sailed into New York Harbor, the area now known as Lower Manhattan has been at the center of things. Lower Manhattan is where George Washington was inaugurated, where Thomas Edison first installed electric streetlights, and where what would become the world's largest stock exchange was founded. Even New York City's sprawling subway system got its start here. To this day, the more than 500 acres south of Chambers Street hold a place of disproportionate importance for the entire city, region, nation, and world.

As defined in this report, Southern Manhattan, though, is more than just the tip of the borough. It includes the areas along the coastal edges of Manhattan north to 42nd Street, encompassing portions of the neighborhoods of Chinatown, the Lower East Side, Stuyvesant

Town, and Kips Bay on the east, and Tribeca, the West Village, Chelsea, and Hudson Yards on the west. (See map: *Neighborhoods of Southern Manhattan*)

These neighborhoods, together with Lower Manhattan, are critical to the city and region. Southern Manhattan contains the fourth-largest business district in the United States. It lies at the heart of New York's transportation networks. It is a mass-transit hub, with 19 subway lines pulsing underfoot carrying millions of riders a day. It has heliports, ferry landings, and contains other key facilities on which all New York City depends, from power substations to healthcare institutions. And, not incidentally, it is home to nearly 200,000 people and approximately 300,000 workers—all while playing host to tens of millions of tourists each year.

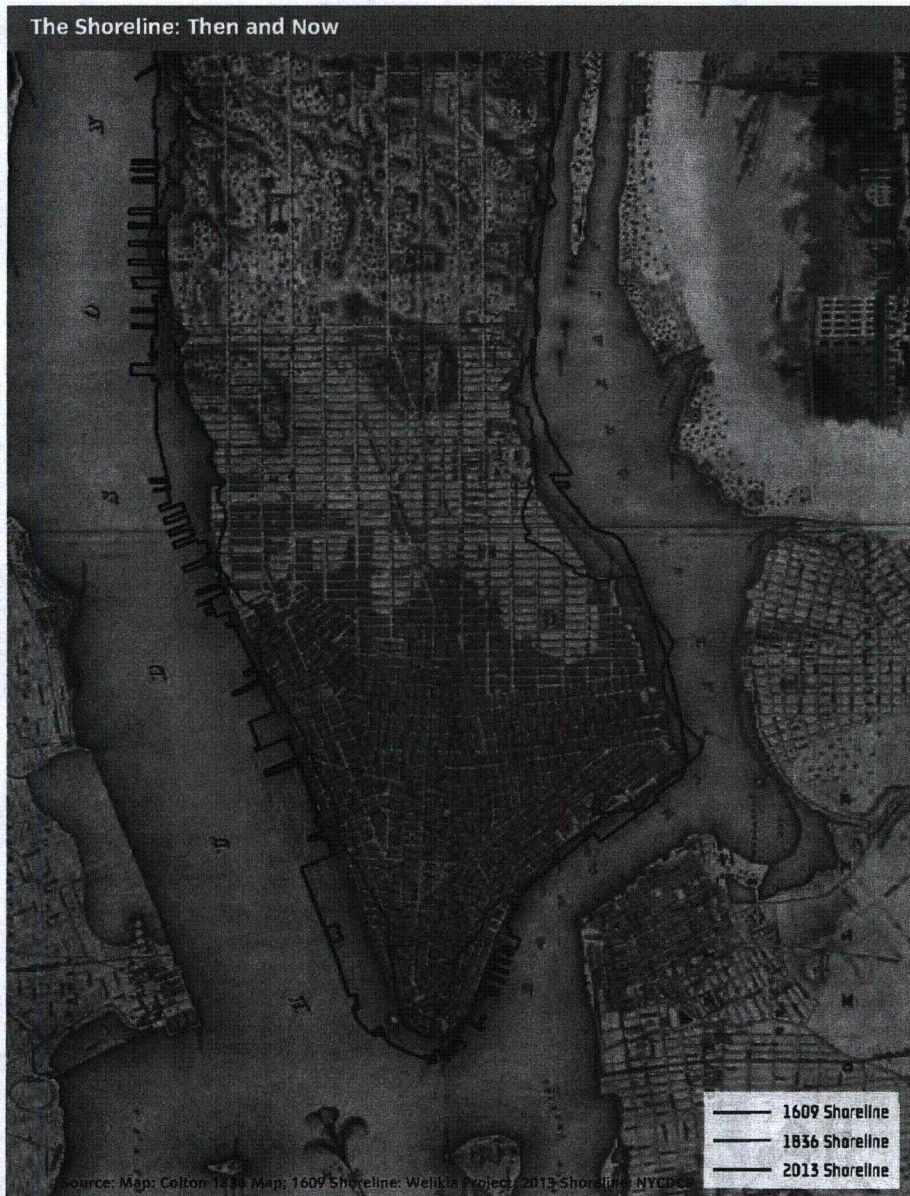
Yet, astonishingly, nearly 40 percent of the land on which Southern Manhattan sits *did not even exist* when the Dutch first arrived.

As the colony, initially called Nieuw Amsterdam and later named New York, grew and prospered, it became a magnet for people from all over the world, creating constant pressure for expansion. Residents moved northward, filling in streams and marshes to make way for roads and houses. From the earliest days, they also expanded outward, seeking access to the water. In the beginning, piers, wharves, and docks were built to facilitate maritime activity. In time, though, the people of the colony added land as well, held in place by stone or concrete "bulkheads," or retaining walls, and always at a low elevation. From the time of the Dutch, to the time of the British, through the modern age, approximately 900 acres would be added to the coasts of Southern Manhattan. (See map: *The Shoreline: Then and Now*)

Whether natural or manmade, the coastal areas of Southern Manhattan have been crucial to New York's evolution from trading post, to major port, to global city—even as the uses of these coastal areas constantly evolved. Through the beginning of the 20th century, industry and maritime interests dominated. Eventually, with the rise of the automobile, major arterial highways were paved along the waterfront. As maritime activity along the Manhattan shoreline declined, especially after World War II, waterfront buildings and piers fell into disrepair, as did many adjacent inland areas, which were occupied by dilapidated commercial buildings, vacant warehouses, and rundown tenement buildings.

In time, the Southern Manhattan shoreline entered an area of transition. Civic leaders recognized that the waterfront could once again become a valuable asset, as a home for parks and new residential and commercial office development. However, through it all, Southern Manhattan's low-lying coastal edges remained vulnerable to extreme weather—a fact that Sandy made painfully clear.

As Sandy's surge entered New York Harbor, it breached the bulkheads all around Southern Manhattan, bringing floodwaters one and two blocks inland and in some cases even farther. Those who lived in, worked in, or owned businesses in Southern Manhattan were, of course, directly affected. The waters that coursed into residential buildings, stores, and office buildings compromised building systems, damaged interiors, and destroyed personal property.



Source: Map: Colton 1854 Map; 1609 Shoreline: Welikia Project; 2013 Shoreline: NYCDO

However, Sandy's floodwaters also disabled critical infrastructure arrayed all along the coast—infrastructure that served citywide networks—and this had widespread repercussions.

In short order, workplaces, schools, and institutions that served all New Yorkers were closed. Even mail delivery was disrupted. Put simply, the crippling of Southern Manhattan during Sandy impaired the entire city.

Though many parts of Southern Manhattan have recovered as of the writing of this report, work remains in certain areas. Additionally, based on recently released flood maps from the Federal Emergency Management Agency (FEMA) and the latest climate projections, it is likely that the threats to Southern Manhattan will increase—with particular vulnerability along the east side and in Lower Manhattan, which is surrounded on three sides by water.

To address these threats, the City has developed a plan for Southern Manhattan that reflects the overarching goals of this report—to limit the effects of extreme weather while enabling New York and its neighborhoods to bounce back quickly when those impacts cannot be avoided. The plan addresses Southern Manhattan's most significant risk—its vulnerability to storm surge and rising sea levels—seeking to limit exposures to floodwaters, make buildings more resilient, and protect vital infrastructure more effectively. The plan also addresses other risks that the area faces—including more frequent and intense heat waves and an increase in the most intense hurricanes and associated winds—by drawing on both citywide and locally tailored initiatives. Finally the plan will help strengthen Southern Manhattan's commercial districts and enhance the area's vibrancy as a destination for visitors and a home for residents—all of which will ensure that, going forward, Southern Manhattan is able to continue to play its traditional role as a center for the entire city and region.

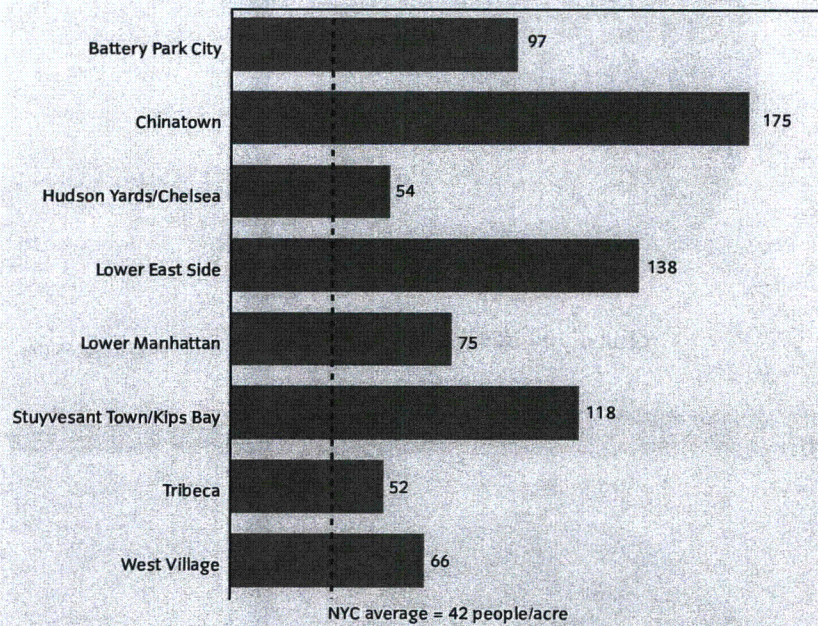
Area Characteristics

Manhattan (New York County) is the most densely populated county in the United States, and the neighborhoods of Southern Manhattan reflect this, all having population densities greater than the citywide average. These densely developed areas contain a total of 285 million built square feet, including 180 million square feet of commercial space and 105 million square feet of residential space. Southern Manhattan is, moreover, a hub of multiple infrastructure systems that serve the wider city and region. (See chart: *Area Population Density*)

Neighborhoods of Southern Manhattan



Area Population Density



Note: Peter Cooper Village included in Stuyvesant Town/Kips Bay

Source: 2010 US Census

At the water's edge, Southern Manhattan is rimmed by a bulkhead wall, which generally fronts on public space. These spaces range from the East River Park and East River Esplanade on the East Side, to Battery Park in the south, to the public spaces of Battery Park City and Hudson River Park on the West Side. On both the East Side and West Side, the area's public open spaces are bordered by major roadways—the FDR Drive and West Street (also known as Route 9A), respectively.

Neighborhoods and Residential Development

Though they share geographic proximity, the neighborhoods of Southern Manhattan—which together contain a population of nearly 200,000—are distinct. Even with this variety, the neighborhoods of Southern Manhattan generally can be grouped into three categories: those that are primarily residential, save for local retail and scattered commercial space; those that are primarily residential, with significant commercial space and other attractions that draw people

from outside of the area; and those that are primarily commercial but increasingly have residential populations. Generally speaking, the first category applies to the neighborhoods that line the East River, the second category applies to the neighborhoods along the Hudson River, and the third category applies to the neighborhoods of Lower Manhattan.

Since development in Southern Manhattan has been unfolding over centuries, the area contains a rich array of building types, ranging from walk-ups of five and six stories to high-rise residential towers, and from industrial buildings to commercial skyscrapers. Though 90 percent of the buildings in the area were erected before 1983, when modern flood-protection standards

were incorporated into the City's Building Code, these buildings are primarily constructed of robust materials including steel, masonry, and concrete. This is generally true even of the over 1,700 buildings in Southern Manhattan that are within the area's 19 historic districts. (See chart: *Area Buildings Characterized by Type*)

Not surprisingly, given the area's density, nearly all (99 percent) of the 102,000 residential units in Southern Manhattan can be found in multi-story buildings. These include the buildings of the 24 public housing developments operated by the New York City Housing Authority (NYCHA), containing over 15,000 housing units. (See chart: *Area Housing Units Characterized by Building Type*)

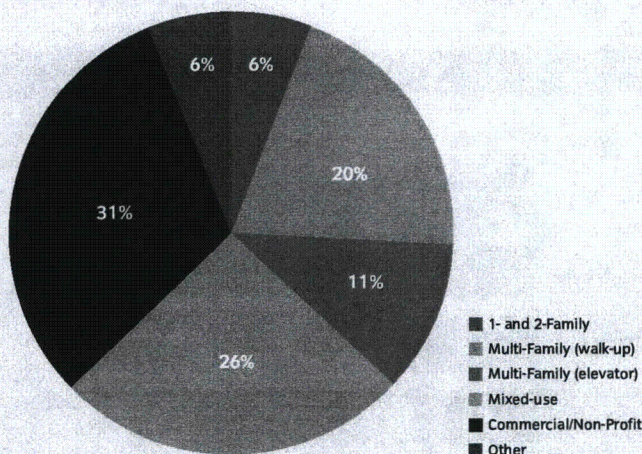
As described above, the neighborhoods lining the East River—Chinatown, the Lower East Side, Stuyvesant Town, and Kips Bay—generally can be characterized as residential areas with local retail stores, though there are exceptions to this characterization, including larger commercial establishments in Chinatown and the hospitals in Kips Bay. In most cases, the 98,500 people who live in these four neighborhoods reside in multi-story attached buildings or in developments comprised of high-rise towers in park-like settings.

Of these neighborhoods, the Lower East Side and Chinatown (including the so-called Two Bridges area) are the most densely populated (and, in fact, are the most densely populated neighborhoods in all of Southern Manhattan), with population densities of 138 and 175 residents per acre, respectively. Together these two neighborhoods alone are home to 70,400 residents, accounting for nearly 36 percent of all Southern Manhattan residents. Starting in the 1940s, large portions of these neighborhoods were developed through urban renewal, which led to concentrations of affordable housing of various kinds. As a result, the Lower East Side and Chinatown contain over 13,000 units of NYCHA housing, for example.

Kips Bay and Stuyvesant Town, which together have a population of 28,100, are slightly less densely populated than the Lower East Side and Chinatown, with 118 residents per acre. Stuyvesant Town (including neighboring Peter Cooper Village) is a planned community built after World War II by the Metropolitan Life Insurance Company, containing 20,000 units in a "tower in the park" setting. Kips Bay, meanwhile, is an older neighborhood with a mix of high-rise residential buildings and walk-ups.

By contrast, the neighborhoods along the Hudson River, while also possessing a strong residential base, contain more significant commercial and retail space. Together, these neighborhoods—Tribeca, the West Village, Chelsea, and Hudson Yards—have 47,900 residents and population densities of 52 to 66 residents per acre. They also attract sizable numbers of workers and visitors from outside of the neighborhoods, working in offices in Hudson Square, browsing at galleries in Chelsea or visiting the High Line. Generally, these areas are characterized by multi-story attached residential buildings as well as multi-story former industrial buildings that have been converted to commercial and residential uses. In many parts of these neighborhoods, shops and restaurants at the street level add liveliness and character to these areas.

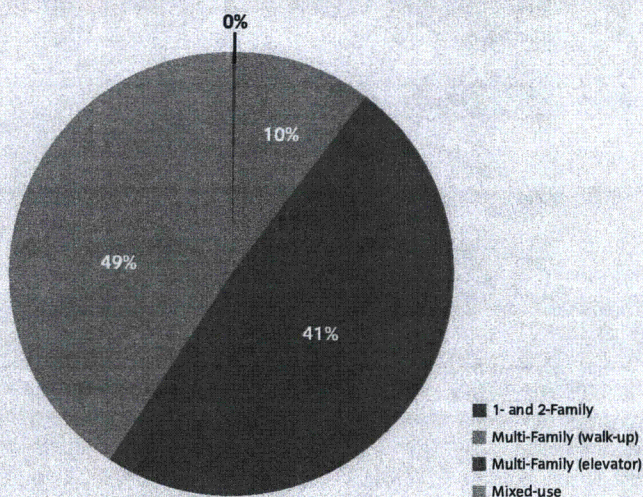
Area Buildings Characterized by Type



Total: 4,900 Buildings

Source: DCP PLUTO

Area Housing Units Characterized by Building Type



Total: 102,000 Housing Units

Source: DCP PLUTO

Socioeconomic Characteristics								
Area	Population	Poverty Rate	Median Household Income	Households	Owner-Occupied Housing Units	% Homeowners	% Owner-Occupied Housing Units with Mortgage	Median Owner-Occupied Unit Value
Battery Park City	13,400	5%	\$170,900	6,200	1,200	19%	66%	\$764,000
Chinatown	15,200	43%	\$26,100	6,100	170	3%	63%	\$673,600
Hudson Yards/Chelsea	20,500	17%	\$76,900	11,600	3,550	31%	59%	\$766,600
Lower East Side	55,200	31%	\$29,900	21,700	2,360	11%	45%	\$537,000
Lower Manhattan	32,400	7%	\$124,000	13,700	3,000	22%	62%	\$785,800
Stuyvesant Town/Kips Bay	28,100	12%	\$93,000	13,000	400	3%	53%	\$714,600
Tribeca	16,000	6%	\$105,900	7,000	2,400	35%	57%	\$867,800
West Village	11,400	6%	\$127,400	6,200	2,100	34%	67%	\$938,600
Citywide Total/Average	8,175,000	19%	\$51,300	3,050,000	993,500	33%	64%	\$514,900

Note: Peter Cooper Village included in Stuyvesant Town/Kips Bay

Source: 2010 US Census, 2011 American Community Survey, 5-Year estimate

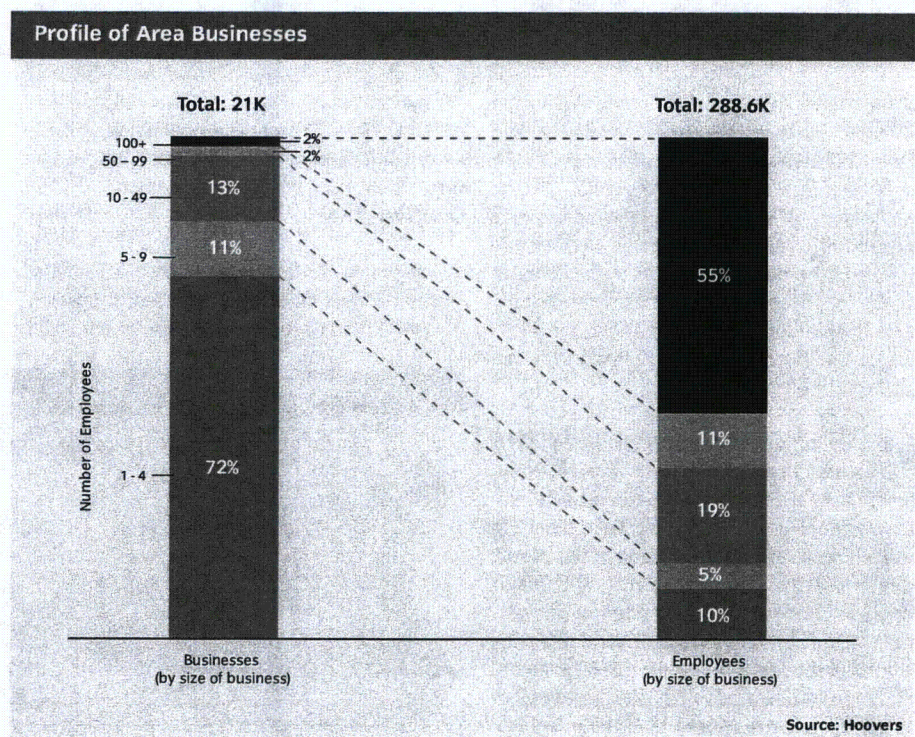
Finally, there is Lower Manhattan, a neighborhood unlike any other in Southern Manhattan. This is, first and foremost, because it is a regional commercial center, attracting 165,000 workers to the area on a daily basis. Here high-rise buildings predominate, although Lower Manhattan has low-scale sections, including the historic South Street Seaport area, with its brick buildings from the 19th century. The area also includes Battery Park City—with its generous parks and open spaces—constructed on landfill put in place in the 1970s along the southwest coast of Manhattan. In all, Lower Manhattan contains over 130 million square feet of commercial space (representing 72 percent of commercial space in Southern Manhattan), which serves both the city and the region.

While Lower Manhattan has primarily been a commercial district, in recent years the area's residential population has grown rapidly, doubling in the last decade to about 45,800 residents. Lower Manhattan also serves as a major tourist destination with over 4,100 hotel rooms, significant retailers, and many historic and cultural attractions, including the National September 11 Memorial & Museum.

Socioeconomic Characteristics

On average, the poverty rate in Southern Manhattan is consistent with the citywide average of 19 percent, though median household income in the area is much greater than the citywide median of \$51,300. However, these averages mask large socioeconomic differences among the neighborhoods. (See table: *Socioeconomic Characteristics*)

For example, in the Lower East Side, the poverty



rate is above 30 percent and in Chinatown it is over 40 percent. At the same time, median household income in the Lower East Side is \$29,900, and in Chinatown it is \$26,100—both of which are less than the citywide average. In Lower Manhattan, Battery Park City, Tribeca, and the West Village, by contrast, the most affluent neighborhoods in all of Southern Manhattan, poverty rates are less than half of the citywide average, while median household incomes in these areas are over \$105,000—ranging from two to three times the citywide median.

Business, Nonprofits, and the Local Economy

Each of Southern Manhattan's neighborhoods has its own economic engines, ranging from neighborhood retailers to small-scale manufacturers to arts and cultural organizations to Fortune 500 companies and nonprofits. Together, these neighborhoods are home to over 21,000 businesses and nonprofits, employing nearly 300,000 people. Though the vast majority (83 percent) of area businesses and nonprofits are small, with fewer



South Ferry subway station (prior to Sandy)

Credit: bebolgood1/wikimedia

than 10 employees, the majority of workers (55 percent) are employed by larger businesses, with over 100 employees. (See chart: *Profile of Area Businesses*)

By far the most significant concentration of commercial activity in Southern Manhattan is in Lower Manhattan. In fact, Lower Manhattan accounts for some 52 percent of the businesses and 57 percent of the workers in all of Southern Manhattan. Lower Manhattan, historically home to businesses in the financial sector, has seen its economy increasingly diversify in recent years, with more and more service and new media and technology firms moving into the area.

Despite being severely impacted by the 9/11 terrorist attacks and the financial crisis of 2008, Lower Manhattan has remained characteristically resilient as an economic hub, boasting more companies as of the writing of this report than were in the area prior to 9/11. With major new developments rising or nearing completion—including 1 and 4 World Trade Center, the National September 11 Memorial & Museum, and the Fulton Transit Center—the area west of Broadway is increasingly becoming a focal point of business activity.

By contrast, the eastern edge of Southern Manhattan, including the Water Street and South Street Seaport district, while still a major commercial area and tourist destination, has faced challenges in recent years. Many financial services firms have moved so-called back-office operations out of this area, while the Seaport has, in recent years, lacked the dynamism of some of Lower Manhattan's other popular destinations. Of particular concern even before Sandy is the fact that leases for over 3 million square

feet of office space in the Water Street corridor are set to expire over the next two years.

Critical Infrastructure

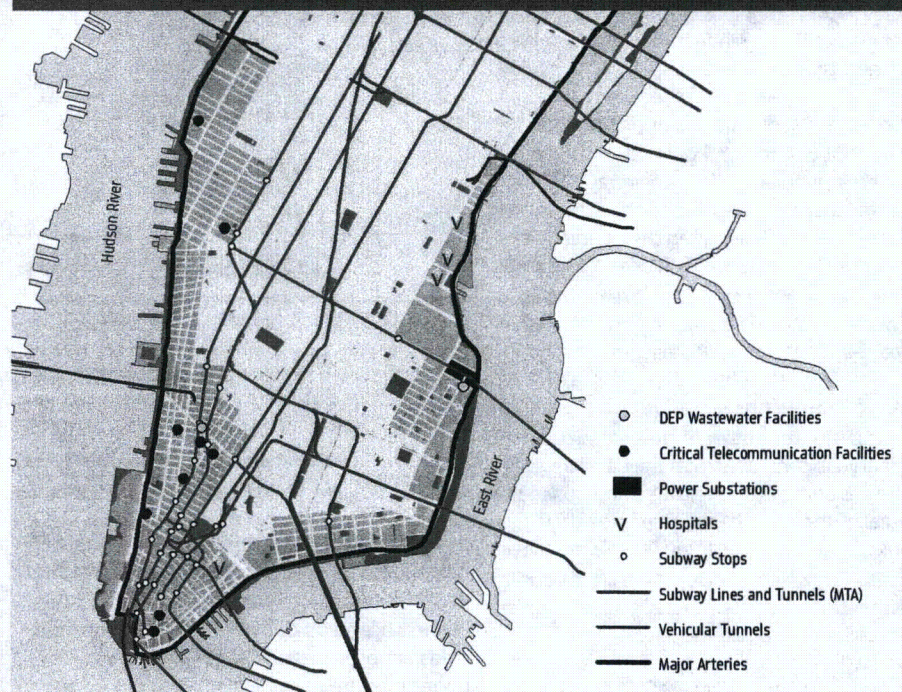
The high concentration of infrastructure assets in Southern Manhattan serves not only the area itself but other parts of Manhattan and, in many cases, the entire city and even the larger New York region. (See map: *Area Critical Infrastructure*)

For example, Southern Manhattan is home to several critical facilities in the electric system. These facilities are key elements of the city's

electric system, which other city infrastructure systems depend on to function. Two substations at Con Edison's East 13th Street complex, which is located in the floodplain near the FDR Drive, send power to distribution networks south of 39th Street and north of the World Trade Center. Additionally, three other distribution substations in Southern Manhattan are in the floodplain. These transmission and distribution substations are critical for the delivery of electrical service to large swaths of the borough.

Healthcare facilities, too, are concentrated in Southern Manhattan, including four hospitals

Area Critical Infrastructure

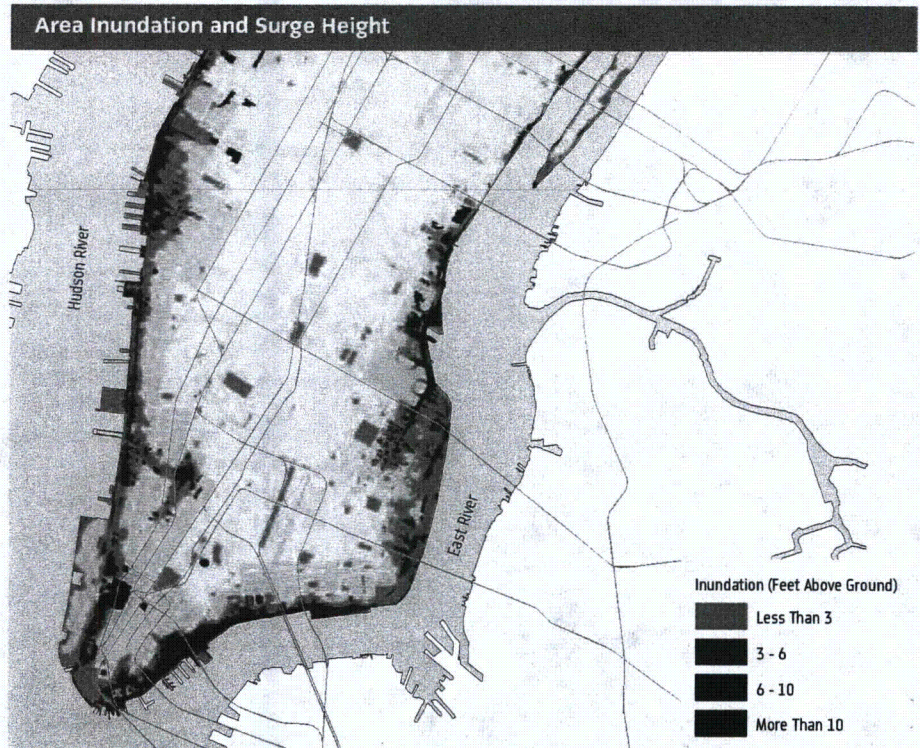


with 2,200 beds—20 percent of the Manhattan total. Three of these four hospitals are located on what is known as “Hospital Row,” between East 23rd and East 34th Streets, along First Avenue. These include New York University’s Langone Medical Center, a large nonprofit hospital; Bellevue Hospital, a public hospital managed by the Health and Hospitals Corporation (HHC) with the only State-designated regional trauma center in Southern Manhattan; and the Veterans Affairs New York Harbor Hospital, a public hospital managed by the US Department of Veterans Affairs. New York Downtown Hospital, located in Lower Manhattan, is the only hospital south of Canal Street. There are three additional hospital facilities south of 42nd Street including Beth Israel, just outside of the Southern Manhattan area on First Avenue.

Southern Manhattan’s telecommunications facilities, too, are indispensable for the residents and businesses of the entire borough. These include two central offices and seven other critical facilities, primarily located on the West Side. Further, important data and land lines made of copper and fiber serving the area and other parts of Manhattan snake below the streets of Southern Manhattan via underground conduit.

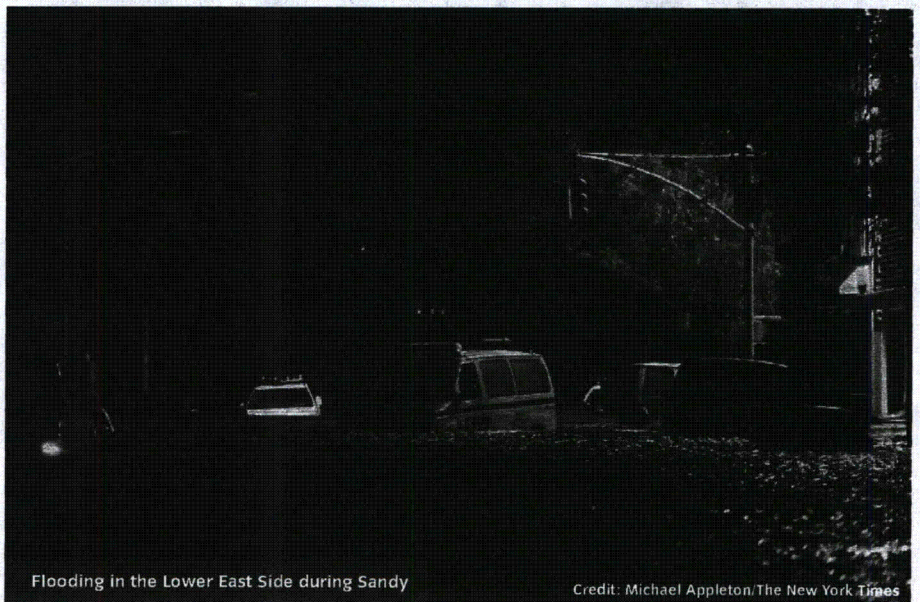
Southern Manhattan also hosts important transportation assets. For example, its roadways are key links in the regional transportation network. These include the FDR Drive and West Street, which move vehicular traffic between Lower Manhattan and points north and beyond. On the West Side, the Lincoln and Holland Tunnels, operated by the Port Authority of New York and New Jersey (the Port Authority), connect Manhattan to New Jersey and serve over 175,000 vehicles a day. On the East Side, the Queens Midtown Tunnel and Hugh L. Carey Tunnel (formerly Brooklyn-Battery Tunnel), which are operated by the Metropolitan Transportation Authority (MTA), connect Manhattan with other New York City boroughs, serving approximately 140,000 vehicles per day. An additional two tunnels in Lower Manhattan, the Battery Park and West Street Underpasses, operated by the New York City Department of Transportation (NYCDOT), connect the FDR Drive to West Street and also provide access to the Hugh L. Carey Tunnel.

Of course, the heart of the transportation network in Southern Manhattan (and the entire city) is the subway system. Run by the MTA, this system serves 5.4 million riders per day and has 22 major lines, all but one of which pass through Manhattan. A total of seven tunnels connect Southern Manhattan and Queens and Brooklyn via the East River and have stations and/or ventilation and mechanical components



Note: Inundation more than 10 feet includes below grade areas.

Source: FEMA (MOTF 11/6 Hindcast surge extent)



Flooding in the Lower East Side during Sandy

Credit: Michael Appleton/The New York Times

in the area. While Southern Manhattan generally is well-served by subways, Lower Manhattan is by far the best-served neighborhood, with 12 lines stopping at 17 stations.

Southern Manhattan is also home to two major Department of Environmental Protection (DEP) wastewater facilities. One, known as the Manhattan Pumping Station, is located at 13th Street, and the other, the Canal Street Pumping Station, is on Canal Street. Both facilitate the flow of wastewater to the Newtown Creek Wastewater Treatment Plant in Greenpoint, Brooklyn.

What Happened During Sandy

Though Southern Manhattan’s location within New York Harbor protected it from the destructive wave impacts felt in areas along the open Atlantic coast, Sandy’s surge arrived in the area with great force and height. In fact, at the peak of Sandy’s surge, the tide gauge at the Battery registered water heights of more than 14 feet above Mean Lower Low Water (MLLW), the average of the lower low water height of each tidal day, or 11 feet above North American

Battery Park City: Construction of a New Coastal Edge



Since the 1600s, the inhabitants of Manhattan have been expanding their island out into the water surrounding it. This has particularly been true in Lower Manhattan. There, the last major expansion occurred in the 1970s, with the creation of Battery Park City, a 92-acre housing and commercial development built on landfill along the western edge of Lower Manhattan in the Hudson River.

As a general matter, during Sandy, the parts of Lower Manhattan built on landfill proved to be

among the most vulnerable to flooding. Battery Park City was one significant exception to this rule, escaping the storm with almost no building damage. This was a direct result of the elevation of the landfill site and the location of the buildings.

Around Lower Manhattan, most historic landfill was created to expand maritime activity. Though well-suited for their original purposes, as these areas transitioned from maritime to other uses, the land never was raised to higher

elevations. By contrast, Battery Park City was planned for housing and commercial space from the start—one of the first examples of landfill being added to Manhattan for a non-maritime purpose. Therefore, the elevation of the site was not dictated by the need to access the water.

Though FEMA's 1983 Flood Insurance Rate Maps (FIRMs) for New York City did not exist when the landfill for Battery Park City was constructed, the engineers who designed the development relied on then-existing flood hazard information to inform their planning. As a result, the buildings at Battery Park City generally sit approximately seven feet higher than the elevation of the former island edge (now West Street) and generally at the highest points on the development. From the building sites, Battery Park City gently steps down two to three feet to a generous riverfront esplanade and park area along most of its waterfront edge. Even this edge, though, is approximately three feet higher than other bulkheads in Lower Manhattan.

During Sandy, the bulkhead and elevation of Battery Park City served the neighborhood well. The bulkhead absorbed wave impacts, and, though water eventually did flood the area's esplanade and parks, the buildings, set back from the water's edge and on higher ground, hardly were affected. In fact, the greatest danger many of the buildings at Battery Park City faced during Sandy came, ironically, from West Street, on the site's inland side. This is because Sandy's surge was able to inundate the roadway from the north and the south—primarily because it had been constructed on landfill at a lower elevation for the purposes of maritime activities.

Vertical Datum of 1988 (NAVD88)—eclipsing the previous high-water mark from Hurricane Donna in 1960 by nearly four feet.

The surge overtopped bulkheads all around Southern Manhattan, sending floodwaters racing inland. Across the area, flooding typically reached one to two blocks from the coastline at depths of two to three feet. In certain areas, though, the waters extended farther inland and to far greater depths. The areas that generally experienced the worst inundation were those that were built on landfill along the coast, and, farther inland, where there had once been marshes and streams that had been built upon centuries ago. (See map: *Area Inundation and Surge Height*)

In Southern Manhattan, the greatest extent of inland flooding was along the area's eastern edge. There, the surge from the East River breached the bulkhead running from Kips Bay to Chinatown. Floodwaters not only inundated the East River Park esplanade, ball fields, and plantings, they traversed the FDR Drive, covering streets and encompassing buildings. In parts of the Lower East Side, much of which is built on landfill, the water traveled nearly 2,000 feet inland, almost reaching Avenue B, with floodwaters up to two feet deep along portions of Avenue C.

Along Southern Manhattan's western edge, the surge rose from the Hudson River, overtopping its bulkhead. Floodwaters inundated Hudson River Park, including piers and playgrounds, tra-

versed West Street, and flowed into inland streets. In most of the neighborhoods on the West Side floodwaters reached one or two blocks inland at depths of two to three feet, but along Canal Street, a former waterway that was filled in during the city's northward expansion, water traveled nearly a half-mile inland.

In Lower Manhattan, meanwhile, the surge also overtopped bulkheads, though here the waterfront edge conditions and inland topography played a significant role in determining the extent of flooding. For example, on the eastern portion of Lower Manhattan, which is generally separated from the water only by an esplanade and local streets—with few inland barriers to slow and contain storm surge—waters flowed directly off of the East River and into the South

Street Seaport area and the buildings along South Street, rising in some areas to eight feet in depth. In this section of Lower Manhattan, the locations with the highest floodwaters corresponded to areas of low-lying fill that had been added to Manhattan in some of the earliest years of the city's history.

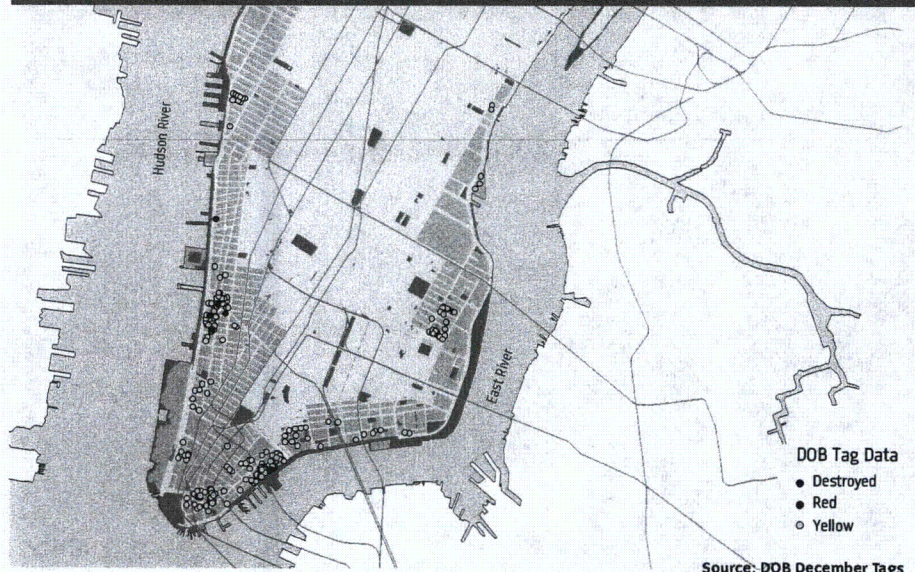
On the west side of Lower Manhattan, it was quite a different story for Battery Park City, because this neighborhood was built to a higher elevation. While Sandy's surge overtopped Battery Park City's bulkhead—and flooded the development's esplanade, playgrounds, fields, and plantings—the buildings in the development, which were constructed on the site's highest points, for the most part emerged from Sandy unscathed. (See sidebar: *Battery Park City: Construction of a New Coastal Edge*)

In other parts of the west side of Lower Manhattan, Sandy brought devastation. Sandy's surge easily flowed over the lower bulkheads to the north and south of Battery Park City, rushing farther inland and flooding the low-lying areas of West Street to depths of over four feet. Waters also spread onto the World Trade Center construction site, flooding below-grade areas, including the National September 11 Memorial & Museum.

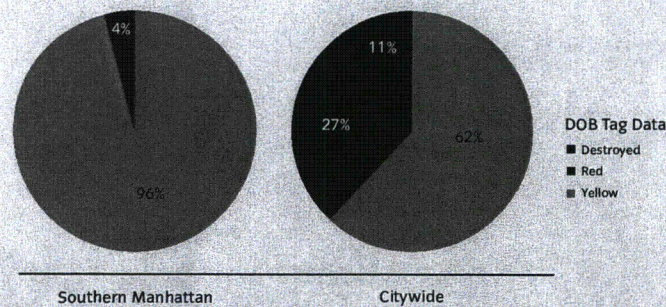
The number of buildings in the area inundated by Sandy was substantial. In total, over 950 residential buildings (containing 46 million square feet of space and more than 40,000 units) and over 700 commercial and non-residential buildings (containing 85 million square feet of space) were affected by floodwaters. Of this total, 24 percent of the impacted floor area was in the neighborhoods of the East Side, 28 percent in the neighborhoods of the West Side, and 48 percent in Lower Manhattan. Perhaps most importantly, 58 percent of all impacted residential units were in the neighborhoods of the East Side.

Buildings impacted by flooding generally sustained damage that was not of a structural nature. This was primarily because most of the buildings in the area are multi-story and constructed of steel, masonry, or concrete frames—unlike the lighter-frame buildings in many other areas Sandy inundated. Instead, most building damage in Southern Manhattan was to critical building systems, business inventory, and personal property. Since so many of these buildings' systems were located in basements or sub-basements, even in areas where floodwaters reached only one to two feet, elevators, water pumps, fire- and life-safety systems, heating and cooling systems, and lighting were compromised, making conditions for those in the floors above challenging or untenable.

Location and Level of Building Damage



Classification of Building Damage



As a result of Sandy, a large number of buildings in Southern Manhattan suffered damage. After the storm, the New York City Department of Buildings (DOB) sent out inspectors to assess damages in Southern Manhattan and other inundated areas of the city. These inspectors were asked to assign "tags" to buildings based on the observed condition of each structure. "Green" tags indicated less serious damage or no damage at all. "Yellow" tags indicated that portions of a building might be unsafe or might have significant non-structural damage. "Red" tags indicated structural damage. And a sub-category of "red" tags was further categorized as "destroyed." (See table: *Classification of Building Damage*)

The most methodologically rigorous building damage assessment undertaken by DOB was completed in December 2012. According to this assessment, of those buildings citywide

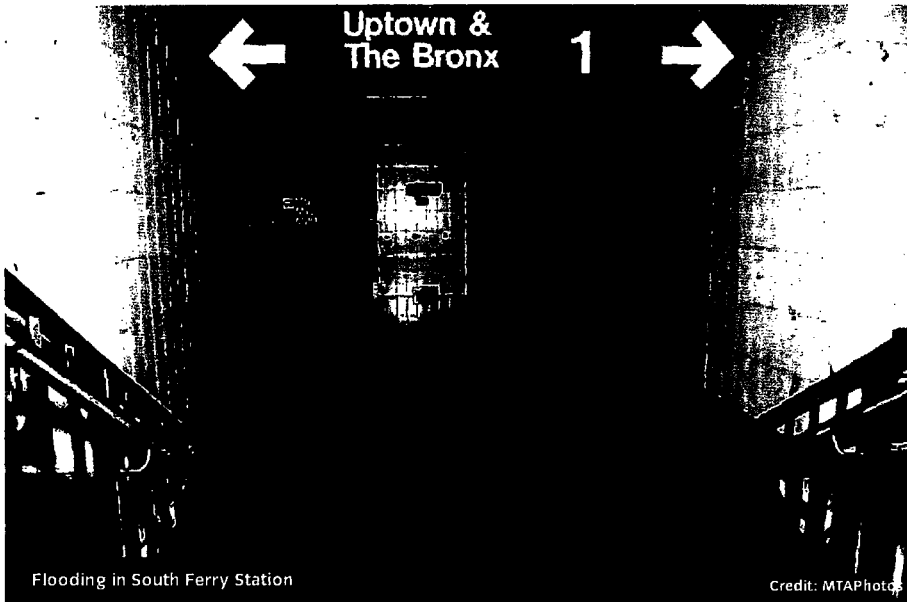
that were tagged either yellow or red (including those further classified as destroyed), 13 percent were located in Southern Manhattan. The yellow and red tagged buildings in Southern Manhattan tended to be clustered on the eastern edge of Lower Manhattan with other clusters in Tribeca around Canal Street and in parts of Chinatown and the Lower East Side. In Southern Manhattan, the percentage of red and yellow tagged buildings that were tagged yellow (96 percent) was higher than the percentage citywide (62 percent). This largely was a result of the nature of the area's flooding (still-water inundation, as opposed to destructive wave action), which tended to cause less structural damage and instead caused damage to building systems and contents. (See map: *Location and Level of Building Damage*)

Though inundation caused a significant amount of damage to Southern Manhattan's building



Power outage in Southern Manhattan during Sandy

Credit: Michael Tapp



Flooding in South Ferry Station

Credit: MTAPhotos

stock, perhaps the most significant impact that Sandy had on the area resulted from power outages that occurred across most of Manhattan south of 34th Street. As a result of these outages, even the many residents of buildings that were not flooded or had minimal damage were left without light, heat, refrigeration, or water for drinking, cooking, flushing toilets, or bathing. In high-rise buildings, elevators also ceased to function. As a result, many older or infirm residents who lived on higher floors were trapped in their apartments—in some cases unable to communicate or gain access to information through television or the Internet.

The storm also directly or indirectly affected businesses and nonprofits large and small. For

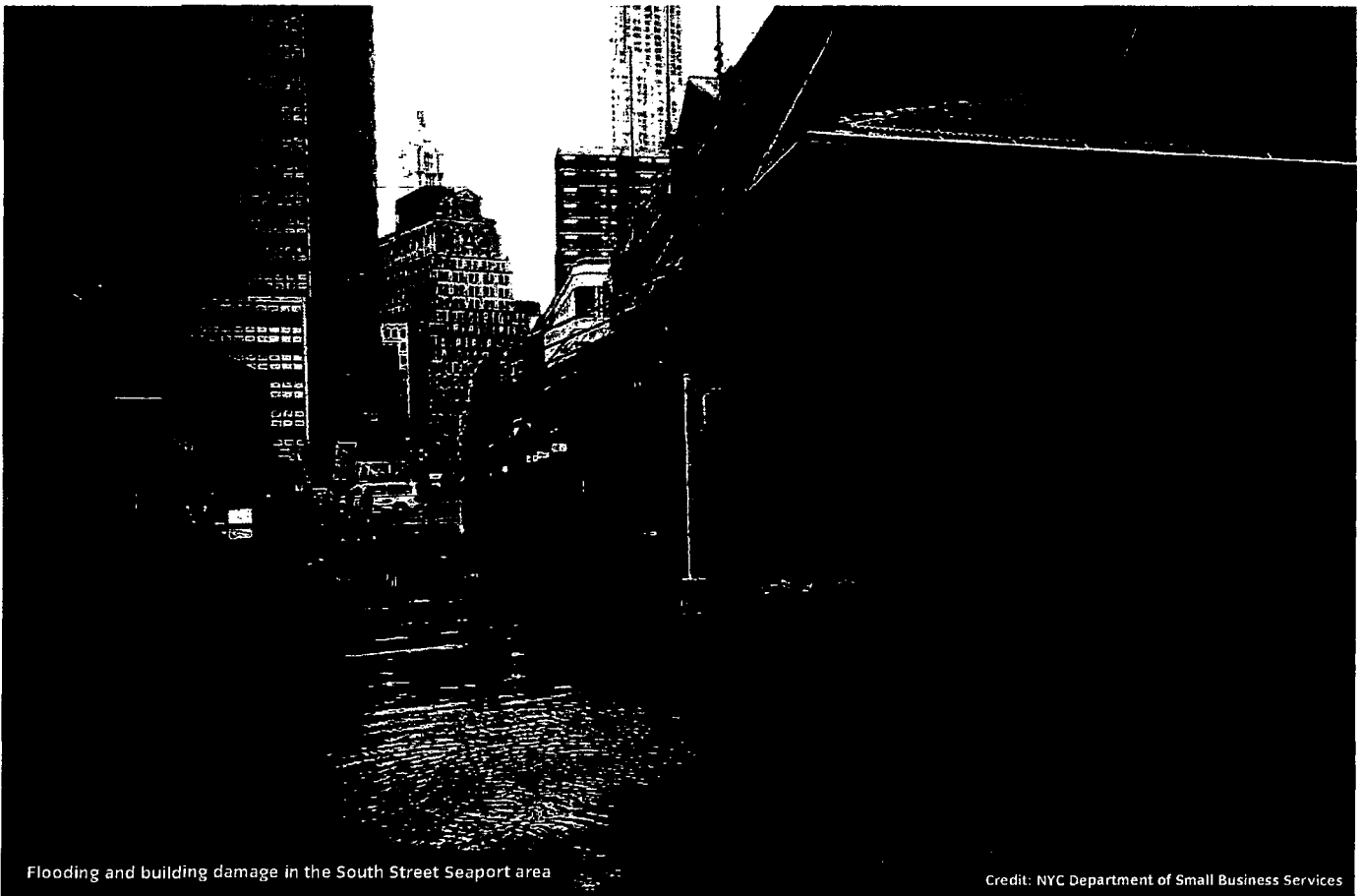
example, the flooding itself wreaked havoc on ground-floor retailers, cultural institutions, nonprofits, and, especially in Chelsea, art galleries, destroying merchandise and inventory as well as equipment. In hard-hit areas, such as the South Street Seaport district, ground-floor businesses were still closed months after the storm, with some still not reopened as of the writing of this report. Many small businesses, even outside of the inundation area in Southern Manhattan, like their residential counterparts, also were impacted by the extended power outage. This destroyed inventory for food-related businesses, which rely on electricity for refrigeration, and interrupted business for various types of firms for up to five days, costing many of them important revenue. The power

outage also disrupted transit, which deprived businesses of customers and made it difficult for employees to get to work.

Even after the waters receded and the power was restored, many small businesses and nonprofits in Southern Manhattan continued to suffer. This was especially true in the hardest-hit areas like Lower Manhattan, where telecommunications disruptions continued for some months, keeping many businesses and nonprofits from returning to normal business operations. In addition, since many high-rise buildings were unoccupied for weeks or even months after Sandy, retailers and others continued to suffer due to a loss of much of their customer base.

On the whole, larger businesses in Southern Manhattan were not impacted directly by Sandy's floodwaters, because most of these businesses occupied offices on upper floors in multi-story buildings. However, these office-oriented businesses were greatly impacted by flooding that impaired their buildings' systems. As with residents, small businesses, and nonprofits, large businesses located inland also were affected by power outages and transit disruptions, which prevented them from operating. In total, throughout Southern Manhattan, over 88 million square feet of commercial space and 6,500 businesses were in areas affected by flooding. An additional 260 million square feet and 68,000 businesses were in areas affected by power outages. Even as large businesses in Southern Manhattan began to resume operations when power and transit were restored, a significant number of those in Lower Manhattan were not able to do so for weeks or months because of various issues including those relating to telecommunications.

Sandy's impact on the Southern Manhattan electric system began before Sandy rolled in, when Con Edison shut down two of its electrical networks in the area preemptively to prevent severe damage and minimize potential downtime to underground distribution equipment (located in vaults beneath sidewalks), plunging over 6,500 hundred "customers" (and many more individuals) on the East Side of Lower Manhattan into darkness. Once the storm arrived, Sandy's surge caused damage to the substations at the East 13th Street complex and at the Seaport, shutting down 11 additional distribution networks and leaving another 225,000 customers without electricity—nearly all of Southern Manhattan south of 34th Street as well as certain areas north to 39th Street. Everything from traffic lights and street lights to cellular antennas was affected. Power to the whole area was not restored fully until about four days after the storm, only after substation



Flooding and building damage in the South Street Seaport area

Credit: NYC Department of Small Business Services

equipment was finally restored. Since many area buildings suffered damage to their electrical systems, building-level power outages would continue in many cases for several days.

The storm also affected Southern Manhattan's hospitals and their patients. New York Downtown Hospital, for example, evacuated patients before the storm once it was told that its power would be preemptively shut off, reopening, when power returned to the area. The Veterans Affairs New York Harbor Hospital also evacuated prior to the storm due to its proximity to the East River. New York University's Langone Medical Center and Bellevue Hospitals, though also near the East River, remained open as Sandy approached. Eventually, Sandy's surge sent floodwaters into the lower levels of these two hospitals (as well as the Veterans Affairs New York Harbor Hospital). This eventually forced New York University's Langone Medical Center and Bellevue to evacuate, during the storm in the case of the former, as its critical building systems failed, and, in the case of the latter, shortly after the storm. All three damaged hospitals remained partially or fully closed for months following the storm, reducing Manhattan's capacity by 2,100 beds or nearly 65 percent of the bed capacity below 42nd Street.

Critical telecommunications facilities and below-grade network cabling in Southern Manhattan also were impacted significantly by Sandy. Two central offices experienced serious damage from floodwaters, disconnecting businesses and residents who depended on these locations to relay phone and cable signals. Although one central office was functional within a day, the other remained closed for 11 days. Even more significantly, in Lower Manhattan, 95 percent of the copper wires in the neighborhood were destroyed by the corrosive floodwaters they soaked in during and after the storm. Significant parts of the network in Lower Manhattan were down for months after the storm as Verizon opted to replace damaged copper wiring with fiber, an upgrade that, over the long run, would benefit customers, but caused significant disruption for them in the post-storm period.

The cell network also experienced failure as cell antennas in Southern Manhattan, which tend to be located on building roofs and to use the electrical supplies of these buildings, stopped working shortly after power went out in the area. As a result, there was limited or no cell service below 34th Street for the duration of the power outage.

Sandy, meanwhile, had a huge impact on Southern Manhattan's transportation infrastructure. The power outage impacted the entire street network south of 34th Street as traffic signals and street lights were knocked out. The surge overwhelmed both of the major Manhattan highways encircling the coastline, inundating them with two to four feet of water which stayed several hours after the storm. Tunnels were flooded including the Holland and Queens Midtown tunnels, which remained closed for over a week. The Battery Park and West Street Underpasses, meanwhile, closed for two weeks, and the Hugh L. Carey Tunnel was closed for nearly three weeks as tens of millions of gallons of water were pumped from its depths.

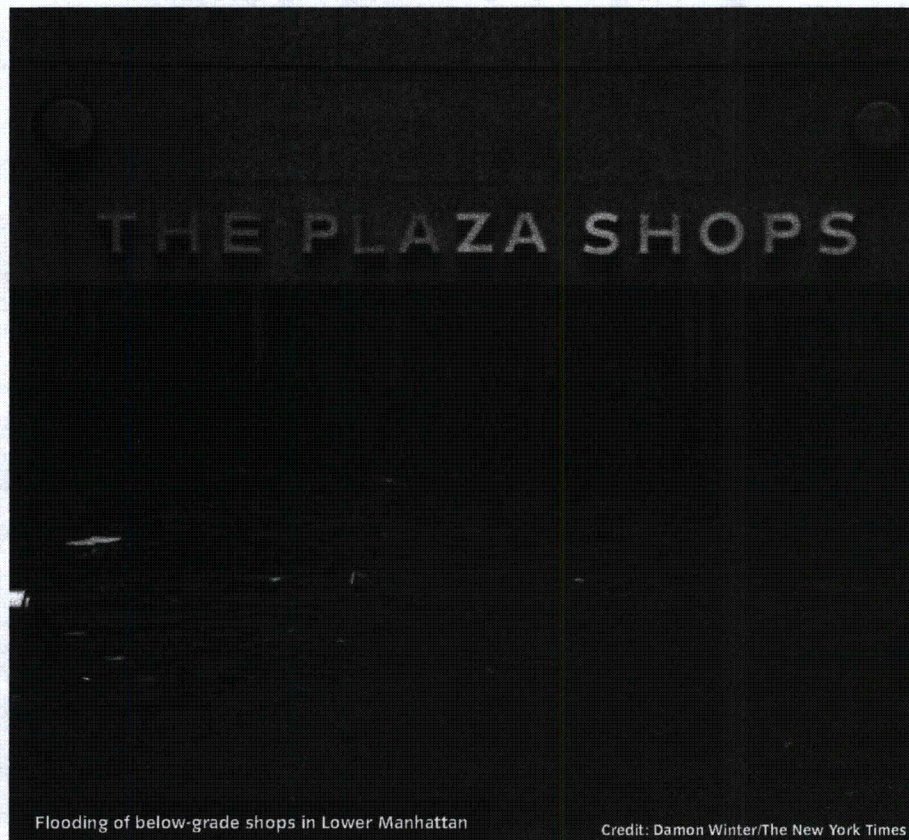
Though the subway system was shut down preemptively as the storm approached, it still was severely impacted by Sandy, experiencing the worst flooding in its history. Floodwaters entered subway stations and tunnels through numerous low-lying entry points. Seven East River subway tunnels flooded, two of which were immersed in seawater from floor to ceiling. While some subway service was restored in Southern Manhattan and other areas of the city within two days of the storm, the cross-river tunnels were out of service longer, with

Risk Assessment: Impact of Climate Change

Major Risk
 Moderate Risk
 Minor Risk

Scale of Impact

Hazard	Today	2020s	2050s	Comments
Gradual				
Sea level rise				Future sea level rise likely would overtop some bulkheads on a regular basis, resulting in localized flooding
Increased precipitation				Minimal impact
Higher average temperature				Minimal impact
Extreme Events				
Storm surge				Significant risk of flooding in addition to limited wave action
Heavy downpour				Minimal impact
Heat wave				Greater strain on power system with potential for more failures; most significant impact on high-rise buildings
High winds				Building codes are calibrated to anticipated wind speeds, though existing building stock and equipment may be vulnerable



Flooding of below-grade shops in Lower Manhattan

Credit: Damon Winter/The New York Times

some closed for over a week. The South Ferry Station, which had only recently been completed and was the southern terminus of the 1 train, meanwhile, was damaged so badly that its predecessor had to be reopened while repairs were made, a process expected to take years as of the writing of this report.

Sandy also impacted Southern Manhattan's two DEP wastewater facilities. Both experienced service outages due to flooding, with the Manhattan Pumping Station down for 25 hours, and the Canal Street Pumping Station down for 42 hours. Though the shutdowns caused seawater mixed with runoff and sewage to be released into surrounding drainage areas, subsequent testing by DEP showed no significant water quality impacts.

What Could Happen in the Future

Going forward, the neighborhoods of Southern Manhattan face a variety of risks related to climate change, chief among them surge and flooding from coastal storms, which is likely to be exacerbated by sea level rise. (See chart: *Risk Assessment: Impact of Climate Change*)

Major Risks

Given the area's coastal exposure, the risk of flooding from storms is significant even today, as illustrated by the Preliminary Work Maps (PWMs) released in June 2013 by FEMA. According to the PWMs, the 100-year floodplain—the area with a 1 percent or greater chance of flooding in any given year—has expanded beyond the 100-year floodplain shown on the 1983 maps that were in effect when Sandy hit. (See map: *Comparison of 1983 FIRMs and Preliminary Work Maps*)

The PWMs reflect expansions of the floodplain typically of one block or less in almost all neighborhoods, with more pronounced expansions in the Lower East Side, Kips Bay, and in Chelsea. Like the 1983 maps, the new maps identify a V Zone, an area where waves are most forceful and could exceed three feet in height, all along the coastal edge of Southern Manhattan. This V Zone generally does not extend inland past the bulkhead.

Though the 100-year floodplain has expanded relatively modestly in terms of total area in Southern Manhattan, because of the high density of the area, even this modest expansion has resulted in a significant increase in the number of buildings in the floodplain. The number of buildings at risk has increased 73 percent (from 930 to 1,610 buildings, encompassing an additional 10,000 residential units).

The floodplain on the PWMs includes 61,000 residents, over half of whom live in Chinatown and the Lower East Side. The built square footage in the Southern Manhattan floodplain has concurrently increased by 25 percent (from 105 million square feet to 132 million square feet).

Just as importantly, Base Flood Elevations (BFEs)—the height to which floodwaters could rise during a storm—have generally increased one to three feet throughout the area. These new BFEs show that the lowest-lying areas, along South Street from Lower Manhattan up to Chinatown, could experience flood heights from six to eight feet.

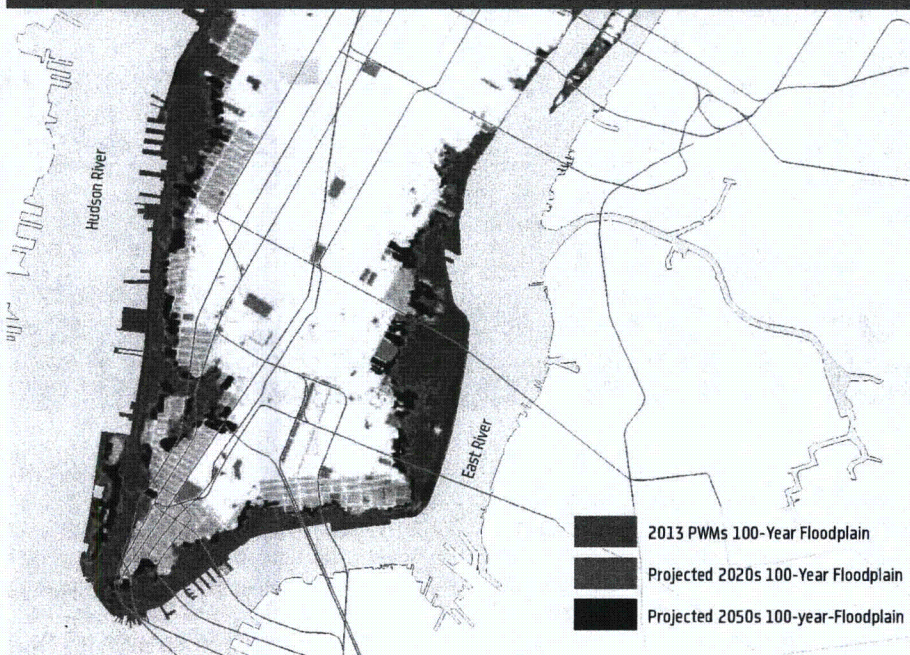
The increased BFEs present a particular challenge in Southern Manhattan with its multi-story and historic building stock. Elevation of ground floors, a possible response to higher BFEs in other parts of the country, is simply not possible or economically viable in Southern Manhattan—especially since the ground floors in many areas are devoted to retail, which adds to the vitality, safety, and economic well-being of these areas.

According to projections from the New York City Panel on Climate Change (NPCC), as described

Comparison of 1983 FIRMs and Preliminary Work Maps



Comparison of Preliminary Work Maps and Future Floodplains



Buildings in the Floodplain

Buildings & Units	100-Year Floodplain			
	1983 FIRMs	2013 PWMs	Projected 2020s	Projected 2050s
Residential Buildings	450	940	1,400	1,650
Residential Units	32,000	42,000	60,800	68,000
Commercial and Other Buildings	480	670	910	1,080

Source: DCP PLUTO, FEMA, CUNY Institute for Sustainable Cities



Flooding of Battery Park Underpass

Credit: Michael Appleton/The New York Times

in Chapter 2 (*Climate Analysis*), sea levels are forecast to rise through the 2020s and 2050s. During this period, the floodplain will expand, and throughout the area, flood heights could increase, resulting in a risk of even higher floodwaters during storms. (See map: *Comparison of Preliminary Work Maps and Future Floodplains*)

The additional growth in the floodplains is anticipated in all Southern Manhattan areas including Battery Park City. According to NPCC's high-end projections, the 2050s floodplain may extend to First Avenue around Kips Bay and in some areas reach Second Avenue. In the Lower East Side, the projected floodplain would extend over a block inland and in some areas could reach Avenue A. In Lower Manhattan and Battery Park City, the floodplain is also expected to increase and encompass buildings at the lower tip of Manhattan. In Tribeca, the

West Village, Chelsea, and Hudson Yards, the projected floodplain would extend inland nearly another block. Throughout Southern Manhattan, the number of at risk buildings could rise to approximately 2,300 buildings by the 2020s (a 43 percent increase over the PWMs) and to over 2,700 buildings by the 2050s (a further 18 percent increase over 2020). (See table: *Buildings in the Floodplain*)

Other Risks

The neighborhoods in Southern Manhattan face other climate risks as well. Sea level rise, for example, even without extreme weather events such as hurricanes, could, in some communities, lead to increased frequency and severity of street flooding on a chronic basis by the 2050s. This risk, which already exists for the areas to the north and south of the Brooklyn Bridge, is expected to increase in the decades to come.

Increased precipitation and more frequent and heavier downpours may result in some flooding. However, this risk is likely to be limited to localized areas. While future projections for changes in wind speeds are not available from the NPCC, a greater frequency of intense hurricanes by the 2050s could present a greater risk of high winds in the New York area. This may pose a threat to Southern Manhattan with its many densely packed high-rise structures and older buildings not constructed to modern wind standards.

Finally, higher average temperatures are not expected to cause meaningful impacts on the neighborhoods in Southern Manhattan. However, the increase in the number of heatwaves could lead to more frequent power outages.

Priorities from Public Engagement in Southern Manhattan

Since the Special Initiative for Rebuilding and Resiliency (SIRR) was launched in December 2012, the input of local stakeholders has helped shape an understanding of what happened during Sandy, what risks Southern Manhattan faces in relation to climate change, and what approaches make sense to address these risks.

Southern Manhattan is represented by a wide array of elected officials at the Federal, State, and local levels. It also is represented by five community boards. The area is further served by a large number of community-based organizations, civic groups, faith-based organizations, and other neighborhood stakeholders. All played an important role in relief and recovery efforts after Sandy. Throughout the process of developing this plan, SIRR staff benefited from numerous conversations—both formal and informal—with these groups and individuals, including, in Southern Manhattan, two task forces that met regularly.

SIRR also held a public workshop in March 2013 in Southern Manhattan, part of a series of such workshops held citywide in which over 1,000 New Yorkers participated to discuss issues affecting their neighborhoods and communicate their priorities for the future of their homes and communities. Generally, the on-the-ground insights provided at this public workshop helped SIRR staff to develop a deeper understanding of the specific priorities of, and challenges facing, the communities of Southern Manhattan.

Overall, out of the various task force and other meetings and public workshops attended by



Task Force	Briefing Frequency	# of Stakeholders from Southern Manhattan
Elected Officials	Monthly	14 City, State, Federal elected officials
Community-Based Organizations	4 - 6 weeks	3 community boards 25+ faith-based, business, and community organizations

SIRR staff since January, several priorities for Southern Manhattan and the SIRR effort clearly emerged:

- Protect critical infrastructure—power, transit, telecommunications—from outages;
- Protect residential buildings and their vulnerable populations from building system outages;
- Protect retail and commercial businesses from flooding;
- Improve infrastructure to prevent future events from having widespread impacts; and
- Continue to strengthen post-event communication.



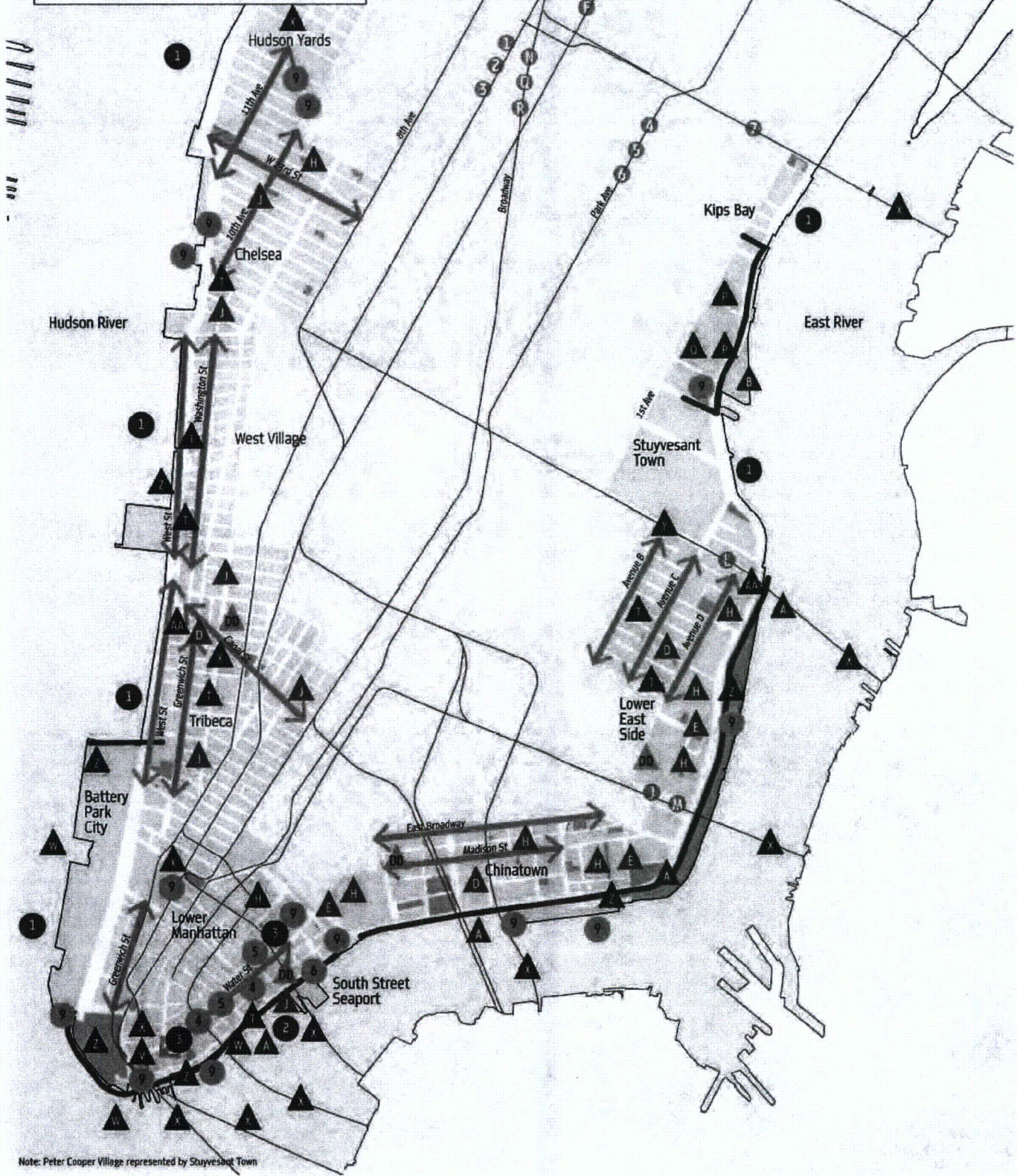
SOUTHERN MANHATTAN | Initiative Summary

Legend

- First Phase Coastal Protections
- Retail Recovery Program Priority Corridor
- Citywide Initiative
- Southern Manhattan Initiative

Initiatives Not on Map

C	F	B	J	A	N	V
D	T	S	U	A	7	8



Note: Peter Cooper Village represented by Stuyvesant Town

Coastal Protection

Selected Citywide Measures

- ▲ Install an integrated flood protection system in Lower Manhattan, including the Lower East Side
- ▲ Install an integrated flood protection system at Hospital Row
- * For additional Coastal Protection Initiatives, see Coastal Protection section of Community Plan
- Create an implementation plan and design for an integrated flood protection system for remaining Southern Manhattan areas
- Conduct a study for a multi-purpose levee along Lower Manhattan's eastern edge to address coastal flooding and create economic development opportunities

Buildings

Selected Citywide Measures

- ▲ Improve regulations for flood resiliency of new and substantially improved buildings in the 100-year floodplain
- ▲ Rebuild and repair housing units destroyed and substantially damaged by Sandy
- ▲ Study and implement zoning changes to encourage retrofits of existing buildings and construction of new resilient buildings in the 100-year floodplain
- ▲ Amend the Building Code and complete studies to strengthen wind resiliency for new and substantially improved buildings
- ▲ Encourage existing buildings in the 100-year floodplain to adopt flood resiliency measures through an incentive program and targeted mandate
- ▲ Retrofit public housing units damaged by Sandy and increase future resiliency of public housing
- ▲ Launch a sales tax abatement program for flood resiliency in industrial buildings
- ▲ Clarify regulations relating to the retrofit of landmarked structures in the 100-year floodplain
- ▲ Amend the Building Code to improve wind resiliency for existing buildings and complete studies of potential retrofits
- * For additional Buildings Initiatives, see Building section of Community Plan

Critical Infrastructure

Selected Citywide Measures

- ▲ Work with utilities and the Public Service Commission (PSC) to harden key electric transmission and distribution infrastructure against flooding
- ▲ Work with utilities, regulators, and gas pipeline operators to harden the natural gas system against flooding
- ▲ Work with steam plant operators and the PSC to harden steam plants against flooding
- ▲ Work with utilities and regulators to minimize electric outages in areas not directly affected by climate impacts
- ▲ Require the retrofitting of existing hospitals in floodplains
- ▲ Support HHC's efforts to protect public hospital emergency departments from flooding
- ▲ Require retrofitting of nursing homes in floodplains
- ▲ Require retrofitting of adult care facilities in floodplains
- ▲ Reconstruct and resurface key streets damaged by Sandy
- ▲ Elevate traffic signals and provide backup electrical power
- ▲ Protect NYCDOT tunnels in Lower Manhattan from flooding
- ▲ Protect Staten Island Ferry and private ferry terminals from climate change-related threats
- ▲ Call on non-City agencies to implement transportation strategies to address climate change threats
- ▲ Expand the city's Select Bus Service (SBS) network
- ▲ Harden or otherwise modify shoreline parks to protect adjacent communities
- ▲ Harden pumping stations
- * For additional Critical Infrastructure Initiatives, see Critical Infrastructure sections of Community Plan
- Construct physical enhancements to Water Street

Community & Economic Recovery

Selected Citywide Measures

- ▲ Launch business recovery and resiliency programs
- ▲ Launch the Neighborhood Game Changer Competition
- ▲ Call for Neighborhood Retail Recovery Program
 - Lower Manhattan (Water St. corridor, South Street, Seaport district, and Greenwich St.)
 - Chinatown (East Broadway and Madison St.)
 - Lower East Side (Avenues B, C, and D)
 - Tribeca (Canal St., West St. and Greenwich St.)
 - West Village (West St. and Washington St.)
 - Chelsea (10th and 11th Aves. and 23rd St.)
- ▲ Support local merchants in improving and promoting local commercial corridors
- * For additional Community & Economy Recovery initiatives, see Community & Economy Recovery section of Community Plan
- Implement temporary programming of Water Street privately-owned public spaces (POPS)
- Launch a program to enable permanent improvements to Water Street privately owned public spaces (POPS)
- Implement planned and ongoing investments in South Street Seaport
- Use the Job Creation & Retention Program to attract and retain businesses in Sandy-impacted areas of Lower Manhattan
- Expand Take the HELM program (Hire and Expand in Lower Manhattan)
- Implement planned and ongoing investments by the City and private partners
 - East River Waterfront
 - Pier 35 EcoPark
 - Pier 42 Waterfront Park
 - Battery Park Play Space
 - Peck Slip Park
 - Asser Levy Park
 - Hudson River Park
 - The High Line
 - Peck Slip Reconstruction
 - Battery Maritime Building
 - Pier A Renovation
 - Hudson Yards South Tower
 - Peck Slip School
 - National September 11th Memorial and Museum

This chapter contains a series of initiatives that are designed to mitigate the impacts of climate change on Southern Manhattan. In many cases, these initiatives are both ready to proceed and have identified funding sources assigned to cover their costs. With respect to these initiatives, the City intends to proceed with them as quickly as practicable, upon the receipt of identified funding.

Meanwhile, in the case of certain other initiatives described in this chapter, though these initiatives may be ready to proceed, they still do not have specific sources of funding assigned to them. In Chapter 19 (*Funding*), the City describes additional funding sources, which, if secured, would be sufficient to fund the full first phase of projects and programs described in this document over a 10-year period. The City will work aggressively on securing this funding and any necessary third-party approvals required in connection therewith (i.e., from the Federal or State governments). However, until such time as these sources are secured, the City will only proceed with those initiatives for which it has adequate funding.

Southern Manhattan Community Rebuilding and Resiliency Plan

Southern Manhattan is an iconic center of activity for the city, the nation, and the world. Its role as a hub for the city and beyond makes its resiliency and continued economic vitality critical.

The following is a multilayered plan that not only applies citywide strategies to Southern Manhattan but also provides strategies designed to address the area's specific needs and particular vulnerabilities. In anticipation of future climate change-related risks, this plan proposes ways that Southern Manhattan neighborhoods can adapt by: addressing inundation along the entire coastline; providing opportunities to retrofit the area's most vulnerable building stock; protecting and improving critical infrastructure; and focusing investments in strategic areas, such as the Water Street office district and the historic South Street Seaport, to advance a long-term and sustainable recovery.

Coastal Protection

As Sandy illustrated, the greatest extreme weather-related risk faced by New York City is storm surge, the effects of which are likely to increase given current projections of sea level rise. Going forward, it is anticipated that climate change will render coastal regions of the city, including Southern Manhattan, even more vulnerable to these risks.

While it is impossible to *eliminate* the chance of flooding in coastal areas, the City will seek to *reduce* its frequency and effects—mitigating the impacts of sea level rise, storm waves including erosion, and inundation on the coastline of the city generally and Southern Manhattan in particular. Among the strategies that the City will use to achieve these goals will be the following: increasing coastal edge elevations; minimizing upland wave zones; protecting against storm surge; and improving coastal design and governance. When evaluating coastal protection, other priorities including navigation and ongoing efforts to improve water quality and natural habitats also will be considered prior to implementation, where appropriate.

The initiatives described below provide important examples of how the City intends to advance its coastal protection agenda citywide. These initiatives will have a significant positive impact on the residents, businesses, and nonprofits of Southern Manhattan. Taken together, when completed, the first three coastal protection initiatives described below would

provide enhanced protection for over 750 buildings representing nearly 27,000 housing units as well as many businesses and much of the critical infrastructure in Southern Manhattan.

For a full explanation of the following initiatives and a complete description of the City's comprehensive coastal protection plan, please refer to Chapter 3 (*Coastal Protection*).

Coastal Protection Initiative 6 Raise bulkheads in low-lying neighborhoods to minimize inland tidal flooding

Bulkheads provide the first line of defense against flooding in many neighborhoods, including Southern Manhattan, but throughout the city, many bulkheads are built to an elevation that may be insufficient given the latest projections of sea level rise by 2050. Subject to available funding, the City, therefore, will launch a program to raise bulkheads and other shoreline structures across the five boroughs in low-lying areas most at risk of daily or weekly tidal flooding, a phenomenon that could impact parts of Southern Manhattan's shoreline by the 2050s. The Mayor's Office of Long-Term Planning and Sustainability (OLTPS) will work with the New York City Economic Development Corporation (NYCEDC) to manage this program, to begin implementation in 2013, in conjunction with the new citywide waterfront inspections program described in Chapter 3.

Coastal Protection Initiative 21 Install an integrated flood protection system in Lower Manhattan, including the Lower East Side

Manhattan's East River edge from the Brooklyn Bridge up through the Lower East Side suffered the most extensive inland flooding in Southern Manhattan. The area, which includes parts of Chinatown and the Lower East Side, is already in the 100-year floodplain and the vulnerability of the area is expected to grow as the climate changes.

This area includes not only a very large residential population (70,000 people), but also a residential population that lives at among the highest densities in the United States (138 people per acre, versus a citywide average of 42 people per acre and 89 people per acre in the rest of Southern Manhattan). The area is also home to the largest number of low- and moderate-income households in Southern Manhattan, with over 9,000 NYCHA housing units alone. Meanwhile, critical infrastructure located in the area, which if compromised, could have citywide impacts. These assets include support structures for the subway system, Con Edison

Conceptual Rendering of Lower East Side Flood Protection System



substations, a DEP pumping station, and the FDR Drive.

Subject to available funding, the City, therefore, will install the first phase of what is intended eventually to be an integrated flood protection system for all of Southern Manhattan, along the coast of the Lower East Side and Chinatown. This system will be composed of permanent features, temporary features, landscaping improvements, and drainage improvements to create a line of protection that would be fully deployed only during pre-storm conditions. The protection would be designed to produce only a minimal impact on, and generally to support, neighborhood fabric during non-storm conditions. The expected alignment of this first phase would start north of the Brooklyn Bridge and continue north along South Street to approximately East 14th Street. The goal is for design work on this first phase to begin in 2014, with completion in 2016. (See rendering: *Conceptual Rendering of Lower East Side Flood Protection System*)

In addition to the foregoing, the City also will consider extending the first phase of this integrated flood protection system south from the

alignment described above to Lower Manhattan, including the Financial District. This is because, though the area contains a smaller and less economically vulnerable residential population and is less densely populated than the Lower East Side and Chinatown, it is a major hub of commercial activity for the region and, like the Lower East Side and Chinatown, contains vital infrastructure. Accordingly, the City will work with the local community, including the local business community and property owners, to explore alternative private financing sources for the aforementioned southern extension that could be leveraged to secure new sources of public financing. By way of example, such private sources could include a modest per-square-foot assessment on commercial space that would be protected by this extension. When completed, the expected alignment of this extension would start at the southern end of the system proposed for the Lower East Side and Chinatown and would run south along South Street to Battery Park, with a small section running along West Street, north of Battery Park City. If funding were identified, the timing for the southern extension could be consistent with the schedule above.

Coastal Protection Initiative 22 Install an integrated flood protection system at Hospital Row

Bellevue Hospital and neighboring healthcare facilities flooded during Sandy and remain at risk of flooding during extreme weather events in the future. Subject to available funding, the City, therefore, will install an integrated flood protection system at Hospital Row north of 23rd Street in Manhattan. OLTPS will work with multiple agencies to design and construct this project. The expected alignment will be along the service road of the FDR Drive, utilizing passive floodwalls and other localized measures where appropriate to integrate the system. The system will specifically enhance protection to Bellevue Hospital, a critical trauma facility, and could potentially integrate with existing plans by neighboring facilities operated by New York University and the Veterans Administration. The goal is to complete design in 2014 with project completion by 2016.

Beyond the priority coastal protection projects described in Chapter 3, including those summarized briefly above, the City is proposing

Conceptual Rendering of Lower Manhattan Multi-Purpose Levee



additional coastal protection initiatives specific to Southern Manhattan's vulnerabilities.

Southern Manhattan Initiative 1
Create an implementation plan and design for an integrated flood protection system for remaining Southern Manhattan areas

As described above, Sandy showed that the entire shorefront of Southern Manhattan is vulnerable to coastal flooding. This vulnerability is expected to increase as the climate changes. Subject to available funding, the City, therefore, will create an implementation plan for an integrated flood protection system to protect the remainder of the Southern Manhattan shorefront, outside of the first phase system described above. The implementation plan and design work will focus on Tribeca, the West Village, Chelsea, Hudson Yards, Stuyvesant Town, and Kips Bay. The intent is for the entirety of the system (first and subsequent phases) to be fully integrated.

Southern Manhattan Initiative 2
Conduct a study for a multi-purpose levee along Lower Manhattan's eastern edge to address coastal flooding and create economic development opportunities

The eastern edge of Lower Manhattan, particularly from the Battery north to Chinatown, is

one of the lowest-lying areas in Southern Manhattan and is, therefore, subject to flooding. This vulnerability, demonstrated during Sandy, is likely to get worse as the climate changes. Though the integrated flood protection system described above could provide substantial protection during extreme weather events, there may need to be a longer-term approach that not only could offer more permanent protection, but also, over time, could be self-financing. Subject to available funding, the City, therefore, will study the creation of a new multi-purpose levee along the eastern edge of Lower Manhattan from the Battery Maritime Building to Pier 35, which would provide protection against multiple climate change-related threats, including storm surge and sea level rise. This approach would provide the protective value of a traditional levee while also providing new land on which commercial and residential buildings could be constructed, both to accommodate the City's growth and to help finance the construction of the multi-purpose levee. The intention would be for this new East River neighborhood to serve much the same function as Battery Park City does along the Hudson River. (See rendering: *Conceptual Rendering of Lower Manhattan Multi-Purpose Levee*)

The multi-purpose levee to be studied could extend from the current East River shoreline out to the existing pierhead line, with the levee's elevation to be determined by current floodplain data, adjusted for expected sea level rise well beyond

2050. Such a protection system would be a major change to the coastal edge and require consideration of water quality, the river ecology, and integration into the existing urban fabric. The study will, therefore, have to explore integrating existing waterfront uses—such as Pier 17, the South Street Seaport Museum vessels, the heliport, and the Pier 11 ferry slips—into the design of the levee. Additionally, the study will explore the opportunities for reimagining the FDR Drive in the area to improve access to the waterfront and the new development area. Yet another component of the study will be an investigation of the potential to coordinate the construction of the levee with the extension of the Second Avenue Subway to its intended terminus at Hanover Square and Water Street. The goal is for NYCEDC to launch this study in 2013.

Buildings

The city's buildings give physical form to New York. As Sandy demonstrated, however, the building stock citywide, including in Southern Manhattan, is highly vulnerable to extreme weather events—a vulnerability that is expected to increase in the future. While the coastal protection measures outlined above are designed to reduce the effects of sea level rise, storm surge, and wave action on the city and the neighborhoods of Southern Manhattan, these measures will not completely eliminate those risks. They also will take time to design, fund, and build. It is equally important, therefore, to sup-

plement these measures by pursuing resiliency at the *building* level.

To achieve building-level resiliency, the City will seek to protect structures in Southern Manhattan and throughout the five boroughs against a spectrum of climate risks, including not only flooding but also high winds and other extreme events. Among the strategies that the City will use to achieve these goals will be to construct new buildings to the highest resiliency standards and retrofit as many existing buildings as possible so that they will be significantly better prepared to handle the impacts of extreme weather events.

The initiatives described below provide important examples of how the City intends to advance building resiliency citywide. These initiatives will have a positive impact on the residents, businesses, and nonprofits of Southern Manhattan. For a full explanation of the following initiatives and a complete description of the City's five-borough building resiliency plan, please refer to Chapter 4 (*Buildings*).

Buildings Initiative 1 **Improve regulations for flood resiliency of new and substantially improved buildings in the 100-year floodplain**

Though buildings constructed to modern Construction Codes generally performed well in Sandy, given the increasing risk of flooding that is likely with climate change, modifications are warranted. The City, therefore, will seek to amend the Construction Codes and Zoning Resolution to provide for strengthened requirements that will, among other things, improve the design of new buildings through the application of appropriate resiliency measures that are calibrated to the best floodplain data available over time and that critical building systems are better-protected from flood risks. In 2013, the City—through OLTPS—will seek to implement these code changes and the Department of City Planning (DCP) will continue to take zoning changes through the public review process, with the goal of adoption before the end of the year. If adopted, they will improve resiliency for the significant amount of mixed-use development likely to take place within the 100-year floodplain over time throughout Southern Manhattan.

Buildings Initiative 2 **Rebuild and repair housing units destroyed and substantially damaged by Sandy**

Roughly 23,000 private residential buildings encompassing nearly 70,000 housing units were damaged or destroyed during Sandy. Subject to available funding, the City, therefore, through

the Mayor's Office of Housing Recovery Operations (HRO), will provide financial and other assistance to owners of residential properties that were destroyed or substantially damaged during Sandy, including approximately 30 residential buildings encompassing approximately 400 housing units in Southern Manhattan. To address the damages sustained and to more effectively prepare these significantly damaged buildings for future storm events, the City either will assist owners or, in limited cases meeting City criteria, will facilitate the acquisition of properties by new owners whom it will assist, in rebuilding and substantially improving these properties based on the best floodplain data available over time. Additionally, the City is seeking to incorporate resiliency measures into approximately 500 to 600 multifamily properties that sustained minor damage including many publicly assisted buildings properties such as those developed pursuant to the Mitchell-Lama program and other affordable housing programs. The City, therefore, will support the retrofit of these publicly-assisted buildings, such as those developed pursuant to Mitchell-Lama and other affordable housing programs.

Buildings Initiative 3 **Study and implement zoning changes to encourage retrofits of existing buildings and construction of new resilient buildings in the 100-year floodplain**

The City, through DCP, will undertake a series of citywide and neighborhood-specific land use studies to address key planning issues in severely affected and vulnerable communities. As part of these studies, the City will identify ways to facilitate the voluntary construction of new, more resilient building stock, and to encourage voluntary retrofits of existing vulnerable buildings over time. To be undertaken in close consultation with local residents, elected officials, and other community stakeholders, these land use studies will focus on the challenges posed by the combination of flood exposure of the applicable neighborhoods; the vulnerability of the building types that are found in these neighborhoods; and site conditions in these areas that can make elevation or retrofit of vulnerable buildings expensive or complicated.

In Southern Manhattan, DCP, will examine neighborhoods with active-ground floor uses and adaptation challenges, including retail and mixed-use buildings in the greater Seaport area and in the neighborhoods along the East River from the East Village to Chinatown. Subject to available funding, the goal is for DCP to commence these studies in 2013. Thereafter, DCP would move to implement changes, if any, that it deems to be appropriate, based on the results.

Buildings Initiative 5 **Work with New York State to identify eligible communities for the New York Smart Home Buyout Program**

The City will evaluate opportunities for collaboration with the State in connection with its home buyout program, using an objective set of criteria developed by the City, including extreme vulnerability, consensus among a critical mass of contiguous local residents, and other relevant factors. It is anticipated that these criteria will be met in a limited number of areas citywide. As of the writing of this report, no areas have been identified for this program in Southern Manhattan.

Buildings Initiative 6 **Amend the Building Code and complete studies to strengthen wind resiliency for new and substantially improved buildings**

As noted above, buildings constructed to modern Building Code standards generally performed well during Sandy. Sandy, however, brought relatively weak winds, compared to other hurricanes. Given the possibility of more frequent or intense wind events in the future, modifications to the Building Code are warranted. The City, therefore, through OLTPS will seek to amend the Building Code to provide for strengthened requirements so that new buildings citywide can meet enhanced standards for wind resiliency. The City will further study whether additional wind resiliency standards should be required going forward. The amendments will be submitted to the City Council for adoption, and the study will commence, in 2013.

Buildings Initiative 7 **Encourage existing buildings in the 100-year floodplain to adopt flood resiliency measures through an incentive program and targeted mandate**

Even if every structure destroyed or damaged by Sandy were rebuilt to the highest resiliency standards, this would still leave tens of thousands of existing structures in the 100-year floodplain vulnerable—with more becoming vulnerable as the climate changes. Subject to available funding, the City, therefore, will launch a \$1.2 billion program to provide incentives to owners of existing buildings in the 100-year floodplain to encourage them to make resiliency investments in those buildings. Of the up to \$1.2 billion available through the program, the City will reserve up to \$100 million for 1- to 3-family homes, up to \$500 million for distribution across the five boroughs based on

each borough's share of vulnerable buildings citywide, and \$100 million for affordable housing developments. The City also will mandate that large buildings (those with seven or more stories that are more than 300,000 square feet in size) undertake certain flood resiliency investments by 2030. If the City consistently achieves its stated goal of encouraging significant resiliency retrofit investments for the vast majority of the built floor area in the 100-year floodplain in the five boroughs, over 30,000 housing units encompassing approximately 90 million square feet of built space in Southern Manhattan would, over time, be made meaningfully less vulnerable. The goal is to launch these programs in 2013.

Buildings Initiative 8

Establish Community Design Centers to assist property owners in developing design solutions for reconstruction and retrofitting, and connect them to available City programs

The City, through HRO, will establish Community Design Centers in neighborhoods across the city, potentially including Southern Manhattan, to assist property owners in developing design solutions for reconstruction and retrofitting, and connect them to available City programs. The Centers would be managed by the City—through agencies such as HRO, HPD, DOB, DCP, and NYCEDC—with support from local partners.

Buildings Initiative 9

Retrofit public housing units damaged by Sandy and increase future resiliency of public housing

During Sandy, public housing developments owned and operated by NYCHA suffered significant damage throughout the city. Still more were not impacted by Sandy but remain vulnerable to extreme weather, with even more likely to become vulnerable as the climate changes. The City, therefore, will through NYCHA, repair public housing developments across the City that were damaged by Sandy, incorporating new flood resiliency measures. In Southern Manhattan, 84 buildings containing nearly 10,000 units will be repaired. NYCHA also will undertake a planning process to identify additional resiliency investments in developments that are vulnerable to weather-related events, even if they were unaffected by Sandy. In Southern Manhattan, NYCHA, subject to available funding, is evaluating resiliency investments, subject to available funding, in 12 buildings containing over 850 additional units.

Buildings Initiative 10

Launch a sales tax abatement program for flood resiliency in industrial buildings

As Sandy demonstrated, many industrial buildings are vulnerable to extreme weather, with more likely to become vulnerable as the climate changes. However, many industrial buildings operate on thin margins making it challenging to invest in resiliency. The City, through the New York City Industrial Development Agency (NYCIDA), therefore, will launch a \$10 million program to provide incentives to owners of industrial buildings to encourage them to make resiliency investments in those buildings. The program will prioritize 1- to 2-story buildings with more than four feet between their actual ground elevation and the applicable BFE. In Southern Manhattan, approximately 27 industrial buildings with over 2 million square feet of floor area will be eligible for this program. This program will be launched in 2013.

Buildings Initiative 11

Launch a competition to increase flood resiliency in building systems

Many existing strategies for improving resiliency in buildings are either imperfect, expensive, or a combination of both. The City, through NYCEDC, therefore, will launch an approximately \$40 million Resiliency Technologies Competition using allocated Community Development Block Grant (CDBG) funding to encourage the development, deployment, and testing of new resiliency technologies for building systems. In Southern Manhattan, 1,610 buildings will be eligible to benefit from this competition. The program will be launched in 2013.

Buildings Initiative 12

Clarify regulations relating to the retrofit of landmarked structures in the 100-year floodplain

The City, through the Landmarks Preservation Commission, will clarify the Commission's regulations to assist owners of landmarked buildings and properties in landmarked districts in the 100-year floodplain who are contemplating retrofit projects. In Southern Manhattan, there are over 170 landmarked buildings in the floodplain, including buildings in portions of 19 historic districts. The Commission will issue its clarifying regulations in 2013.

Buildings Initiative 13

Amend the Building Code to improve wind resiliency for existing buildings and complete studies of potential retrofits

As noted above, given the possibility for more frequent intense wind events in the future, modifications to the Building Code are warranted. The City, therefore, through OLTPS, will seek to amend the Building Code and expand the existing DOB Façade Inspection Safety Program for high-rise buildings to include rooftop structures and equipment. The City will further study whether additional wind resiliency standards are required going forward. These amendments will be submitted to the City Council for adoption and the study will commence in 2013.

Insurance

Insurance can help provide residents and businesses with financial protection against losses from climate change and other types of risks. Sandy not only highlighted the importance of insurance, it also revealed that many New Yorkers are exposed to flood losses, which are not covered in standard homeowners or small business property insurance policies. Citywide, 95 percent of homeowners carry homeowners insurance, but when Sandy struck less than 50 percent of residential buildings in the effective 100-year floodplain had coverage through the National Flood Insurance Program (NFIP), a Federal program, administered by FEMA that provides flood insurance to properties in participating communities like New York City. While larger properties, in particular large commercial properties, tend to purchase flood insurance through the private market, NFIP is the primary source of flood insurance for homeowners throughout the country. Furthermore, Sandy drew attention to the significant cost increases in flood insurance that many New Yorkers will soon face, resulting from recent reforms to the NFIP as required by the Biggert-Waters Flood Insurance Reform Act.

The City will use several strategies to encourage more New Yorkers to seek coverage and to help the NFIP meet the needs of policyholders citywide. Specifically, the City will work to: address affordability issues for the most financially vulnerable policyholders; define mitigation measures that are feasible in an urban environment such as the Southern Manhattan communities and create commensurate premium credits to lower the cost of insurance for property owners who invest in these measures; encourage the NFIP to expand pricing options (including options for higher deductibles) to give potential policyholders more flexibility to make choices

about coverage; and launch efforts to improve consumer awareness, to help policyholders make informed choices. The initiatives described below are important examples of how the City will advance these strategies. These initiatives will have a positive impact on the residents, small businesses and nonprofits in this community. For a full explanation of the following initiatives and a complete description of the City's five-borough insurance reform plan, please refer to Chapter 5 (*Insurance*).

Insurance Initiative 1

Support Federal efforts to address affordability issues related to reform of the NFIP

The City will call on FEMA to work with the National Academy of Sciences to complete the study of flood insurance affordability, as required under the Biggert-Waters Act. The City will urge its Federal government partners to comply with this provision of the Act and take swift action to enact the recommendations.

Insurance Initiative 4

Call on FEMA to develop mitigation credits for resiliency measures

The NFIP provides few incentives for property owners to protect their buildings from flood damage and reduce their premiums, other than by elevating their buildings—actually lifting structures above flood elevation levels. In an urban environment such as Southern Manhattan, for a variety of reasons, elevation can be impractical, undesirable, and/or economically infeasible. Fortunately, other mitigation options are available. The City, therefore, will call upon FEMA to provide appropriate premium credits for mitigation measures other than elevation.

Insurance Initiative 6

Call on FEMA to allow residential policyholders to select higher deductibles

Flexible pricing options can encourage more people, especially those not required to carry insurance, to purchase insurance coverage that suits their needs. A higher-deductible option can substantially reduce premium costs to policyholders while remaining truly risk-based. Currently under the NFIP, deductibles up to \$50,000 are allowed for commercial policies, but residential policies are limited to a maximum deductible of \$5,000. The City, therefore, will call upon FEMA to allow homeowners that are not required to carry NFIP policies to purchase high-deductible policies that will protect them from catastrophic loss; initial estimates indicate that doing so could reduce insurance premiums by about half.

Critical Infrastructure

A resilient New York requires protection of its critical services and systems from extreme weather events and the impacts of climate change. This infrastructure includes the city's utilities and liquid fuel system, its hospitals and other healthcare facilities, telecommunications network, transportation system, parks, wastewater treatment and drainage systems, as well as other critical networks—all vital to keeping the city, including Southern Manhattan, running.

Utilities

The city's electric, natural gas, and steam systems are essential to everyday life in areas throughout the five boroughs, including Southern Manhattan. As Sandy proved, however, these systems are highly vulnerable to extreme weather events, with 800,000 customers losing electricity and 80,000 customers losing natural gas service during Sandy across the City, including approximately 230,000 that lost electricity service in the borough of Manhattan. This vulnerability will only grow as the climate changes.

Among the strategies that the City will use to address these challenges for residents of Southern Manhattan and other parts of the city will be to: call for risk-based analysis of low-probability but high-impact weather events to be incorporated into utility regulation and investment decision-making; call for capital investments that harden energy infrastructure and make systems more flexible in responding to disruptions and managing demand; and better diversify the city's sources of energy. The initiatives described below provide important examples of how the City intends to advance utilities resiliency citywide. These initiatives will have a positive impact on the residents, businesses, and nonprofits of Southern Manhattan. For a full explanation of the following initiatives and a complete description of the City's five-borough utilities resiliency plan, please refer to Chapter 6 (*Utilities*).

Utilities Initiative 5

Work with utilities and the Public Service Commission (PSC) to harden key electric transmission and distribution infrastructure against flooding

Various transmission substations, distribution substations, utility tunnels, and underground equipment in the city are at risk of flooding during extreme weather, including 5 substations in Southern Manhattan. For example, 40 percent of transmission substations are in the 100-year

floodplain today, and 67 percent are likely to be in the 100-year floodplain by the 2050s. The City, through OLTPS, will work with Con Edison and the Long Island Power Authority (LIPA) to prioritize these assets based on their roles in system reliability and to harden them as appropriate. This effort will begin in 2013.

Utilities Initiative 7

Work with utilities, regulators, and gas pipeline operators to harden the natural gas system against flooding

Although the city's high-pressure gas transmission system performed relatively well during Sandy, there were instances where remote operation of parts of the system failed. Additionally, the distribution system had localized outages due to water infiltration. Seeking to limit the compromising effects of future floods on both the system's backbone and the ability of Con Edison and National Grid to control and monitor the system, the City, through OLTPS, will work with the PSC, Con Edison, and National Grid to harden control equipment against flooding. In addition, the City will call upon Con Edison and National Grid to take steps to prevent water from infiltrating its gas pipes. This effort will begin in 2013.

Utilities Initiative 8

Work with steam plant operators and the PSC to harden steam plants against flooding

Many buildings within Southern Manhattan—including critical hospitals—rely upon Con Edison steam service for heating and cooling. All of the plants providing this steam are in existing floodplains and are also vulnerable to non-flood-related power outages. The City, therefore, will call upon Con Edison and the PSC to increase the resiliency of these plants by taking flood-protection measures, including adding floodwalls, sealing building perimeters, raising equipment, and installing flood-protected backup generators at each plant (to allow Con Edison to continue to deliver steam even during power outages).

Utilities Initiative 12

Work with utilities and regulators to minimize electric outages in areas not directly affected by climate impacts

Coastal flooding typically requires the shutdown of electrical feeder circuits that could potentially be exposed to floodwaters. In dense areas such as Southern Manhattan, this affects thousands of customers not directly in the floodplain. To reduce the incidence of these so-called sympathetic outages, the City will work with the utilities to design and implement new network

boundaries. In Southern Manhattan for example, had the network been configured in this manner, New York Downtown Hospital, which is outside of the flood zone, may have been able to avoid preemptive outages and thus the need to evacuate in advance of Sandy. In Southern Manhattan, a particular focus should be on hospitals and other critical facilities.

Utilities Initiative 14

Work with utilities and regulators to speed up service restoration for critical customers via system configuration

After extreme weather events, electric utilities may not be able to restore electrical circuits until all damaged customer equipment in an applicable area is repaired or replaced. For critical customers, this can mean a delay in the restoration of service even if that customer's own equipment is functional. The City, therefore, will work with Con Edison and LIPA to identify cost-effective ways to isolate critical customers, installing switches and other equipment along feeders that supply them.

Utilities Initiative 21

Work with public and private partners to scale up distributed generation (DG), including microgrids

The city's DG systems, including microgrids, have the potential for significant expansion—but are constrained by regulations, financing challenges, and lack of information. The City, through OLTPS and the New York City Distributed Generation Collaborative—a stakeholder group convened by the City in 2012—will continue efforts to achieve a PlaNYC goal of installing 800 megawatts of DG citywide by 2030. These efforts will include reform of PSC tariffs and other regulatory changes, expansion of low-cost financing, and provision of technical assistance to property owners and developers. This ongoing effort will continue in 2013.

Liquid Fuels

The liquid fuels supply chain is essential for everyday life throughout the five boroughs, including in Southern Manhattan. Sandy demonstrated the vulnerability of this system to extreme weather events. In the aftermath of Sandy, citywide—and particularly in Southern Manhattan—there were long lines at gas stations and other challenges for drivers, including emergency responders. The vulnerability of this system will only grow as the climate changes. Among the strategies that the City will use to address these challenges for residents of Southern Manhattan and other parts of the city will be to develop a strategy for the hardening of liquid fuel

infrastructure along the supply chain; increase redundancy and fuel supply flexibility; and increase supply availability for vehicles critical to the city's infrastructure, safety, and recovery from significant weather events. The initiatives described below provide important examples of how the City intends to advance its liquid fuel resiliency agenda citywide. These initiatives will have a positive impact on the residents, businesses, and nonprofits of Southern Manhattan. For a full explanation of the following initiatives and a complete description of the City's five-borough liquid fuels resiliency plan, please refer to Chapter 7 (*Liquid Fuels*).

Liquid Fuels Initiative 1

Call on the Federal government to convene a regional working group to develop a fuel infrastructure hardening strategy

The fuel supply shortage after Sandy was caused mainly by damage to infrastructure in New Jersey and other states, where the City and State of New York have no regulatory or legislative authority or oversight. The City, through OLTPS, will call on the Federal Hurricane Sandy Rebuilding Task Force and the United States Department of Energy to convene regional stakeholders to develop a strategy for hardening key infrastructure against future extreme weather. This effort will be launched in 2013.

Liquid Fuels Initiative 4

Work with New York State to provide incentives for the hardening of gas stations to withstand extreme weather events

New York State's 2013–2014 budget required that certain retail fuel stations invest in equipment that would allow them to connect generators quickly in the event of a power loss, and enter into supply contracts for emergency generators. The City, through OLTPS, will support the State in the design and implementation of this generator program, an effort that will include working with the New York State Energy Research and Development Authority (NYSERDA) to develop an incentive program to minimize the financial impact of the requirements on the businesses involved. In addition, OLTPS will work with the State to develop incentives to encourage retail fuel stations to implement resiliency measures other than back-up power capability. This effort will be launched in 2013.

Liquid Fuels Initiative 5

Enable a subset of gas stations and terminals to have access to backup generators in case of widespread power outages

Gas stations are vulnerable to widespread power outages resulting from extreme weather events, which could prevent them from dispensing fuel. In New York State's 2013–2014 budget, NYSERDA was directed to develop a generator pool program for gas stations. The City, through its Office of Emergency Management (OEM), will work with NYSERDA, FEMA, and the USACE in 2013 and beyond to develop such a pool and to create a pre-event positioning plan to enable the ready deployment of generators to impacted areas in the wake of a disaster.

Liquid Fuels Initiative 8

Develop a package of City, State, and Federal regulatory actions to address liquid fuel shortages during emergencies

Various regulations relating to the transportation and consumption of fuels in New York City limit the flexibility of the market to respond to disruptions, including following extreme weather events. The City, through OEM, will work with the State and Federal governments to prepare an "off-the-shelf" package of regulatory measures for use in the event of a liquid fuels shortage to allow supply-demand imbalances in the fuel supply to be mitigated more quickly. This effort will be launched in 2013.

Liquid Fuels Initiative 9

Harden municipal fueling stations and enhance mobile fueling capability to support both City government and critical fleets

The City must be able to respond quickly to a fuel supply disruption, providing continuous fueling to vehicles that are critical for emergency response, infrastructure rebuilding, and disaster relief. The City, through the Department of Citywide Administrative Services (DCAS), will procure fuel trucks, generators, light towers, forklifts, and water pumps to permit the City to put in place emergency fueling operations immediately following a disruption in the fuel supply chain. DCAS also will issue a Request for Expressions of Interest (RFEI) to potential suppliers of liquid fuels to evaluate options for sourcing such fuel during emergencies. The procurement effort will be launched in 2013, with the RFEI to follow in 2014.

Healthcare

The city's healthcare system is critical to the well-being of New Yorkers throughout the five boroughs, including in Southern Manhattan. This system is also a major economic engine for the city as a whole. This is especially true for Southern Manhattan, with four hospitals, several nursing homes and adult care facilities, and a network of community-based facilities, doctors' offices, and pharmacies support the local area. Sandy exposed this system's vulnerabilities, which are expected to grow as the climate changes.

Among the strategies that the City will use to address these challenges for residents of Southern Manhattan and other parts of the city will be to: build new hospitals, nursing homes, and adult care facilities to higher resiliency standards and harden existing facilities to protect critical systems; seek to keep lines of communication open between patients and providers, even during extreme weather events; and enable community-based providers to reopen quickly after a disaster. The initiatives described below provide important examples of how the City intends to advance its healthcare resiliency agenda citywide. These initiatives will have a positive impact on the residents, and healthcare providers of Southern Manhattan. For a full explanation of the following initiatives and a complete description of the City's five-borough healthcare resiliency plan, please refer to Chapter 8 (*Healthcare*).

Healthcare Initiative 2 Require the retrofitting of existing hospitals in floodplains

Many existing hospital buildings in the floodplain remain vulnerable to the impact of storm surge, with more likely to become vulnerable as the climate changes. The City, through OLTPS, therefore, will seek to amend the Construction Code to require existing hospital buildings in the 500-year floodplain—including Bellevue Hospital, New York University's Langone Medical Center, and voluntarily the Veterans Administration Hospital—to meet by 2030 a subset of the amended Construction Code standards for flood-resistant design. To minimize the risk of emergency evacuations and extended closures, these hospitals will be required to protect their electrical equipment, emergency power system, and domestic water pumps to the 500-year flood elevation. These hospitals also will be required to install backup air-conditioning service for inpatient care areas in case of utility outages, pre-connections for temporary boilers and chillers if primary equipment is not elevated, and pre-connections for external generators as a backup power source. These facilities already have begun exploring a number

of these and other flood mitigation measures as part of their post-Sandy rebuilding process. OLTPS will propose these requirements to the City Council in 2013.

Healthcare Initiative 3 Support HHC's efforts to protect public hospital emergency departments from flooding

Emergency departments (EDs) are critical points for patients in need of hospital services, and at three public hospitals citywide—including Bellevue which has the only designated regional trauma center below 68th Street—EDs are at risk of flooding due to storm surge. Subject to available funding, the City, therefore, through HHC, will invest in measures to flood-protect vulnerable EDs so they can remain available to provide care during extreme weather events. The goal is for this effort to begin in 2013.

Healthcare Initiative 4 Improve design and construction of new nursing homes and adult care facilities

New nursing homes and adult care facilities are at risk of power failures due to storm surge, which could result in patient evacuations. The City, through OLTPS, therefore, will seek to amend the Construction Codes to require that new facilities are constructed with additional resiliency measures for their emergency power systems. New nursing homes also will be required to have emergency generators and electrical pre-connections for external stand-by generators. Adult care facilities will be required to install either emergency generators that are adequately protected or pre-connections to external stand-by generators. OLTPS will propose these requirements to the City Council in 2013.

Healthcare Initiative 5 Require retrofitting of nursing homes in floodplains

Many existing nursing home facilities in the five boroughs are vulnerable to storm surge—a vulnerability that will only grow as the climate changes. The City, through OLTPS, therefore, will seek to amend the Construction Codes to require nursing homes in the 100-year floodplain to meet standards for the protection of electrical equipment, emergency power systems, and domestic water pumps (if applicable) by 2030. These systems will be protected to the 100-year flood elevation, in accordance with specifications already in the Construction Codes, and will help enable patients to shelter in place safely or reoccupy quickly after a storm. OLTPS will propose these requirements to the City Council in 2013.

Healthcare Initiative 6 Require retrofitting of adult care facilities in floodplains

Nineteen adult care facilities in the city are vulnerable to storm surge, including one in Southern Manhattan. The City, through OLTPS, will seek to amend the Construction Codes to require existing adult care facilities located in the floodplain to elevate or protect their electrical equipment to the 100-year flood elevation by 2030, in accordance with the specifications in the Construction Codes. In addition, the City will seek to require these providers to have either emergency generators that are adequately protected or electrical pre-connections to external generators. OLTPS will propose these requirements to the City Council in 2013.

Healthcare Initiative 7 Support nursing homes and adult care facilities with mitigation grants and loans

The primary challenge for most nursing homes and adult care facilities in implementing mitigation measures is obtaining financing. Subject to available funding, the City, through NYCEDC and the New York City Department of Health and Mental Hygiene (DOHMH), therefore, will administer competitive grants and subsidized loans to assist providers with mandated retrofit projects. The goal is for NYCEDC and DOHMH to launch the program when the proposed Construction Code amendments applicable to nursing homes and adult care facilities proposed in this report go into effect, likely in 2013.

Healthcare Initiative 8 Increase the air conditioning capacity of nursing homes and adult care facilities

Nursing homes and adult care facilities typically do not have enough emergency power capacity to run their air conditioning systems following the loss of power. This could cause some providers to evacuate during power outages that occur during hot summer months. The City, will offer sales tax waivers totaling \$3 million city wide to assist eligible nursing homes and adult care facilities that install emergency power solutions for air conditioning systems

Healthcare Initiative 9 Harden primary care and mental health clinics.

In communities such as Southern Manhattan that are at risk of extensive flooding during extreme weather events, primary care and mental health services may be compromised for weeks after a disaster due to extended facility closures. Subject to available funding, the City, through DOHMH and a fiscal intermediary,

therefore, will administer a competitive financing program to harden large clinics providing primary care and mental health services in Southern Manhattan and other high-need communities. The program will include grants and interest-free loans for capital investments that enable faster recovery of services—for example, installation of emergency power systems, protection of other critical building systems, and wet flood-proofing of facilities. The goal is for this effort to be launched in late 2013 or early 2014.

Healthcare Initiative 10
Improve pharmacies' power resiliency

Pharmacies dispense life-saving medicines essential for those with chronic conditions. However, without power, pharmacists cannot access the necessary patient records or insurance information to dispense these medicines. The City, through DOHMH, will work with pharmacies to improve their ability to leverage generators for power resiliency and address their other emergency preparedness needs including the launch of an emergency preparedness website for pharmacies. This effort already has begun and will continue throughout 2013.

Healthcare Initiative 11
Encourage telecommunications resiliency in the healthcare system

In the aftermath of a disaster, it is important that New Yorkers be able to speak to their doctors for guidance on needed medical care. The City, through DOHMH, therefore, will develop a best practice guide and outreach plan to help community-based providers understand the importance of telecommunications resiliency. Resiliency solutions could include using back-up phone systems (such as a remote answering service that would not be affected by local weather hazards), Voice over Internet Protocol (VoIP) technology that allows office phone lines to be used off-site, and pre-disaster planning to inform patients of available emergency phone numbers. This effort will begin in 2013.

Healthcare Initiative 12
Encourage electronic health record-keeping

Doctors rely on patients' medical records to provide and track care, but paper records may be compromised or destroyed due to extreme weather events. The City, through existing DOHMH programs, therefore, will call upon community-based providers located in the 100-year floodplain and other disaster-prone areas to implement electronic health records (EHR) systems for resiliency. DOHMH's Primary Care Information Project will sponsor initiatives to

provide primary care and mental health providers citywide with EHR technical assistance. This effort will begin in 2013.

Telecommunications

The city's telecommunications system is essential to individuals and businesses throughout the five boroughs, including in Southern Manhattan. While this is true at all times, it is especially true during emergencies. As Sandy demonstrated, however, this system is highly vulnerable to extreme weather events—precisely when telecommunications are most needed. Citywide and in Southern Manhattan, Sandy resulted in outages to landlines and mobile service, as well as to data service. The vulnerability of this system likely will grow as the climate changes.

Among the strategies that the City will use to address these challenges for residents, businesses and nonprofits of Southern Manhattan and other parts of the city will be to: increase accountability among providers to promote resiliency; use strengthened City regulatory powers and stronger relationships with providers to enable rapid recovery after extreme weather events; encourage hardening of facilities to reduce weather-related impacts; and increase redundancy to reduce the impact of outages. The initiatives described below provide important examples of how the City intends to advance its telecommunications resiliency agenda citywide. These initiatives will have a positive impact on the residents, businesses, and nonprofits of Southern Manhattan. For a full explanation of the following initiatives and a complete description of the City's five-borough telecommunications resiliency plan, please refer to Chapter 9 (*Telecommunications*).

Telecommunications Initiative 1
Establish an office within the Department of Information Technology and Telecommunications (DoITT) to focus on telecommunications regulation and resiliency planning

While the City has regulatory authority over some aspects of telecommunications service, it has no entity focused broadly on ensuring the resiliency of the public communications networks. The City, therefore, will form within DoITT a new Planning and Resiliency Office (PRO) that will have the resources needed to develop, monitor, and enforce resiliency standards, in close cooperation with State and Federal regulators and providers. DoITT will launch the new office in 2013.

Telecommunications Initiative 2
Establish new resiliency requirements for providers using scheduled renewals of the City's franchise agreements

Flooding caused outages during Sandy in facilities that did not follow the Federal Communication Commission's recommended best practices for resiliency, including flood protection measures. The City, through DoITT, therefore, will encourage and enforce resiliency standards for telecommunications providers through the franchise renewal process and through other agreements into which such providers enter with the City. The City will also seek to require standardized outage reporting and publishing. DoITT will launch this effort in 2014, in advance of 2020 franchise renewals.

Transportation

Without the city's expansive transportation system, New York would grind to a halt. This was illustrated starkly during Sandy when outages occurred across the system during and immediately following the storm. These outages severely impacted the residents of Southern Manhattan, which found themselves inaccessible and isolated by the shutdown of subway and other public transit systems, as well as by flooding on arterial and secondary roads. The vulnerability of this system will only grow as the climate changes.

Among the strategies that the City will use to address these challenges for residents of Southern Manhattan and other parts of the city will be to: make the system more flexible and more resilient; protect critical elements of the system from damage; and seek to maintain system operations during extreme weather events; and, following extreme events, to enable quick recovery, while also putting in place plans for back-up transportation options until regular service can be restored. The initiatives described below provide important examples of how the City intends to advance its transportation resiliency agenda citywide. These initiatives will have a positive impact on the residents, businesses, and nonprofits of Southern Manhattan. For a full explanation of the following initiatives and a complete description of the City's five-borough transportation resiliency plan, please refer to Chapter 10 (*Transportation*).

Transportation Initiative 1
Reconstruct and resurface key streets damaged by Sandy

Sandy's waves and flooding caused significant damage to area roadways. The City, through

NYCDOT, will reconstruct 60 lane-miles of streets that were damaged severely, and will repave approximately 500 lane-miles of streets with damaged surfaces. In Southern Manhattan, this will include three linear miles of reconstructed streets, primarily in Tribeca and the West Village but also in Lower Manhattan and the Lower East Side. Wherever feasible, the reconstructed streets also will include resiliency features to prevent future damage. NYCDOT will launch this initiative in 2013 with funding from Federal and City sources.

Transportation Initiative 3 **Elevate traffic signals and provide backup electrical power**

New York's traffic signals—and particularly the controllers that operates these signals and communicate with the NYCDOT Traffic Management Center—are vulnerable to damage from flooding as well as to power loss from various extreme weather events. Accordingly, the City, through NYCDOT, will raise controllers at approximately 500 intersections in flood-vulnerable locations across the city, including in Southern Manhattan. In tandem with this effort to place electrical hardware above the 100-year floodplain elevation, NYCDOT also will install power inverters in approximately 500 NYPD vehicles to allow these vehicles to provide backup electrical power to critical traffic signals. This effort will begin in 2013.

Transportation Initiative 4 **Protect NYCDOT tunnels in Lower Manhattan from flooding**

The two tunnels controlled by NYCDOT in Lower Manhattan—the Battery Park Underpass and the West Street Tunnel—are vulnerable to flooding from both storm surge and heavy downpours. This vulnerability is likely to increase as the climate changes. The City, through NYCDOT, will, therefore, evaluate a series of potential flood protection strategies at these two tunnels (including installing permanent floodgates, raising entrances and ventilation structures, and using temporary inflatable tunnel closure plugs) and, subject to available funding, will implement the most appropriate solution or solutions within the next three years.

Transportation Initiative 6 **Protect Staten Island Ferry and private ferry terminals from climate change-related threats**

To allow for quicker restoration of service on the Staten Island Ferry, the East River Ferry, and other ferry services, the City will use Federal Transit Administration Emergency Relief funds to construct physical improvements to the

floating infrastructure, loading bridges/gangways, pilings, and piers at both the Whitehall and Saint George ferry terminals and at additional ferry landings around the city including Southern Manhattan. NYCDOT will launch this investment immediately.

Transportation Initiative 8 **Call on non-City transportation agencies to implement strategies to address climate change threats**

Many non-City agencies that own and operate critical portions of New York City's transportation system have already announced resiliency and protection initiatives appropriate to their system. Without such action, these critical facilities managed by these agencies will remain vulnerable to damage and disruption from future weather-related events. The City, therefore, will call on these agencies to implement the initiatives that they have announced and take additional steps to protect their major transportation assets from climate change threats and prepare for quick restoration following an extreme weather event. Assets that may require hardening and/or preparation measures in Southern Manhattan include: subway stations and supporting elements in the 100-year floodplain; the PATH system; the Hugh L. Carey Tunnel; the Queens Midtown Tunnel; and the Holland Tunnel. The City will work with these agencies to advance these plans in 2013.

Transportation Initiative 9 **Plan for temporary transit services in the event of subway system suspensions**

When major portions of the subway system are out of service, there simply is not sufficient capacity in the rest of the transit network or the roadway system to carry the increased volume of commuters and other travelers. The City, through NYCDOT, therefore, will work with the MTA and other transportation partners to develop and regularly update formal plans to provide temporary transportation services in such an event, including following extreme weather. These services could take the form of temporary, high-capacity "bus bridges" of the type implemented during Sandy, linking other boroughs to Manhattan (see *Initiative 16, below*) or temporary point-to-point ferry services, for example connecting coastal areas in Manhattan and other boroughs to Lower Manhattan. This planning effort will begin in 2013.

Transportation Initiative 10 **Identify critical transportation network elements and improve transportation responses to major events through regular resiliency planning exercises**

Many of the facilities critical to the City's ability to respond effectively to a disaster are vulnerable to disruption and damage during extreme weather events, potentially impairing delivery of emergency services and supplies, as well as impairing the restoration of critical non-transportation infrastructure and economic activity. This vulnerability is expected to increase as the climate changes. To respond better to a variety of different possible transportation outage and restoration scenarios, the City, through NYCDOT, will work with transportation agencies around the region to identify the critical elements of the surface transportation network that need to be available quickly following different types of events. The key tool to identify these networks will be an ongoing series of detailed and multi-disciplinary resiliency planning exercises that will allow NYCDOT and its partners to understand where resources need to be focused before, during, and after an event. This effort will begin in 2013.

Transportation Initiative 16 **Expand the city's Select Bus Service (SBS) network**

Parts of the city lack subway access or have slow and unreliable public transportation. In these areas, the City and the MTA have been deploying SBS routes to improve general mobility. These routes can form the backbone of high-capacity bus service in the event of major subway outages, including following extreme weather events. The City, through NYCDOT, will work with the MTA to expand the SBS network significantly, building on a plan developed jointly in 2010 and reinforced in the New York State 2100 Report issued in January 2013. Implementation of this plan has already begun in areas, with additional new SBS identified for Southern Manhattan.

Beyond the priority transportation resiliency projects described in Chapter 10, including those summarized briefly above, the City is proposing an additional transportation resiliency initiative specific to the vulnerabilities of Southern Manhattan. This initiative is described below.

Southern Manhattan Initiative 3
Construct physical enhancements to
Water Street

As the main vehicular corridor along the eastern edge of Lower Manhattan and a high-density district containing 19 million square feet of office space (the leases for 15 percent of which are scheduled to expire in the next two years) and 2 million square feet of residential space, Water Street is in need of significant streetscape improvements. These improvements would aim to improve both the roadway itself and the pedestrian environment. To this end, the City will implement both short-term and long-term improvements to the roadway and sidewalks along Water Street. NYCDOT will begin to implement short-term improvements along Water Street from Whitehall Plaza to Fulton Street during the summer of 2013 including new pedestrian-friendly sidewalk expansions and crosswalks, new seating and lighting, and new plazas in the public right of way. These short-term improvements also will include new and improved signage and wayfinding.

Upon completion of the short-term improvements described above, NYCEDC, in partnership with NYCDOT and the Alliance for Downtown New York will commence design work for a longer-term capital project for Water Street. This project will build upon NYCDOT's short-term improvements, creating permanent vibrant and attractive pedestrian spaces, and include sustainable and storm-resilient measures such as permeable paving and stormwater retention treatments to absorb water during heavy rain events. Once design is complete, NYCEDC will lead the construction effort in close coordination with NYCDOT. \$20 million in funding commitments are in-place from the City and the Lower Manhattan Development Corporation (LMDC) for this project, the design of which is expected to begin in 2013.

Parks

During Sandy, it became clear that, in addition to serving as neighborhood front yards and recreation centers, in many places (including Southern Manhattan), the City's parks serve as the city's front line of defense when extreme weather events hit, buffering adjacent neighborhoods. As the climate changes, it will be even more critical that the city's parks are able to play all of these roles.

Among the strategies that the City will use to address these challenges for residents of Southern Manhattan and elsewhere in the City will be to: strengthen city's parks so that they

are able to survive weather-related events more effectively and can act as stronger buffers for adjacent communities; and pursue technologies and approaches that will enable the City to monitor, analyze, and prepare the park system for its many roles in an era of increasing change. The initiatives described below provide important examples of how the City intends to advance its parks resiliency agenda citywide. These initiatives will have a positive impact on the residents, businesses, and nonprofits of Southern Manhattan. For a full explanation of the following initiatives and a complete description of the City's five-borough parks resiliency plan, please refer to Chapter 11 (*Parks*).

Parks Initiative 2
Harden or otherwise modify shoreline
parks and adjacent roadways to protect
adjacent communities

Approximately 24 percent of DPR parks and other open spaces are in the 100-year floodplain, which is expected to expand as sea levels rise—including in areas where parks front residential and commercial districts. Subject to available funding, the City, through DPR, will study and identify mitigation strategies, including cost-effective ways to use its park system to protect adjacent neighborhoods and the parks themselves. Strategies could include hardening or elevating park infrastructure, construction of levees or floodwalls to minimize flooding and attenuate waves, and using flood-tolerant materials in the construction of parks. Target sites in Southern Manhattan include East River Park, Battery Park, and Hudson River Park. The goal is to complete this study in 2014.

Parks Initiative 11
Improve the health and resiliency of the
city's urban forest

The city's forests and trees provide an array of health and environmental benefits, but are vulnerable to a variety of climate change-related impacts, including storm surge, wind, and even changes in average temperatures. Subject to available funding, the City, through DPR, will undertake a variety of efforts to protect trees—whether located in natural areas and parks, or along streets. This would include adding forest management crews, identifying locations in which to expand tree beds, and modifying regular tree inspection and pruning efforts to prioritize trees in areas vulnerable to extreme weather events. The goal is for DPR to launch this effort in 2013.

Water and Wastewater

The city's water and wastewater system is one of the most complex in the world, not only supply-

ing millions of New Yorkers with safe drinking water in all conditions, but also treating wastewater to enable the area's waterways to remain clean, while draining rainwater to minimize flooding. Sandy demonstrated the system's vulnerability to a whole host of weather-related threats, ranging from surge and sea level rise, to heavy downpours—threats that are expected to worsen as the climate changes.

Among the strategies that the City will use to address these challenges for residents of Southern Manhattan and other parts of the city will be to: protect wastewater facilities from storm surge; improve and expand drainage infrastructure; and promote redundancy and flexibility to make available a constant supply of high-quality drinking water. The initiatives described below provide important examples of how the City intends to advance its water and wastewater resiliency agenda citywide. These initiatives will have a positive impact on the residents, businesses, and nonprofits of Southern Manhattan. For a full explanation of the following initiatives and a complete description of the City's five-borough water and wastewater resiliency plan, please refer to Chapter 12 (*Water and Wastewater*).

Water and Wastewater Initiative 1
Adopt a wastewater facility design stan-
dard for storm surge and sea level rise

Sandy damaged wastewater treatment plants and pumping stations even though the design of City wastewater facilities typically has taken into account the highest historically recorded water height of nearby water bodies or the BFEs identified in FEMA maps. The City, therefore, will adopt an increased level of protection for design and construction of all wastewater facilities based on the latest FEMA maps, modified to reflect sea level rise projections for the 2050s. DEP will adopt the new design guidelines in 2013.

Water and Wastewater Initiative 2
Harden pumping stations

Many of the city's pumping stations are located in low-lying areas and are necessary to convey wastewater and stormwater out of communities; however, their location also increases their vulnerability to storm surge. Therefore, subject to available funding, the City, through DEP, will retrofit these pumping stations to improve their resiliency. These retrofits will include raising or flood-proofing critical equipment, constructing barriers, and installing backup power supplies. Preliminary estimates indicate that there are currently 58 at-risk pumping stations, of which several are already scheduled for capital improvements. DEP, subject to available funding, will pursue implementation of resiliency projects

in conjunction with repairs and planned capital work, and as appropriate based on the level of risk, historical flooding, and potential community impacts, among other criteria. Among the pumping stations to be considered for hardening are two in Southern Manhattan. The goal is to begin implementation in 2014.

Water and Wastewater Initiative 3 Harden wastewater treatment plants

All 14 of the City's wastewater treatment facilities are located along the waterfront and are therefore at risk in the event of a coastal storm. Subject to available funding, the City, through DEP, will protect these critical treatment facilities by raising or flood-proofing assets that are critical to the treatment process, constructing barriers, improving waterfront infrastructure, or implementing redundancy measures to avoid failure of these critical treatment systems. DEP will target initially facilities that have been identified as either most at-risk, or most likely to create issues for adjacent communities and waterways, based on the findings of an in-depth study by DEP. The goal is for DEP to begin implementation of adaptation measures for these and other facilities in 2014 as part of repairs and other planned capital projects.

Water and Wastewater Initiative 8 Reduce combined sewer overflows (CSOs) with Green Infrastructure

As climate change brings increasing rainfall volume to the New York area, the city may also experience shifts in the frequency and volume of CSOs. The City will continue to implement its Green Infrastructure Plan and CSO Long-Term Control Plans (LTCPs) to reduce such CSOs. For this purpose, DEP, working with the DPR and NYCDOT, will continue to pursue its plan to capture the first inch of runoff in 10 percent of impervious surfaces citywide by 2030. At the same time, DEP also will continue to develop LTCPs to evaluate long-term solutions to reduce CSOs and improve water quality in New York City's waterways. DEP will issue 10 waterbody-specific LTCPs and one citywide LTCP to follow through 2017.

Other Critical Networks: Food Supply

Though the food supply chain generally emerged intact following Sandy, in certain local areas (including parts of Southern Manhattan), residents found themselves without access to basic sustenance after the storm. In addition, had Sandy played out just a little differently, it is possible that significant links in the food sup-

ply chain—including the food distribution center in Hunts Point in the Bronx—could have been seriously threatened. As the climate changes, it is likely that risks such as these will grow.

Although initiatives outlined in several other sections above are important contributors to the overall resiliency of the food supply network (including especially those addressing utilities, liquid fuels, and transportation), the City also will pursue food-specific strategies to meet this goal for the benefit of residents of Southern Manhattan and other parts of the city. These strategies will involve calling for resiliency investments at the most significant food wholesaling and distribution centers in the city and addressing issues relating to retail access in the event of extreme weather. The initiatives in Chapter 13 describe how the City intends to advance its food supply resiliency agenda citywide. These initiatives will have a positive impact on the residents, businesses, and nonprofits of Southern Manhattan. For a complete description of the City's five-borough food supply resiliency plan, please refer to Chapter 13 (*Other Critical Networks*).

Other Critical Networks: Solid Waste

On a daily basis, the solid waste collection system in New York disposes of more than 12,000 tons of waste and recycling in a safe and sanitary fashion. Unlike many other critical City systems, during Sandy this one proved remarkably resilient, resuming many of its normal functions almost immediately after the storm. In fact, thanks to the efforts of the City's Department of Sanitation, even as the agency was dealing with its own storm-related challenges, it was able to assist with the recovery of Southern Manhattan and the larger city by collecting the debris left by the storm in an organized and efficient manner.

However, the system does face real issues. For example, during Sandy, the city's solid waste disposal system experienced interruptions that interfered with its ability to convey refuse out of the city to its ultimate destination. Additionally, as the climate changes, it is likely that this system will become more vulnerable to extreme weather.

Among the strategies that the City will use to address these challenges for residents of Southern Manhattan and other parts of the city will be to: harden critical City-owned solid waste assets to protect them from extreme weather-related impacts; and seek to improve the resiliency of the broader solid waste network—both City- and

third-party-owned—enabling it to resume operation quickly should disruptions occur. The initiatives in Chapter 13 describe how the City intends to advance its solid waste resiliency agenda citywide. These initiatives will have a positive impact on the residents, businesses, and nonprofits of Southern Manhattan. For a complete description of the City's five-borough solid waste resiliency plan, please refer to Chapter 13 (*Other Critical Networks*).

Environmental Protection and Remediation

Sandy showed that extreme weather events—which are likely to increase in severity with climate change—not only have the potential to impact the city's people, built environment, and critical systems, they also can have a deleterious impact on the natural environment. To help minimize the impact of future extreme weather on the environment, the City will advance a range of initiatives to protect open and enclosed industrial sites containing hazardous substances in an economically feasible way, and to encourage the cost effective remediation and redevelopment of brownfields in a resilient fashion. These initiatives will have a positive impact on the residents, businesses, and nonprofits of Southern Manhattan, which is home to approximately 600 industrial companies and 10 sites designated under the New York City Brownfield Cleanup Program. For a complete description of the City's five-borough environmental protection and remediation plan, please refer to *Environmental Protection and Remediation*.

Community and Economic Recovery

New York is a city of neighborhoods, and these neighborhoods vary widely in size and nature. Notwithstanding this variety, successful neighborhoods across the city tend to share certain traits. Two of these are: a formal and informal network of community members who help and support one another in good times and bad; and vibrant commercial and nonprofit sectors that employ and provide goods and services to the people of the community.

As Sandy demonstrated, however, both the network of community-based organizations and the commercial and nonprofit sectors in New York's neighborhoods can be sorely tested when extreme weather hits. During these times (when contributions from these networks and sectors are desperately needed) these organizations and businesses themselves are

frequently coping with the same set of challenges that the community at large is—a circumstance that can push even the most well-run organization or business to the breaking point. Even with these pressures, during and in the immediate aftermath of Sandy, New York's commercial and nonprofit sectors overcame many of their own difficulties, playing a critical role in the recovery of neighborhoods across the city, including Southern Manhattan. However, as the climate changes, difficulties such as these will likely arise more frequently, testing institutions mightily.

Among the strategies that the City will use to achieve the goal of making its neighborhoods and their critical institutions more resilient will be to: help build grassroots capacity and foster community leadership; help businesses and nonprofits impacted by Sandy to recover; help businesses and nonprofits in vulnerable locations to make resiliency investments that will better prepare them for future extreme weather; and bring new economic activity to neighborhoods recovering from the impacts of Sandy to enable these neighborhoods to come back even stronger than before.

The initiatives described below provide important examples of how the City intends to advance its community and economic recovery agenda citywide. These initiatives will have a positive impact on the residents, businesses, and nonprofits of Southern Manhattan. For a full explanation of the following initiatives and a complete description of the City's five-borough community and economic recovery plan, please refer to *Community and Economic Recovery*.

Community Disaster Preparedness Initiative 1 **Identify and address gaps in community capacity**

The capacity of a community to organize to aid businesses and residents after an extreme weather event or other disaster is a strong predictor of the success of that community's recovery. To improve the capacity of vulnerable communities, The City's Office of Emergency Management (OEM), working with the NYC Center for Economic Opportunity (CEO), will undertake a pilot assessment of the strengths and weaknesses of a Sandy-impacted community—which could be a neighborhood in Southern Manhattan—to inform the creation of a plan to address needs uncovered by the assessment. Subject to funding, the City, through OEM and CEO will choose a pilot community and begin their study in 2013.

Community Disaster Preparedness Initiative 2 **Continue and expand OEM's Community Emergency Response Teams**

OEM currently trains 54 teams of 1,500 volunteers across the city, which staff Community Emergency Response Teams (CERTs). Before, during, and after disasters, including extreme weather events, members of these teams help to organize community disaster preparedness and participate in emergency response and recovery. Going forward, OEM will work with communities to create additional teams, ensuring that the volunteers that staff them are as representative as possible of the communities that they serve. Towards the same end, OEM, working with the CEO, will also identify low-income young adults to be trained to lead their communities in disaster preparedness. OEM and CEO will launch this program by 2014.

Economic Recovery Initiative 1 **Launch business recovery and resiliency programs**

During Sandy, over 27,000 businesses citywide, including 6,500 in Southern Manhattan, were inundated by the storm. For many, recovery has been challenging. To assist with this recovery, immediately after the storm, the City launched the series of programs, described in *Community and Economic Recovery*, including a \$25 million loan and grant program and a \$25 million sales tax waiver program designed to help businesses get back on their feet. Building on the momentum of these programs, which have assisted over 2,500 businesses as of the writing of this report, the City, through NYCEDC, will launch the CDBG-funded Business Resiliency Investment Program of up to \$100 million to help vulnerable businesses throughout the city make resiliency investments in their buildings and equipment, and the Business Loan and Grant Program of up to \$80 million will assist businesses with recovery and rebuilding efforts. NYCEDC will launch these program in 2013.

Economic Recovery Initiative 2 **Launch the Neighborhood Game Changer Competition**

The recovery of many of the communities impacted by Sandy, including Southern Manhattan, has been hampered by a lack of opportunities for economic advancement and employment among significant populations that were impacted by the storm. In many cases, these challenges existed even before Sandy, but have been exacerbated by the impacts of the storm. To address this, the City, through NYCEDC, will launch the CDBG-funded

Neighborhood Game Changer Competition to invest up to \$20 million in public money in each of the five communities on which this report focuses, including Southern Manhattan. This funding will be available on a competitive basis to help finance transformational projects. To win the competition, a project will have to spur incremental economic activity, and match public funding with significant private capital. Projects that would be eligible to be funded in Southern Manhattan through this competition could include new attractions bringing new visitors, significant new operations of a major business or nonprofit, the revitalization of important commercial corridors, the expansion of an existing neighborhood institution or a major new transportation option. NYCEDC will launch this program in 2013.

Economic Recovery Initiative 3 **Launch Neighborhood Retail Recovery Program**

At the core of many Sandy-impacted neighborhoods are the local commercial corridors that provide employment opportunities and services to those who live and work around them. They include local retailers, institutions, and service providers—such as food markets, pharmacies, social service organizations, laundromats, and others. In many cases, though, these corridors were devastated by the storm. To address this, the City will call on the PSC and Con Edison to amend the preferential Business Incentive Rate (BIR) program which offers a discount on Con Edison's electric delivery charges, to allow it to be extended to impacted small businesses in the five communities on which this report focuses, including Southern Manhattan. Businesses and nonprofits with 10 or fewer employees that have received support from City-sponsored loan and grant programs will be eligible for the discount for five years up to a maximum discount of \$50,000 per business or nonprofit. The maximum aggregate benefit available across Southern Manhattan will be \$1 million. The goal is for NYCEDC to launch this effort in 2013. Among the corridors where the benefit will be available in Southern Manhattan include:

- Lower Manhattan (Water Street corridor, South Street Seaport district, and Greenwich Street)
- Chinatown (East Broadway and Madison Street)
- Lower East Side (Avenues B, C, and D)
- Tribeca (Canal Street, West Street and Greenwich Street)
- West Village (West Street and Washington Street)
- Chelsea (10th and 11th Avenues and 23rd Street)

Economic Recovery Initiative 4 **Support local merchants in** **improving and promoting local** **commercial corridors**

As mentioned above, Sandy highlighted the important role played by local commercial corridors in many of the communities impacted by the storm. The City, through the Department of Small Business Services (SBS), will provide financial and/or technical assistance to area business improvement districts (BIDs), merchant associations, and other groups that work to improve, market, maintain, and otherwise promote primary commercial corridors. Subject to review of applications received, SBS will prioritize Sandy-impacted commercial corridors. Such funding could be used for a variety of purposes, including capacity building, façade improvement programs, streetscape improvements, and business recruitment and marketing efforts. In Southern Manhattan, corridors that could receive this additional assistance include corridors in and around the historic Seaport District, Chinatown, the Lower East Side, and Hudson Square. SBS will provide this assistance beginning in 2013.

Economic Recovery Initiative 6 **Reassess commercial properties citywide** **to reflect post-Sandy market values**

After Sandy, many commercial properties were worth less than before the storm. To reflect this fact and to help with recovery from the storm, the City has reassessed more than 88,000 properties impacted by the storm citywide. Overall, these reassessments have lowered the tax burden on Sandy-impacted properties—including both commercial and residential properties—by over \$90 million, with commercial properties in neighborhoods impacted by Sandy receiving a reduction, on average, of approximately 10 percent of their pre-storm assessed values.

In addition to the measures described above, the City will advance the following initiatives to address the community and economic recovery needs of Southern Manhattan.

Southern Manhattan Initiative 4 **Implement temporary programming of** **Water Street privately owned public** **spaces (POPS)**

Though the Water Street corridor is a high-density commercial and residential area, with over 21 million square feet of built floor area, because of zoning that was put in place in 1961, most of its buildings are set back from the street, with large public spaces with few amenities in front of

them. As a result, street-level activity along this corridor is significantly less vibrant than it is in other parts of Lower Manhattan. As a first step towards enlivening this corridor and increasing pedestrian activity in the area, the City will adopt temporary zoning regulations that allow events and new amenities in existing POPS. In conjunction with and to complement these temporary modifications, the City will also select a partner to produce programming and events in these POPS, with the goal of bringing activity to the street level in the district. Example of activities that NYCEDC and its partner may seek to bring to Water Street POPS could include farmers markets, musical performances, outdoor fitness events, and food or wine tastings. The goal is for these events to run throughout the week, with a larger number of events scheduled during the summer months. DCP, NYCEDC, and the Office of the Mayor are working together to implement this initiative, which will be launched in July 2013.

Southern Manhattan Initiative 5 **Launch a program to enable permanent** **improvements to Water Street privately** **owned public spaces (POPS)**

As described above, Water Street has the potential to be a much more vibrant corridor on par with others in Lower Manhattan. The City, therefore, will launch a new program to encourage permanent physical improvements to buildings and associated POPS, with the goal of activating ground floor spaces, upgrading public spaces, and strengthening the flood resiliency of buildings. DCP, in partnership with NYCEDC, will identify design criteria that promote active uses such as ground-floor retail, improvements to underperforming POPS, and improved flood resiliency, and will solicit proposals from property owners for comprehensive upgrades to both their ground floors and adjacent POPS based on these criteria. For proposals that meet the design criteria, DCP will facilitate applications for land use actions needed to carry out these improvements, and consider developing a broader regulatory framework to accommodate similar upgrades for other buildings along the Water Street corridor, going forward. This program would target the 19 buildings and associated POPS in the Water Street corridor that are in the 100-year floodplain. The program will launch in 2013, with any land use actions to begin public review in 2014.

Southern Manhattan Initiative 6 **Implement planned and ongoing** **investments in the South Street Seaport**

The South Street Seaport area was one of the areas in Southern Manhattan that was most impacted by Sandy. As of the writing of this report, it is still recovering, due both to the extent

of flooding and the fragility of the area's historic building stock. To support the recovery of the area and minimize the impacts of future extreme weather events, the City will make permanent resiliency investments in the mechanical systems in the City-owned buildings in the Seaport district, including the so-called Museum Block and Schermerhorn Row. The City's investments, to be made through NYCEDC, will total approximately \$850,000 and will relocate electrical equipment and boilers above the BFE. To complement these efforts, the City will also continue to pursue expanded summer programming in the area to increase the number of visitors, and will continue to support private investment in the area, including the renovation planned by the Howard Hughes Corporation for Pier 17. NYCEDC will complete its resiliency investments in the area by the end of 2013. The Pier 17 redevelopment is expected to commence in the fall of 2013 and be completed in 2015.

Southern Manhattan Initiative 7 **Use the Job Creation & Retention** **Program to attract and retain** **businesses in Sandy-impacted** **areas of Lower Manhattan**

The Job Creation & Retention Program (JCRP) is a Federally funded program that was created after the 9/11 attacks to keep businesses in Lower Manhattan and to attract new businesses to the area. The program, by law, is focused on the portion of Lower Manhattan south of Canal Street. To date, the program has retained or attracted some 65,000 jobs in the area. There is currently funding remaining in JCRP, though the program is set to expire at the end of 2013.

Given the new awareness of extreme weather risks in Lower Manhattan, there is a concern that some businesses may now be reluctant to relocate to, or remain in the area—a concern that is reminiscent of concerns after 9/11. The City, through NYCEDC, therefore, will seek to work with LMDC and the Empire State Development Corporation (ESDC), to extend JCRP through at least 2017, and to focus \$15 to \$20 million of the remaining funds on a new program to stabilize and produce momentum in the marketplace for Sandy impacted buildings. The City will seek to target new leases (or extensions of existing leases) in buildings in the 100-year floodplain, constructed prior to 1983. Under this program, JCRP would offer incentives per employee higher than those typically offered under JCRP (\$7,000 per retained employee and \$10,000 per new employee) to mid- and large-sized companies (those over 500 employees) that commit to leases in this challenging sub-category of Lower Manhattan building

stock before the end of 2014. Companies relocating from other New York City boroughs or from north of 60th Street in Manhattan would not be eligible for the program.

Southern Manhattan Initiative 8

Expand Take the HELM program (Hire and Expand in Lower Manhattan)

Over the past decade, the City has sought to diversify the Lower Manhattan economy so that the area would be less singularly dependent on the financial services industry and the public sector. This goal is particularly important post-Sandy when many more traditional tenants in the area may be hesitant to sign new leases, given their experiences during and after the storm—even if building owners are making significant investments to reduce future vulnerability. To complement the efforts to date, subject to available funding, the City will expand subsequent rounds of its successful Take the HELM program, a program that offers cash prizes of \$250,000 each to promising companies in the creative and technology fields that are willing to sign leases in Lower Manhattan south of Chambers Street, adding five new prizes during 2013 and 2014 specifically targeted at companies that agree to locate in the 100-year floodplain.

Southern Manhattan Initiative 9

Implement planned and ongoing investments by the City and private partners

Preservation and revitalization of neighborhoods most significantly impacted by Sandy will be hampered if the momentum of planned investments is lost. The City, therefore, will continue to pursue and execute planned investments in the neighborhood, and should continue to work with partners to facilitate private investment in Southern Manhattan. Such projects include but are not limited to:

Parks and Open Space

- *East River Waterfront*, a 2-mile long esplanade and piers project, extending from the Battery Maritime Building (at Broad Street) to Montgomery Place, just north of the Manhattan Bridge, the next phases of which (Broad Street to Old Slip, near Pier 11; and Pike and Allen Streets to Pier 35) are set to be completed by 2013.
- *Pier 35 EcoPark*, an open space and ecohabitat restoration project, planned for completion in 2013.
- *Pier 42 Waterfront Park*, an interim recreational park opened in May 2013, the long-term designs for which are underway.
- *Battery Park Playspace*, a renovation project

for an existing play space in Battery Park being undertaken by the Battery Park Conservancy, using imaginative, interpretative, art-based design, combined with inventive water features, that is scheduled for construction in 2014.

- *Peck Slip Park*, a redesign project covering the portion of the Slip from Water to South Streets that will include seating, planting, and trees and is set to commence in spring 2014.
- *Asser Levy Park*, a project that will convert Asser Levy Place between 23rd and 25th Streets from a roadway into a park with seating, trees, and recreational facilities, expected to be completed in 2014.
- *Hudson River Park*, an ongoing park construction and planning project which is 70 percent complete, the next phases of which (a new boathouse and restaurant at Pier 26 and renovation of Pier 57 for a market with cultural and educational uses) are scheduled to be completed between 2013 and 2015.
- *The High Line*, an elevated park on the Far West Side, construction of the final section of which will bring the park to 34th Street and is to be completed in 2014.

Infrastructure and Transportation

- *Peck Slip Reconstruction*, an infrastructure repair project that will replace a water main and other vital utilities and rebuild roadways, curbs and sidewalks, anticipated to be completed by spring 2014.

Economic Development

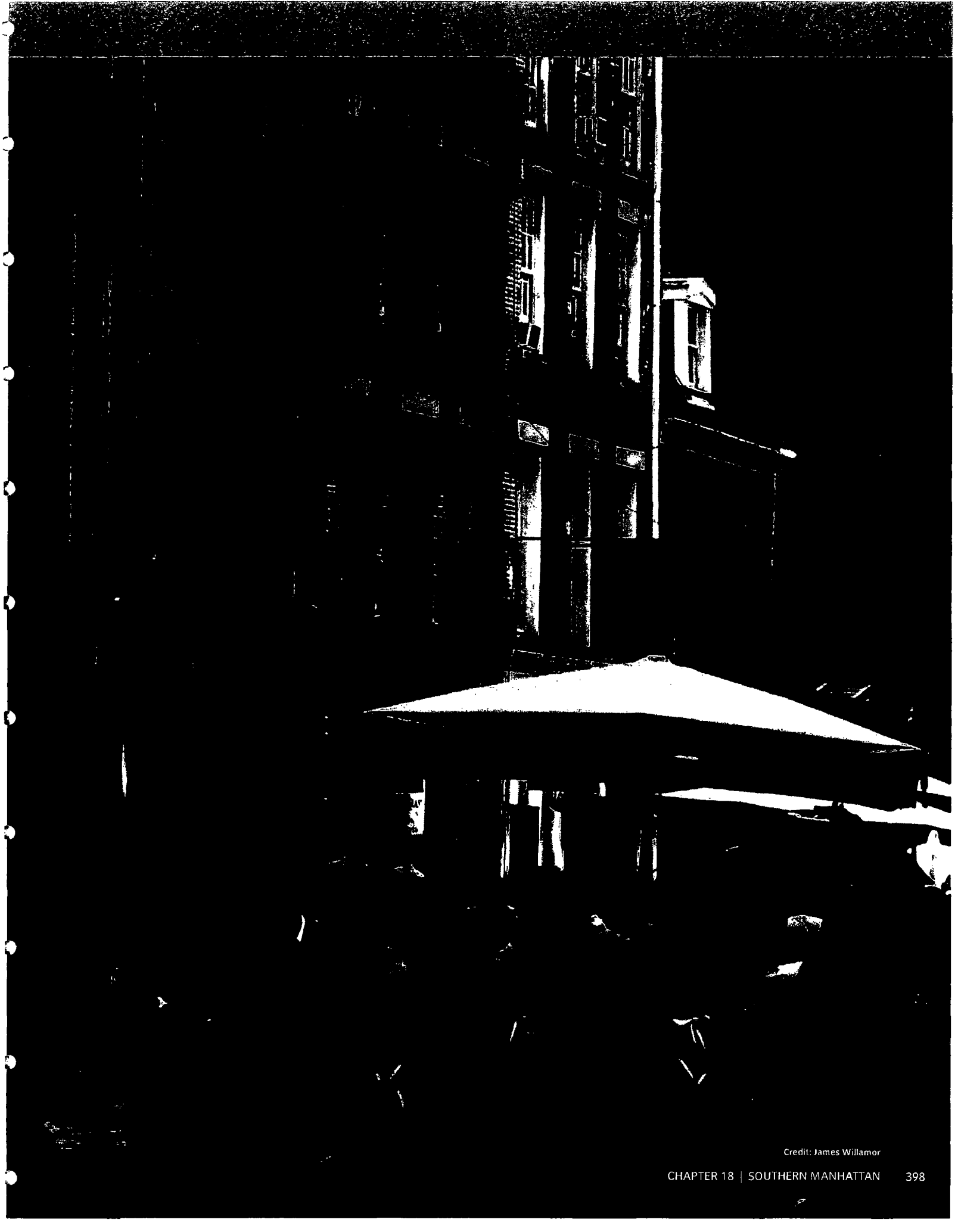
- *Battery Maritime Building*, a mixed-used project containing a catering event space, a 67-room boutique hotel, and rooftop restaurant and bar, construction of which is expected to be completed in 2014.
- *Pier A Renovation*, a redevelopment project that will create a beer garden and casual dining area, as well as a restaurant and event space, and live entertainment and bar venue, scheduled for completion in 2014.
- *Hudson Yards South Tower*, an office tower that is the first in this rezoned area that will provide 1.7 million square feet of space and is scheduled for completion in 2015.

Community Facilities

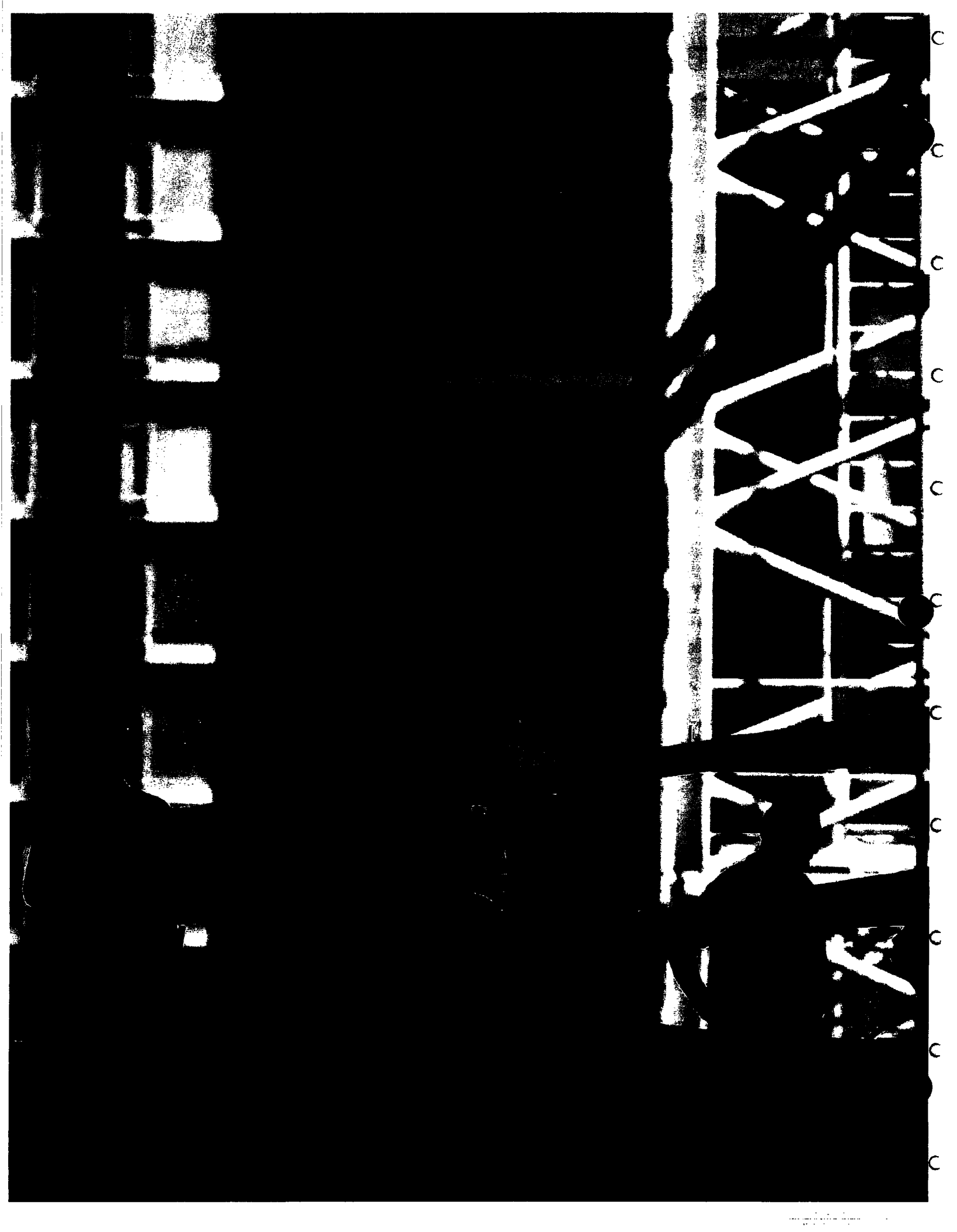
- *Peck Slip School*, a conversion of a former US Post Office building into a 600+ seat elementary school that is to be opened in 2015.

Cultural

- *The National September 11 Memorial & Museum*, a 110,000 square feet exhibition space devoted to examining the implications of the events of 9/11, that is set to open in 2014.



Credit: James Willamor



Funding

This report outlines a variety of strategies and initiatives designed to make New York stronger and more resilient to climate change. Given a world of limited resources, the goal of this report is to begin now to make ambitious but targeted and cost-effective investments that will make New Yorkers materially safer than they were before Sandy. These investments also will ensure that when, from time to time, extreme weather events overwhelm the City's best-laid plans (which, because of nature's power, they sometimes will), New York will be able to bounce back more quickly than in the past.

The advantage of this approach is that it not only puts forward bold proposals, but also puts forward bold proposals that can be implemented starting immediately. It also reserves for future City leaders the ability to monitor changes in the climate over time and to make incremental investments based on observed experience as conditions warrant and further resources become available.

Because of the scale of the challenge posed by climate change, even a tailored plan scaled to available resources brings with it a significant price tag that will need to be borne by the public. In the case of the plan outlined in this report, this public price tag (which includes government-funded projects, as well as projects funded by broad populations, such as utility ratepayers) is projected to total almost \$14 billion. This amount will cover both capital expenditures and study costs. When combined with various other housing, business, and City agency recovery and resiliency needs, the total grows to approximately \$19.5 billion.

Though the needs are clearly significant, the good news for New Yorkers is that, as of the writing of this report, available public funding sources are significant too. For example, thanks to Sandy-related federal aid as well as a robust ongoing City capital program, much of the plan as outlined is already funded (approximately \$10 billion), or is expected by the City to be funded (approximately \$5 billion). However, even assuming the foregoing sources, the City's plan comes with a significant funding gap, estimated at approximately \$4.5 billion.

As outlined in this chapter, the City proposes to address this gap in two ways. First, with the funding in hand or expected to become available, the City will start to implement the initiatives that can be covered by these sources—initiatives that will, even without more funding, result in a New York that is materially stronger and more resilient than it is today. The remaining unfunded initiatives in this report, however, remain critically important.

That is why, as a second part of its strategy for addressing the funding gap, the City is putting forward proposals for meeting the shortfall. Enacting these funding proposals will require the cooperation of the State and Federal governments—cooperation that is essential for the sake of not just the city, but also the region and the country.

Uses of Funds

The uses of funds identified below include primarily capital costs over the next ten years, expressed in nominal terms, based on cost estimates as of the writing of this report. The total also includes identified study and planning costs, where recommended.

Special Initiative for Rebuilding and Resiliency (\$14 billion)

As discussed above, it is currently estimated that the initiatives outlined in this report, will require total public funding of over \$14 billion over a ten-year period. These costs are associated with only the first phase of the projects and programs that are described throughout this report. They do not include implementation costs for projects and programs that are identified as worthy of study or that are proposed for completion beyond the 10-year time horizon of this plan; these projects and programs will need to be funded separately with new sources. So, for example, the costs described in this chapter do include the proposed Phase 1 measures described in Chapter 3 (*Coastal Protection*), but do not include the incremental costs associated with completing the Full-Build measures described in that chapter.

While significant investments and other programs are called for throughout this report, certain chapters require particularly significant capital investments, including those focused on the water and wastewater system, coastal protection, the existing building stock, and energy utility systems. Anticipated funding under the plan also would be dispersed geographically, with over three-quarters of the allocated resources anticipated to be spent in vulnerable areas outside of Manhattan, including more than a third in Staten Island and Brooklyn, and over a quarter in Queens alone.

Other Recovery and Resiliency Needs

Generally, this report concentrates on resiliency investments, rather than investments intended purely to assist with recovery from Sandy (i.e., helping businesses and individuals impacted by the storm to repair damage and “get back on their feet”). The reason for this is that the City's recovery efforts have, by necessity, focused on

short- to medium-term needs, rather than the medium- to long-term timeframe of this report. It is important to note, however, that this report and the City's recovery efforts, led by a combination of the Mayor's Office of Housing Recovery Operations (HRO), the Department of Housing Preservation and Development, the New York City Economic Development Corporation (NYCEDC), the Department of Small Business Services and an array of other City agencies, have been developed in parallel and with substantial coordination.

Notwithstanding the different timeframes of the City's recovery efforts and this report, because certain elements of the recovery efforts are so closely linked to the mission of this plan (e.g., housing recovery as it pertains to the most impacted communities), in certain cases these recovery efforts have been incorporated into this report by reference. In so doing, the City has sought to highlight these efforts and ensure that their connection to the City's longer-term efforts is clear to all.

Among the recovery efforts that are closely related to the focus of this report and that, therefore, are included in the total public cost estimate are the following:

Housing Recovery (\$2.4 billion)

The mission of HRO is to return Sandy-impacted residents in New York City to permanent, safe and sustainable housing. This includes, in many cases, rebuilding destroyed homes and repairing homes that suffered substantial damage (greater than 50 percent loss), in each case ensuring—per Federal, State, and City requirements—that these homes are rebuilt to the highest resiliency standards (i.e., elevation). HRO also will seek to repair homes that suffered less-than-substantial damage. In these cases, repairs will involve primarily replacement in-kind, rather than mitigation measures such as elevation. The City currently estimates the total cost of these housing recovery efforts will be \$2.5 billion, with about \$100 million of this likely to come from private insurance payouts and philanthropic sources. The remaining \$2.4 billion is likely to come from public sources, of which a portion has been secured (see below for further details).

Public Housing Resiliency (\$1.1 billion)

Over 400 buildings owned by the New York City Housing Authority (NYCHA) were affected significantly by Sandy, including as a result of flooding and/or loss of power. In addition to repairing these facilities (which include community centers and NYCHA's Emergency Operations Center), NYCHA has identified a need of approximately \$420 million to ensure the inclusion of resiliency measures in these

repairs. Beyond those impacted by Sandy, there also are a significant number of additional NYCHA buildings that are found in the 100-year floodplain throughout the city and, therefore, remain vulnerable. NYCHA has estimated a total cost of \$620 million to implement basic resiliency and mitigation measures in these buildings. NYCHA also has identified approximately 30 community centers located in undamaged buildings in flood-vulnerable areas that also require resiliency investments to enable them to serve as warming centers, information distribution sites, local command centers, phone-charging centers, or emergency shelters in future storms. NYCHA estimates that this effort will cost \$60 million. All of these uses are likely to be funded through public sources, of which a portion has been secured (see below for further details).

Business Recovery (\$300 million)

Hurricane Sandy caused significant damage to businesses across the five boroughs, including approximately 23,400 businesses that were located in flood-impacted areas and faced extensive damage from loss of inventory, and damaged equipment and personal property. While private insurers and federal agencies such as the Small Business Administration (SBA) have stepped in to provide assistance, the City has implemented its own loan and grant programs and expects to provide additional assistance going forward (please refer to *Economic Recovery* for additional details). It is currently anticipated that the City's comprehensive business recovery needs will total approximately \$300 million. These uses are likely to be funded through public sources, of which a portion has been secured (see below for further details).

City Agency Recovery Needs (\$1.2 billion)

In preparing for and responding to Hurricane Sandy, City agencies incurred an array of unexpected costs that must be reimbursed in order to avoid creating a hole in the City's operating budget, requiring unplanned cuts in other programmatic areas. Various agencies also saw damage to facilities that must be repaired. Though some of these costs are eligible for federal reimbursement, in other cases only a portion of these costs are eligible. Finally, some agencies—particularly the Health and Hospitals Corporation—must be reimbursed for staff and other expenses necessary to maintain their operational readiness to restore vital services to the community as quickly as possible. These and other agency recovery needs currently are estimated at approximately \$1.2 billion. These are likely to be funded through public sources, of which a portion has been secured (see below for further details).

City Agency Resiliency Needs—First Phase (\$500 million)

In the aftermath of Hurricane Sandy, at the request of the Mayor's Office, City agencies took stock of the resiliency investments that may be needed to ensure that the City can provide essential services over the long term, as the climate changes. While the City is continuing to gather and prioritize these needs, at least \$100 million of these investments are a high priority and will be funded by an incremental addition to the City's capital budget. Another \$400 million may be eligible for certain federal hazard mitigation funds provided as a supplement to FEMA Public Assistance grants (see below for further details).

Sources of Funds

Existing Sources

As stated above, the City has available to it, or is highly confident that it will receive, significant funding against the needs described in this report. These sources include amounts already funded through its capital plan and certain federal assistance. The total value of these existing sources is approximately \$10 billion, calculated as follows:

City Capital (\$5.5 billion)

The City's existing capital plan includes funding for a number of the initiatives included in this report. Among the initiatives funded through the City's capital budget are a variety of water and wastewater initiatives, as well as selected economic development, infrastructure, and cultural investments in impacted communities. This existing \$5.5 billion investment program is a clear demonstration of the City's commitment to make vulnerable assets more resilient and accelerate recovery in the neighborhoods hit hardest by Sandy.

Community Development Block Grants—First Allocation (\$1.8 billion)

On February 6, 2013, the Department of Housing and Urban Development (HUD) announced the allocation to the City of nearly \$1.8 billion in funding from the Community Development Block Grant (CDBG) appropriation provided for in the Disaster Relief Appropriations Act of 2013. The passage of this Act, frequently referred to as the "Sandy Supplemental," was the result of an aggressive advocacy effort on the part of the Congressional delegations of New York and New Jersey in the wake of the disaster.

In accordance with federal regulations, the City detailed its proposed uses of this allocation in a Partial Action Plan, which

HUD approved on May 10, 2013, after public comment (the City's partial action plan and other recovery resources are available at www.nyc.gov/recovery).

The initial funding allocations in this Partial Action Plan are:

- Housing recovery and resiliency programs (\$648 million);
- Business recovery and resiliency programs (\$293 million);
- Repair and restoration of City infrastructure and other City services (\$360 million); and
- Planning and administration (up to \$177 million of which any unused portion will be reallocated to programs).

The City's initial Partial Action Plan also reserved \$294 million for resiliency investments, in addition to approximately \$26 million of the funding for planning and administration costs noted above for a total resiliency allocation of \$320 million. In anticipation of the completion of this report, the Partial Action Plan did not provide for the programming of these funds with specificity. The City now will seek approval from HUD for the following applications of these funds:

- Coastal Protection (at least \$180 million), associated with the construction of an integrated floodwall system along "Hospital Row" in Manhattan, repair of and enhancements to bulkheads citywide, and armored revetments along the South Shore of Staten Island and Coney Island Creek, all as described in detail in Chapter 3 (*Coastal Protection*);
- Building Resiliency (at least \$120 million), representing the first tranche of an incentive program intended to assist vulnerable buildings to implement the Core Flood Resiliency Measures, as described in Chapter 4 (*Buildings*); and
- Planning and Administration (up to \$26 million), including funding for studies described in this report to be undertaken by the Office of Long-Term Planning and Sustainability, the Department of City Planning (DCP), the Department of Buildings, and other agencies.

Housing Recovery Funding (\$700 million)

As noted above, the City has identified housing recovery needs of approximately \$2.5 billion, of which \$2.4 billion is likely to come from public sources. In addition to the CDBG funding described above, the City estimates available public funding other than the CDBG funding above to be approximately \$700 million. These public sources include payouts from the National Flood Insurance Program, as well as assistance from the Federal Emergency Management Agency (FEMA).

Sandy Supplemental Aid Package

Congress passed and the President signed into law two bills in the aftermath of Sandy. The first, passed in December 2012, provided for a \$9.7 billion increase in the National Flood Insurance Program's borrowing authority in order to enable the program to make payouts to insured victims of Sandy and other storms. The second was the Disaster Relief Appropriations Act of 2013, a \$50.7 billion aid package known alternatively as the Sandy Supplemental, which is dedicated primarily (though not exclusively) to Sandy disaster relief, recovery, and resiliency. The \$50.7 billion aid package was subsequently reduced to approximately \$48 billion due to the sequestration process resulting from ongoing negotiations to reduce the federal deficit. Although the Federal government may restore the sequestered funds after a successful resolution of future budget negotiations, there is no assurance that such restoration will occur.

The federal aid package includes funding for an array of uses, including most significantly, \$16 billion in pre-sequestration CDBG funding, \$13 billion in pre-sequestration Department of Transportation funding, \$12 billion in pre-sequestration Department of Homeland Security/FEMA funding, and \$5 billion in pre-sequestration USACE funding. With the exception of Section 406 and Section 404 funds described elsewhere in this chapter, the bulk of this funding is dedicated to help those whose homes and businesses were damaged or destroyed to rebuild and recover. Some of this rebuilding will include resiliency investments, but a significant majority of these funds will be dedicated to purposes other than the long-term resiliency measures that are the focus of this report.

Funding Provided by the Disaster Relief Appropriations Act of 2013

Recovery Funding for Top Agencies

\$ in Millions



Recovery Funding for Other Agencies

\$ in Millions

Department of Commerce	476	NASA	15
Department of Veterans Affairs	236	General Services Administration	7
Department of Agriculture	228	Smithsonian Institution	2
Department of Defense	113	Social Security Administration	2
Department of Labor	25	Legal Services Corporation	1
Department of Justice	21		

Source: Federal Hurricane Sandy Rebuilding Task Force

Other Federal Aid (\$2.3 billion)

The City has received or is expected to receive additional federal funding from a variety of sources as a result of the Sandy Supplemental. A portion of these amounts can be used for resiliency investments called for in this report. This includes especially funding for a variety of US Army Corps of Engineers (USACE) projects in Brooklyn, Queens, and Staten Island as described in Chapter 3.

Other Sources (\$40 million)

Immediately following Sandy, the City put in-place emergency recovery programs. These included \$25 million in loan and grant programs for small businesses, as well as \$15 million in mold removal programs for inundated housing. This money came from a combination of City sources, including NYCEDC, and matching funding from private organizations and philanthropies, such as the Mayor's Fund for the Advancement of New York City.

Expected Sources

In addition to the existing sources described above, the City also expects several other public sources of funding to be available to pay for the plan set forth in this report, including the following:

Additional Federal Sources (at least \$4 billion)

1. Community Development Block Grants—Future Allocations (TBD)

The Sandy Supplemental includes a total CDBG allocation of \$16 billion, primarily for Sandy-impacted areas, although the law instructs the HUD Secretary to reserve an unspecified portion for other natural disasters in the years 2011 through 2013. The law does not specify the process by which HUD should allocate the CDBG funds to particular grantees. Such allocation is left to the discretion of the HUD Secretary.

In the first allocation, the City received nearly \$1.8 billion out of HUD's first allocation of \$5.4 billion, or nearly 33 percent of that allocation. HUD noted that it based its first allocation on data from the FEMA Individual Assistance program and the SBA's disaster loan programs, which enabled HUD to identify the areas of greatest need.

With respect to the remaining \$10.6 billion in CDBG funding available under the Sandy Supplemental, a portion of this amount has, unless remedied in Washington, been lost to sequestration (leaving nearly \$9.3 billion available at present). At the same time, a portion is to be reserved for natural disasters other than Sandy. If HUD were to allocate a significant share of the available funds in the same proportion as the initial allocation, the City could receive billions of dollars in additional CDBG funds.

2. Section 404 and 406 Funding (TBD)

The Robert T. Stafford Disaster Relief and Emergency Assistance Act, as amended (Stafford Act) provides the authority for Federal disaster assistance activities, including not just assistance for response and recovery, but also for preparedness and mitigation. FEMA defines mitigation as any sustained action taken to reduce or eliminate long-term risk to life and property from a hazard event. In pursuit of mitigation, the Stafford Act authorizes post-disaster funding to help governments and certain nonprofit organizations reduce their risk of future loss.

The Stafford Act has two distinct hazard mitigation funding streams that are available post-disaster. First, FEMA may provide hazard mitigation funding as part of its Public Assistance program, as authorized by Section 406 of the Stafford Act. This funding pays

for the inclusion of mitigation measures in the repair of damaged facilities and infrastructure. City agencies, led by the Office of Emergency Management (OEM) and the Office of Management and Budget, currently are in the process of identifying projects that are eligible for hazard mitigation funding as part of Public Assistance projects, pursuant to Section 406.

Eligibility for this funding is based on a set of objective criteria and project-specific limitations, though there is no program-level cap for the amount of funding available. Every project that receives Public Assistance from FEMA may also be eligible to receive additional mitigation funds under the Section 406 program for approved mitigation measures. By FEMA policy, funding under this program generally is available in an amount equal to up to 15 percent of the cost of the associated approved repair project (or, up to 100 percent if the project is on a list of predetermined, cost-effective mitigation measures).

Currently, the City estimates that agencies will receive approximately \$3 billion in Public Assistance for capital-eligible work. At the 15 percent level, this would translate to more than \$400 million in available Section 406 funding, though, as indicated above, the overall sum available to the City could be significantly more or less than this amount.

The second source of funding under the Stafford Act is Section 404 and is also known as Hazard Mitigation Grant Program (HMGP) funding. This program provides mitigation funding for undamaged facilities and infrastructure not covered by Section 406 hazard mitigation funding. Private building owners may apply through a government entity. Funding – which is capped at an amount set as a percentage of FEMA Individual Assistance and Public Assistance dispensed during a given disaster – is allocated pursuant to a State-led application process. Eligible sub-applicants, including local governments and certain nonprofit organizations providing a general government-like service, may submit projects for consideration by the State.

In order to be eligible for Section 404 funding, federal law requires that jurisdictions have a FEMA-approved Hazard Mitigation Plan (“HMP”) in place. In New York City, OEM is responsible for the creation of the HMP, working in close partnership with a Mitigation Planning Council that includes nearly 40 City, State, and private entities, as well as extensive community input. The City’s HMP, which received FEMA approval in 2009, includes 161 potential projects intended to address eight separate weather-related hazards and is now in the process of being updated by OEM in close partnership with DCP.

Based on the allocation of FEMA Individual Assistance and Public Assistance during and after Sandy, the City currently projects that New York State will be eligible to receive approximately \$1 billion in Section 404 funding, though the actual amount may vary from this estimate. The State is, therefore, expected to launch a process that invites sub-applicants such as the City to propose projects suitable for funding. The City currently intends to submit funding requests for projects in the following four categories:

- Mitigation investments for destroyed or substantially damaged homes (e.g., elevation);
- Mitigation investments other than elevation for vulnerable buildings;
- Mitigation investments for vulnerable City-owned infrastructure; and
- Mitigation investments for vulnerable City-owned hospitals.

In addition, a number of nonprofit hospitals located in New York City are eligible to apply directly to the State for Section 404 funding—including several Staten Island institutions that have been prioritized by the Borough President. The City will support and provide technical assistance to these applications, as necessary and appropriate.

In total, given the distribution of Public Assistance and Individual Assistance claims across New York City and the rest of New York State, the City is seeking to receive allocations representing at least half of the State’s Section 404 allocation.

3. Summary of Additional Federal Sources

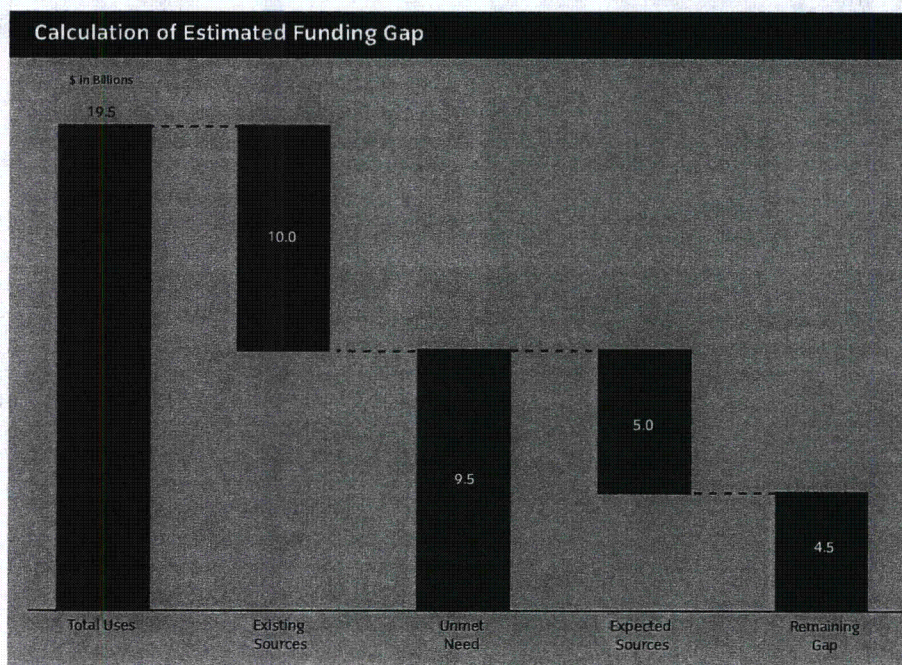
Based on the foregoing, the City currently estimates that between future CDBG

allocations, Section 404 funding, and Section 406 funding, the City could be eligible to receive an additional \$4 billion or more for use in funding the programs and projects described in this report. As indicated above, however, these amounts remain subject to processes and decision-making that generally are not within the City’s control.

Utility Rate Base (at least \$1 billion)

In Chapter 6 (*Utilities*), this report outlines a plan to support new resiliency standards for utilities, including significant hardening of key assets, increases to system flexibility, and projects to ensure faster service restoration. The City estimates that this plan would require significant capital investments in utility infrastructure over the next five to ten years. For example, Con Edison already has filed a proposal to spend \$1 billion on resiliency investments over the next three years. These cost projections are preliminary however, and the plan is subject to approval by the New York State Public Service Commission (PSC). Other utility-related investments may be subject to the approval of the PSC or the Federal Energy Regulatory Commission, as well as acceptance by the utilities and generation asset owners.

The City expects that most, if not all, of approved resiliency costs will be recoverable from the utilities’ existing rates through modifications to the utilities’ budgets, reprioritization of projects, and cost reductions in other areas. To the extent there is a proven need for additions to the utilities’ revenue requirements to achieve the goals of the plan, the City will support requests by the utilities for corresponding adjustments to their rates



(inclusive of a reasonable rate of return). Given the level of capital funding already included in rates, the City estimates that the impact to customers from any requests for rate adjustments will be minimal.

On May 31, 2013, the City provided detailed testimony on a rate case that Con Edison submitted to the PSC, including certain investments described in Chapter 6 of this report. While these measures will require additional funding, the City believes that they can be made within the parameters of Con Edison's proposed rate case. The PSC is expected to rule on Con Edison's proposal by the end of 2013.

Sizing the Gap

Based on the uses and sources identified above, the City currently faces a funding gap for the initiatives identified in this report of approximately \$4.5 billion. This means that, without additional sources, a number of these initiatives and programs would need to be delayed, scaled back, or even eliminated. However, the challenge of climate change is too great, and the potential impact of these initiatives too

Additional Supplemental Appropriation Precedent

There is a clear precedent for the proposed supplement to the initial USACE allocation for Sandy-impacted areas. In the year after Hurricane Katrina struck the Gulf Coast region, Congress appropriated over \$6 billion to the USACE for coastal protection. However, recognizing the needs beyond this initial appropriation—much of which, like the Sandy Supplemental, targeted short-term investments to repair coastal infrastructure—Congress provided four additional USACE appropriations for Katrina-related work, including the creation of significant new defenses. These additional appropriations totaled over \$9 billion.

An equivalent \$9 billion allocation would enable the City and other area governments to begin to make significant progress on the type of coastal defenses described in this report, protecting residents, businesses, and critical infrastructure from extreme weather events. At a minimum, Congress should allocate to New York City the \$3.7 billion necessary to fund the Phase 1 coastal protection initiatives set forth in Chapter 3 of this report.

significant, to simply accept this funding gap. That is why the City will continue to push aggressively to identify ways of filling this gap. Provided below are a series of strategies that would allow for the full implementation of the plan set forth in this report.

Strategies to Fill the Gap

The following are potential approaches for filling all or a significant portion of the identified funding gap associated with the plan outlined in this report. In the case of several approaches, the approval of another governmental entity (at the State or Federal level) would be required. However, because of the risks associated with the failure to implement this plan, the City is hopeful that it will find willing partners to secure the funding needed to make them a reality.

Additional Supplemental Appropriation

The Sandy Supplemental signed into law in January includes \$5.4 billion in funds for the USACE. However, much of this funding provides merely for the repair and restoration of protections that existed before the storm hit, and were damaged. Only limited funding is available for the study, design, and implementation of new measures that reflect the risk New York City and its neighbors face now and in the future, with very limited funding available for implementing these measures.

Given this, it is clear that the initial USACE allocation in the Sandy Supplemental is inadequate to deal head-on with the threats that climate change poses—especially taking into account the size of the area's population and its contribution to the national economy. Accordingly, an additional, significant USACE allocation would represent a valuable and necessary investment on the part of the Federal government. The City will work with the State, the Congressional delegation, and regional leaders to secure this necessary federal contribution. (See sidebar: *Additional Supplemental Appropriation Precedent*)

Lower Manhattan Tax Benefit Trade-In

In the months following the September 11, 2001 terrorist attacks, Congress provided \$5 billion in tax benefits to help in the rebuilding and economic recovery of Lower Manhattan. However, subsequent analysis showed that New York never received at least \$2 billion of this aid, due to technical issues in the design of the tax benefits. The City previously sought to work with Congress and the President to reprogram these unused tax benefits for investments in transportation infrastructure. In the wake of Hurricane Sandy, however, it is now appropriate to consider ways in which this

promised but still-undelivered \$2 billion in Federal assistance can be used for resiliency purposes, in order to prevent future damage in the City's vulnerable coastal areas, including Lower Manhattan.

Property & Casualty Insurance Resiliency Assurance Surcharge

Insurance exists to compensate policyholders for losses in the event that unfortunate events occur. While that compensation can help soften the blow of a loss, policyholders frequently do not receive full compensation—either for their losses, or for their non-financial costs, including lost time and anxiety. That is one reason why even those with insurance would prefer that losses not happen in the first place.

That is why, in the event that the City is unsuccessful in securing the supplemental federal appropriations described above, the City will work with the State, including the State legislature, to explore a "Resiliency Assurance Charge" (RAC) on property and casualty (P&C) insurance policies in New York City. This insurance includes automobile, homeowner, general liability, commercial multi-peril, and certain other forms of insurance. Because of the massive volume of P&C insurance premiums written for New York City exposure (over \$33 billion in New York State in 2010 alone, according to the State Department of Financial Services, of which a majority is applicable to New York City), even a small surcharge would produce sufficient proceeds to fill the identified gap. For example, by bonding against a surcharge of approximately 1.5 percent, the City could generate more than enough in upfront bond issuance proceeds and excess revenues to cover the \$5 billion shortfall. This surcharge would translate to just over a dollar a month for a homeowners insurance policy with a \$1,000 annual premium.

To access this funding source, the City would need to obtain passage of State legislation. Models such as this one exist in other areas of the country that are vulnerable to climate change, including Florida, Louisiana, and Texas, though, in these jurisdictions, surcharges on P&C policies are generally assessed after an extreme weather event to pay for insured losses that cannot otherwise be covered, rather than, as proposed in this report, to minimize the chances that those losses will happen in the first place.

City Capital Contribution

As described above, the City's existing capital budget includes significant funds for projects with an important resiliency and community recovery component. Although the City believes that the Federal and other sources

identified above could (and, especially in the case of the Federal sources, should) fill the bulk of the resiliency funding gap identified by this report, the City remains committed to making necessary investments that will protect New York and its residents. The Bloomberg Administration, therefore, is prepared to work with the City Council to make up to an additional \$1 billion in capital available for resiliency efforts, as follows:

- **Implementation of this plan (\$150 million):** The City will begin to invest immediately in selected resiliency measures included in this report that do not already have a dedicated funding source. This includes providing funding for the required “local match” for certain projects that are largely federally-funded, such as the USACE’s plan to construct an armored dune along portions of the East Shore of Staten Island;
- **Agency resiliency needs (\$100 million):** As described previously, the City has begun the process of identifying, and is prepared to fund, an initial set of \$100 million high-priority agency investments that would protect critical City facilities and ensure the continued provision of City services, during and after future extreme events;
- **City “match” for new sources (up to \$750 million):** Accessing the non-City sources described above will in each case require State or Federal approval. The City is prepared to allocate, on a contingent basis, additional funds to the extent that these approvals are obtained, on the basis of a 1-to-5 match, up to \$750 million. For example, if the City were successful in obtaining an additional \$3.75 billion in new funding, it would allocate the additional \$750 million in City capital, bringing total funding to \$4.75 billion (including the \$150 and \$100 million in new capital allocations described immediately above).

Other Sources

The options identified above represent the most significant and least speculative potential sources to fill the funding gap identified above. However, other potential sources that may be smaller in scale or more speculative are also available and worthy of consideration.

For example, Chapter 18 (*Southern Manhattan*) suggests studying the creation of a new multi-purpose levee along the eastern edge of Lower Manhattan from the Battery Maritime Building to Pier 35 to protect this at-risk area in the same way that Battery Park City helped to protect adjacent neighborhoods during Sandy, thanks to the area’s elevation. In addition to offering this protection, the multi-purpose levee, if constructed, also would create new, developable parcels that could generate significant excess proceeds—as proved to be the case for Battery Park City—that, in turn, could be

used for further resiliency investments. Given the extensive analysis, permitting, and construction that would be required before the multi-purpose levee were to become a reality, any proceeds from this project must be deemed to be highly speculative and unlikely to materialize for many years, if at all.

Another strategy for protecting Southern Manhattan, as described in Chapter 3, is an integrated floodwall system that would include both permanent measures (e.g., landscaping) and temporary, deployable floodwalls. The City is proposing to construct such a system as part of its Phase I coastal protection plan across a significant section of the Lower East Side and Chinatown. The Phase I plan could be extended south to the Financial District, below Chambers Street, were additional resources identified. Given the concentration of high-value real estate in the Financial District, a potential source to cover all or a portion of the cost of such an extension would be a modest per-square-foot assessment on some or all of the buildings in the area. Though such an assessment could obviate the need for some landlords to invest in certain building-level protections from extreme weather and could also result in lower insurance premiums for area buildings, such an assessment also could face opposition, meaning that this source too must be deemed a relatively speculative one.

Yet another potential source to fund the gap identified in this report is a concept known as mitigation banking. Mitigation banking is meant to address the sub-optimal outcome caused by the fact that, currently, developers in New York wishing to build on wetlands are required to restore adjacent wetlands in-kind. While this approach is laudable in theory, the reality is that the requirement often results in wetland restorations that are neither as cost-effective nor as environmentally desirable as they could be. To address a similar issue, 28 states—including New Jersey and Connecticut—have instituted mitigation banking programs, through which a third-party entity performs wetland restoration in offsite, environmentally significant areas, thereby generating “mitigation credits” that are sold to developers to offset the impacts of their activities. Such an approach typically enables the protection of more and more critical wetlands, but at a lower cost than onsite mitigation. This approach could be used to fund several of the wetlands-related proposals contained in Chapter 3. Currently, NYCEDC is piloting such a program (working with the Department of Environmental Protection and others), that if successful, would be expanded. As beneficial as a program such as this could be, however, it is expected to be a comparatively limited source for the proposals contained in this report.

Third-Party Proposal: MoveNY

Former Traffic Commissioner Sam Schwartz has introduced a plan called “MoveNY.” In the plan, Schwartz identifies problems with area tolling, including that significant revenue is collected at bridges far from central business districts, in areas that lack transit alternatives. For example, every entry into Staten Island is tolled, and many Queens residents pay to travel within the borough. At the same time, there are untolled entrances into Manhattan, despite numerous transit options. According to Schwartz, these entrances lure drivers from highways that lead to tolled crossings instead to local streets that lead to free bridges.

To address these problems, Schwartz proposes tolls to enter the Manhattan central business district via the East River bridges and at 60th Street. The plan would use funds from these tolls to reduce tolls on the Verrazano Narrows, Gil Hodges, Cross Bay, Whitestone, and Throgs Neck bridges.

Schwartz projects that the plan would produce about \$1.5 billion in new annual revenues, which he estimates could support a bond issuance of \$12 to \$15 billion. This sum could fund bridge maintenance, transit improvements, achievement of a “state of good repair” for MTA and City transportation assets, and more. According to Schwartz, the plan also offers other benefits including traffic reduction, improvements to public health and the environment, and economic impacts from new construction.

As outlined in this chapter, the City will seek a number of sources to fill the funding gap identified in this report. If these sources are secured, additional funding would not be required for the initiatives detailed herein (though it could be required to pay for later phases of resiliency investment). As such, the City is not, in this report, calling for the implementation of MoveNY. However, the additional sources that the City is seeking require approvals that are far from certain. Accordingly, acknowledging the significant approvals that would be required to institute MoveNY as well, but given the fact that there is a nexus between auto usage and climate change, and that many of the areas that would benefit from toll reductions are also areas that are recovering from Sandy, the City believes it would be prudent for New Yorkers and their future leaders to evaluate the MoveNY proposal as a way, not just of achieving Schwartz’s goals, but potentially funding resiliency investments as well.

