NEW YORK CITY COMPTROLLER
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Safeguarding Our Shores: Protecting New York City's Coastal Communities from Climate Change

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Contents

Executive Summary **4**

Introduction **8**

$101 Billion on the Frontlines of Climate Change **13**

Recommendations to Enhance Shorefront Resiliency **15**

Endnotes **27**

Executive Summary

With more than 500 miles of coastline, New York City sits on the frontlines of climate change. Rising sea levels already threaten the safety of our shorefront communities across all five boroughs. While the city's landscape has always been characterized by dynamic change, the mounting threat of severe flooding promises to irrevocably transform the geography of our city and our relationship to our waterfront. Without major investment in resilient infrastructure and an immediate global effort to stem carbon emissions, neighborhoods across our city will be left to face the ever-encroaching tide and the onslaught of more frequent and ferocious storms.

Addressing climate change and building a more resilient city is not just a moral imperative, it is an economic necessity. This report by New York City Comptroller Scott M. Stringer highlights the urgent need to prepare our shorefront communities against the oncoming threat of rising seas. Despite the enormous concentration of economic value and human capital within our floodplain, much of our coastline remains unprotected from the next storm.

This analysis, by New York City Comptroller Scott M. Stringer, finds the following:

- A staggering $101.5 billion in property value is located within New York City's current 100-year floodplain map. That marks a *more than 70 percent increase* in property value recorded by the City's Department of Finance since 2010, as new development and appreciating property values have further concentrated value near our shorefronts. Cumulative property values rose within each borough, including by more than 127 percent in Queens. Staten Island, where the effects of Superstorm Sandy are still felt today, saw the smallest difference in cumulative value at 14.7 percent increase.

- The City has made halting progress in spending dollars appropriated for Superstorm Sandy Recovery. As of March 31, 2019 – the most recent date for which figures are available -- the City had spent only 54 percent of a combined $14.7 billion in already-allocated federal grants directed towards Sandy recovery and resiliency improvements according to the City's own tracking numbers. That includes:

    - Of the roughly $10.5 billion in grants provided by the Federal Emergency Management Administration (FEMA) for public infrastructure recovery and resiliency, the City has spent only 43 percent of its total allocation. This includes spending only 20 percent of funds allocated to critical

infrastructure like NYC Health + Hospitals, 41 percent of funds allocated to the New York City Housing Authority, and 57 percent of funds allocated to the School Construction Authority.

  - Of $4.2 billion awarded to the City by the U.S. Department of Housing and Urban Development (HUD) for housing recovery, business support, and resiliency, the City has spent 79 percent of allocated funds. However, certain categories of projects lag behind others. Only 14 percent of the $473.2 million in funds for coastal resiliency projects had been deployed as of March 31, 2019. It is imperative that these dollars are quickly put to work, especially in light of the fact that HUD grants include an expenditure deadline of September 30, 2022, for the majority of New York City projects.
  - Meeting the challenge of climate change requires all available resources. Research shows that every federal grant dollar dedicated towards flood mitigation can save $6 in future disaster costs. It should be acknowledged that implementation of complex resiliency projects work requires significant care and time. The City has also been compelled to navigate reams of red tape imposed by federal agencies. However, given the urgency of preparing for the next storm, each level of government must make every effort to ensure these federal dollars are put to work protecting New York City.

- Despite this urgency, New York City's beleaguered Build it Back program has still not completed its mission of repairing and reconstructing homes damaged during Sandy. Build it Back has spent as much as $1.1 million per home on home reconstruction and elevations under certain, area-specific contracts (as of October 2016), while total program costs have ballooned from $1.7 billion to $2.2 billion. Ultimately, rising costs and gross inefficiencies associated with the program raise serious questions about our City's capacity to mount an efficient and effective recovery operation in the event of a future disaster.

Of course, the true value of our climate-vulnerable neighborhoods cannot be reduced to dollars and cents. These are our homes, hospitals, schools, and businesses, not to mention our history and heritage as one of the great port cities in the world. Protecting these areas is not just a pressing fiscal challenge, it is an existential threat to be tackled. With the aim of safeguarding our communities and protecting the economic value along our shoreline, this report offers the following recommendations:

- **Accelerate the Pace of Investment in Resiliency Projects**: The City should expedite the pace of spending on resiliency infrastructure, especially on projects funded by Federal dollars. While the City has made some progress in planning and installing coastal defenses, much of the City's waterfront remains exposed. Additionally, many of the dollars the City received for Sandy-related recovery

projects – from repairing hospitals, roads, and other facilities – have not yet been deployed. The City must make completing its Sandy recovery a priority so that City is prepared to face the next storm.

- **Develop a Citywide Comprehensive Coastal Resiliency Plan:** Every shorefront community deserves the benefit of a comprehensive coastal resiliency plan, not just Lower Manhattan. With 520 miles of New York City coastline under threat, the City should undertake assessments of climate vulnerabilities in every community and propose specific interventions that can be achieved in the short- and long-term to ameliorate risk. Plans must be regularly assessed and can build off of pre-existing work by a variety of City Agencies, including important work done by the Department of City Planning. A Citywide coastal resiliency plan should include robust community engagement strategies and should pay special heed to the vulnerability of low-income populations clustered close to the shorefront. The City should also seek to incorporate the perspective of all relevant advocates and stakeholders.

- **Expand Optional Neighborhood-Based Buyout Programs for Targeted Neighborhoods:** Homeowners across the city should be offered the opportunity to participate in an optional home buyout program, targeted at communities at risk of repeated flooding. By offering to purchase properties at market value from willing homeowners before homes are damaged in a disaster, the City can create resiliency easements to mitigate flooding, while enhancing community safety and reducing the cost of any potential post-disaster recovery program. Participating homeowners can escape the prospect of repeated flooding, as well as the threat of onerous increases in flood insurance premiums. Programs should be developed in consultation with community groups. Successful buyout programs operated in New Jersey, North Carolina, and Texas offer templates for how best to structure such a program. New York State ran a successful buyout program in Staten Island following Sandy, and the City has proposed an additional pilot program focused on buyouts funded by federal grants at $5 million.

- **Study and Develop New Revenue Sources for Resiliency Projects, including a Possible Insurance Surcharge on High-Value Policies:** New York State lawmakers should explore the viability of charging a small surcharge on high-value property and casualty insurance policies that could fund resiliency projects. Estimates by the Regional Planning Association suggest such a statewide surcharge could cost a policy holder as little as $25 to $60 per year for a policy with a $1,000 annual premium but could yield as much as $144.5 million in yearly dedicated revenue for New York State resiliency projects. By issuing bonds based on an insurance surcharge, the State could realize millions more in additional funding for resiliency projects. While building resilient infrastructure is costly, investments in resiliency are far less expensive than the costs associated with inaction. A dedicated

stream of funding earmarked for resiliency could ultimately help guard against rises in insurance premiums associated with future disasters.

- **Improve Upon the Build it Back Model to Prepare for Future Storms**: Knowing our region will inevitably face future storms and disasters, the City must conduct a thorough post-mortem on the beleaguered Build it Back Program to investigate failures in service, applicant attrition, and ballooning costs associated with the program. Before the next disaster strikes, the City should consider ways to more efficiently design both a Rapid Repairs-type program and a longer-term home reconstruction program. The City must take the measure of what worked and what did not in Build it Back and evaluate how the program's hard-won successes, like the use of pre-fabricated construction, can be deployed in future recovery efforts.
- **Increase Access to Low-Cost Resiliency Loans**: The City should expand the parameters of its newly minted Commercial Property Assessed Clean Energy (PACE) program to allow business owners to take out loans repaid by annual assessments on property tax bills. Assessments could be partially or wholly offset by reduced flood insurance premiums. By drawing on low-interest funding to elevate their businesses, participants in the program can finance effective interventions like high-cost elevations. The City should also explore if this model can be exported to private homes as well as businesses. Beyond PACE, the City should consider programs that provide low-interest loans or vouchers to finance home retrofits, especially for multifamily homes or single-family homes requiring elevation. These programs must prioritize the needs of middle- and low-income populations who may lack other options to safeguard their homes and lives.

Introduction

In October 2012, Superstorm Sandy brought unparalleled devastation to New York City's shorefront communities. At the storm's height, a storm surge of over 13 feet swept into Lower Manhattan, 10-foot high waves pummeled the Rockaways, and winds of 80 miles per hour pounded Staten Island.[1] An astonishing 17 percent of the city's landmass was inundated by seawater, an area home to 88,700 buildings and 443,000 people.[2] Flooding caused by Sandy exceeded the City's 100-year floodplain boundaries by more than 50 percent. All told, Sandy cost the City an estimated $5.7 billion in lost gross city product and an additional $14 billion in private and public damages.[3] Most tragically, 52 New Yorkers lost their lives to the storm and its aftermath.[4]

> The severity of floods are often referred to in reference to their likelihood to occur in a time frame — a "100-year flood", a "500-year flood", a "1,000-year flood." Areas within a "100-year floodplain" are areas that scientists deem to have a 1 percent chance (or 1-in-a-100 chance) of flooding in any given year. However, given that "100-year flood" refers to a probability, not a time frame, areas can suffer multiple major flood events independent of time. For instance, Houston suffered three 500-year flood events within a recent three-year stretch. Some estimates suggest Sandy ranked as a 260-year storm.

Superstorm Sandy was an unprecedented weather event in New York City's history. However, while Sandy's unmatched fury was a product of several contributing factors, rising sea levels and more unpredictable weather patterns have put New York City in further peril from extreme weather events. A 2017 paper published in the Proceedings of the National Academy of Science offered a sobering assessment of New York City's increasing vulnerability to Sandy-like weather events. According to the paper's projections, the likelihood of a Sandy-type storm hitting New York City has increased in the past 200 years from a one-in-500 year event to a one-in-25 year event today. As climate change accelerates and Antarctic ice mass shrinks, storms similar in impact to Sandy could become one-in-five year events as soon as 2030.[5]

These more frequent storms are estimated to threaten increasingly large swaths of New York City's landscape. The New York City Department of City Planning has published maps depicting how far the 100-year and 500-year floodplains reach into the interior of the city. Map One depicts the extent to which each borough would be at risk from flooding by a 500-year storm in 2050.

Map One: 500 Year Floodplain Map in 2050

Areas exposed to flooding risk grow appreciably greater by 2100, with the risk of 500 year flooding expected to penetrate even farther inland.

Even beyond the threat posed by frequent and ferocious storms, large swaths of the City's coastline will be forced to contend with a dramatic rise in sea levels and tidal flooding. According to projections made in 2015 by the New York Panel on Climate Change, sea levels surrounding the City can be expected to rise by as much as 11 to 21 inches by the 2050s and a further 18 to 39 inches by the 2080s.[6] These increases follow the already steep rise in sea levels over the past two centuries, with measurements at the Battery having risen by more than 17 inches since the start of recordkeeping in 1856.[7]

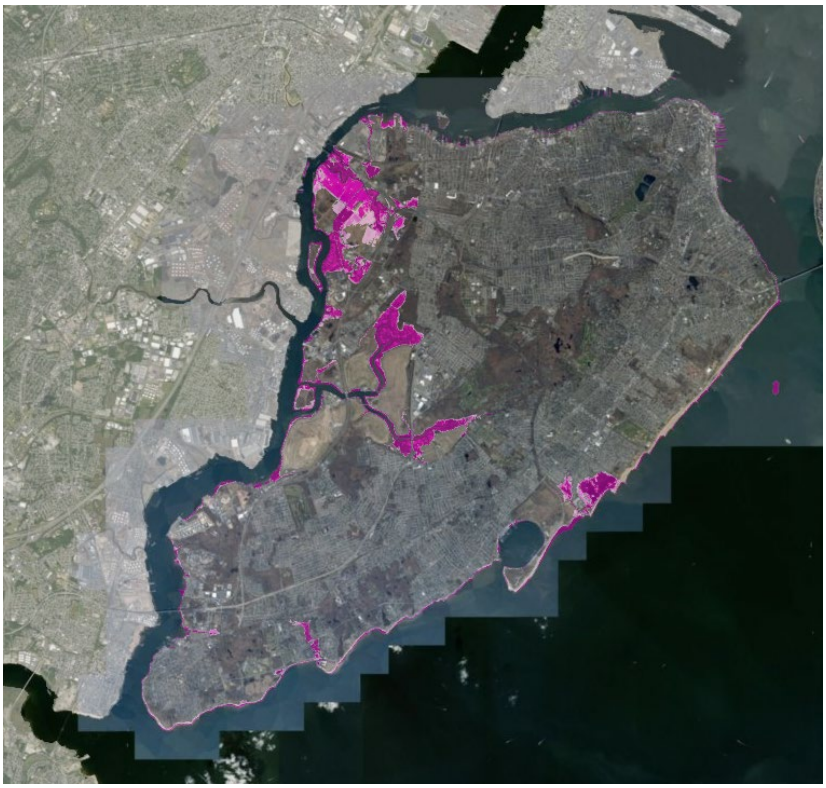
In their most recent report, the New York Panel on Climate Change cautioned that though its 2015 projections "represent the current scientific foundation for New York City decision-making and planning," newly documented trends "in land ice mass losses and advances in ice–ocean–atmosphere interactions raise the possibility of higher future sea

levels than previously assumed."[8] The Panel's 2019 report cautions that the City must plan for a future where a worst-case scenario of 6.75 feet of sea level rise in the 2080s and as much as 9.5 feet of sea level rise by 2100 are possible outcomes.[9] Increases of this magnitude would prove catastrophic for New York City's shoreline absent massive investment in resiliency measures.

Rising sea levels translate into increased risk of tidal or nuisance flooding. Tidal flooding refers to events unassociated with storm surge, but are instead more routine occurrences.[10] Across the nation, tidal flooding has increased by approximately 50 percent in the past twenty years and is expected only to become more prevalent as sea levels rise.[11] Using measurements from Battery Park, the Union of Concerned Scientists estimate that New York will see almost more than three times as many tidal flooding events by 2030 and as many as 59 tidal flooding events per year by 2045.[12]

Maps issued by the New York City Department of City Planning portray how rising tides will interact with New York City's geography.[13] For instance, a map projecting high-tide levels expected by 2050 shows sizable portions of Staten Island at risk of repeated flooding on a regular basis (Map Two).[14]

Map Two: High Tide Flooding 2050



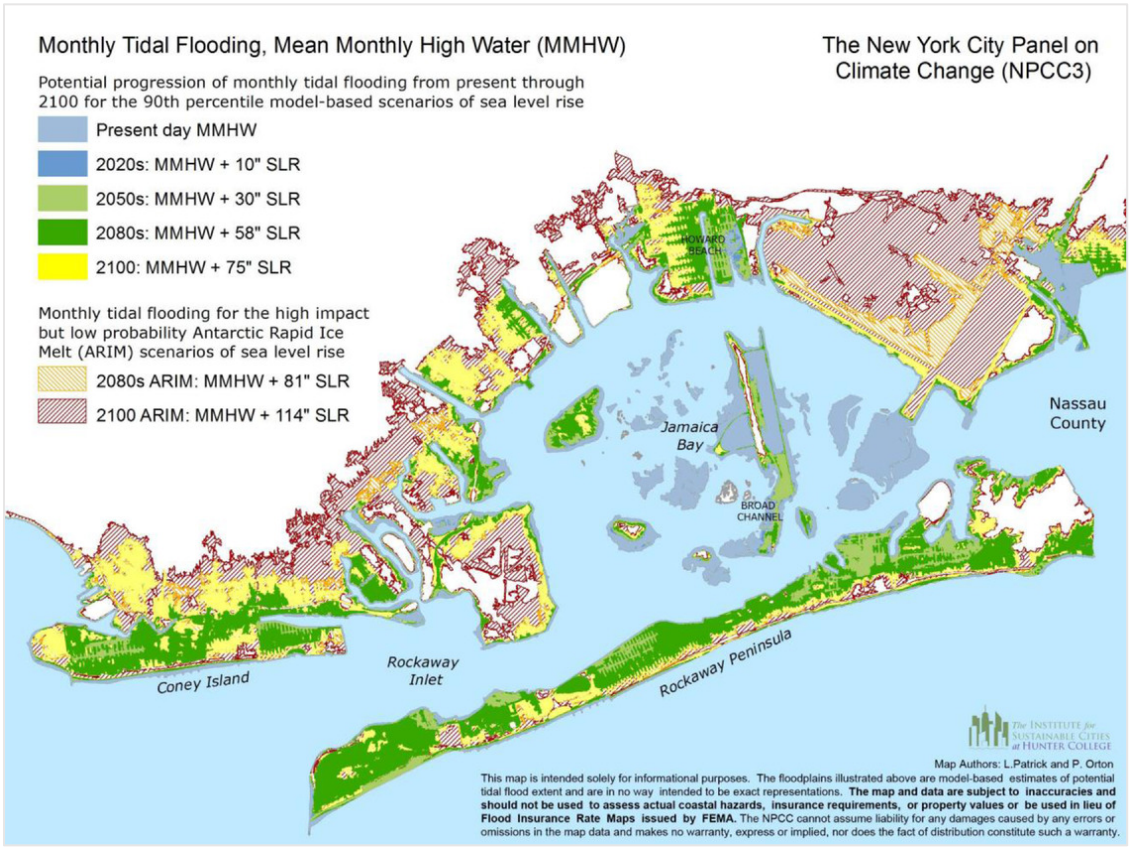
Similarly low-lying neighborhoods like the Rockaway Peninsula, Howard Beach, and Coney Island are also expected to face monthly tidal flooding by 2050.[15]

The reach of tidal flooding only grows in the face of unchecked sea-level rise. By 2010, current estimates show that large swaths of southern Brooklyn and Queens will face regular flooding risk from high tides (Map Three).[16]

Map Three: High Tide Flooding 2100

Using the New York Panel on Climate Change's 2019 estimates of higher risk, more extreme sea rise scenarios, monthly tidal flooding will carry farther and farther inland, potentially submerging John F. Kennedy Airport by 2100 under certain scenarios (Map 4).[17]

Map Four: High Tide Flooding by Sea-level Rise Scenario

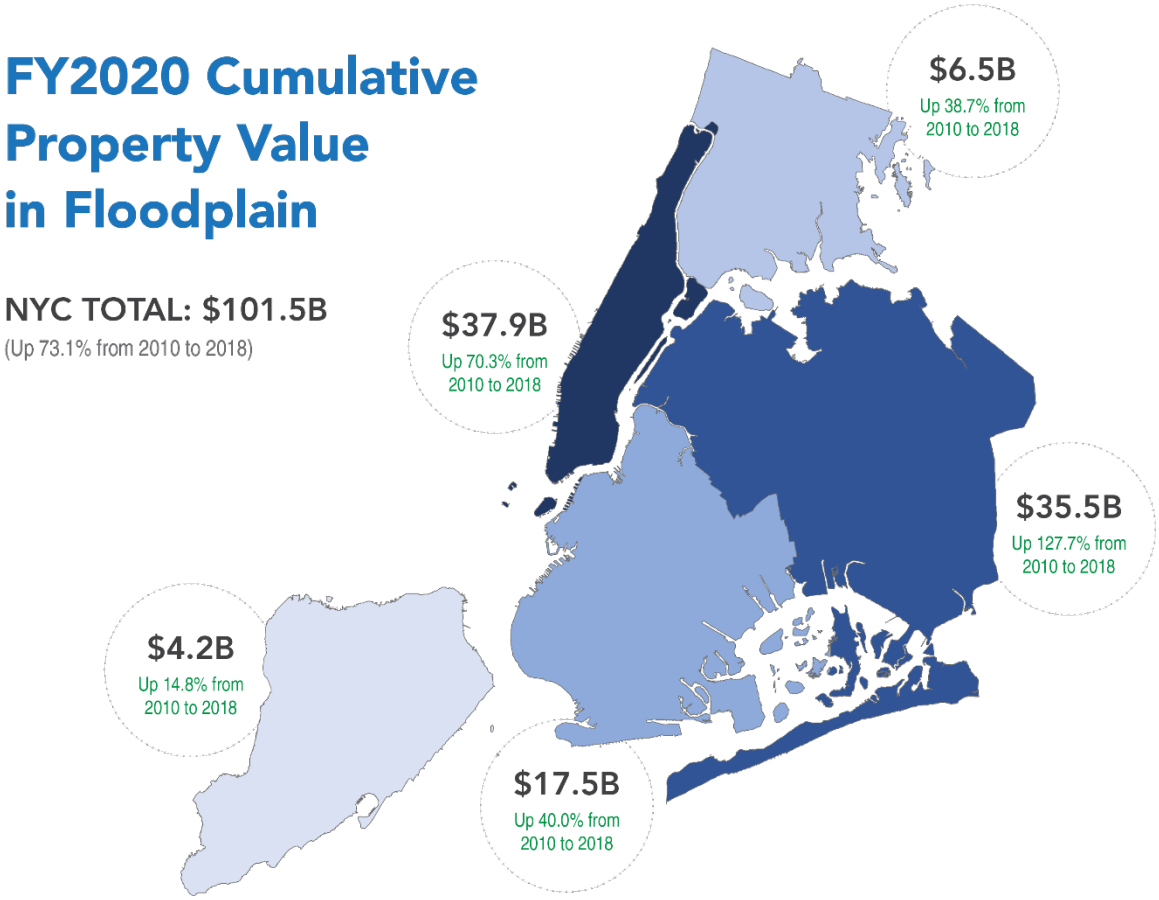


The New York Panel on Climate Change estimates that under certain extreme but conceivable scenarios "sea level rise by the end of this century could raise daily tidal flooding to levels even more severe than that which occurred during Hurricane Sandy."[18]

$101 Billion on the Frontlines of Climate Change

Rising tides and more frequent storms pose a direct threat to billions of dollars of real estate lying within the floodplain. These buildings comprise homes, businesses, schools, hospitals, and public assets. Though the true value of these buildings to our shorefront communities is not quantifiable, the cumulative economic value of these buildings presents an unambiguous rationale for investment in resiliency measures.

Drawing on the current FEMA flood insurance rate maps (FIRMs), this report estimates that the current value of property within the 200-year floodplain amounts to $101 billion, an increase of 73 percent since 2010.[19]



Four of the five boroughs show sharp increases in value, driven by new development in coastal areas and appreciation in property values. The Queens waterfront showed the highest increase in property value from Fiscal Year (FY) 2010 to FY 2020, with the

cumulative value catapulting upwards by 127 percent. Similarly, property values in Manhattan rose upwards by 70 percent. Brooklyn and the Bronx saw still substantial increases in property value.

Property Value in the Floodplain by Borough

Borough	FY2010 Property Value	FY2020 Property Value	Percentage Difference in Value
Manhattan	$22,238,617,525	$37,863,768,154	70.26%
Brooklyn	$12,488,076,236	$17,481,841,725	39.99%
Queens	$15,608,337,563	$35,532,389,275	127.65%
Staten Island	$3,629,900,714	$4,165,299,031	14.75%
Bronx	$4,697,417,394	$6,514,634,556	38.69%
Total	**$58,662,349,432**	**$101,526,431,741**	**73.07%**

Significantly, this analysis only estimates the value of buildings within territory covered by current FEMA flood insurance rate maps. These maps do not account for the sea level rise scenarios projected by the New York Panel on Climate Change. By most measures, the number of buildings within the reach of flood waters and their associated property value will be much higher than the estimates produced here.

Notably, the cumulative value of property within Staten Island's floodplain saw a significantly smaller rise in total value than other boroughs. This finding corresponds with research that shows slower growth or even negative growth in residential value in areas impacted by Sandy. In a study of Superstorm Sandy's impact on the New York City housing market, Francesc Ortega and Sűleyman Taşpınar found a 13 percent reduction in housing prices in Sandy-affected areas, including homes unaffected by the storm but still within the floodplain.[20] Their paper posits that the perceived risk of flooding, as well as factors like rising flood insurance costs, may have a chilling effect on the residential housing market in these areas. Additional factors may also contribute to the relatively slower growth in Staten Island floodplain real estate values. New York State's NY Rising Enhanced Buyout Program resulted in the demolition of 473 homes and their removal from the tax base.[21]

Recommendations to Enhance Shorefront Resiliency

Climate change is likely to be the defining issue of the remainder of the 21st century. Rising temperatures and sea levels will dictate quality of life within New York City. Over the next 100 years, flooding will necessarily redefine where New Yorkers live and work, and shoreline resiliency projects will transform the city's waterfront. Confronting the challenges associated with climate change will require coordinated efforts by all levels of government, new sources of funding, and an absolute commitment to facing up to and preparing for the worst projected scenarios.

This report offers a series of recommendations designed to bolster New York City's defenses against floodwaters:

Accelerate the Pace of Investment in Resiliency Projects:

The City must do all that it can to expedite the construction of both large-scale resiliency projects and resiliency improvements to existing City infrastructure. More than six years following from Superstorm Sandy, the City's progress drawing down available federal funds for resiliency projects has been halting. In order to protect our coast before the arrival of the next storm, the City must act aggressively to put all available federal dollars to work.

Following the devastation of Superstorm Sandy, New York City was allocated approximately $15 billion in federal disaster recovery grants. These grants include $10.5 billion in FEMA grants and approximately $4.2 billion in HUD CDBG-DR grants, as well as further smaller allocations by other Federal grant programs. The City has secured additional help from the U.S. Army Corps of Engineers, who were appropriated $5.35 billion to address Sandy damages across the region and reduce food risk. The Army Corps is responsible for the deployment of these dollars.

Despite the urgency posed by rising sea levels and by the continued threat of succeeding hurricane seasons, as of March 31, 2019, the City had spent only 54.1% of a combined $14.7 billion in FEMA and HUD disaster recovery funding according to the City's own publicly available analysis.[22]

Indeed, as of March 31, 2019, the City had only spent 43.9 percent of available FEMA grants intended for Sandy-related repairs to City assets and infrastructure. Spending has been slow even at high-value assets like Health + Hospitals (H+H), which has only spent

19.9 percent of the dollars intended to reconstruct facilities and improve flood mitigation. H+H does not expect to complete FEMA supported projects until October 2021, some nine years following Sandy. [23]

Federal FEMA Grants by Agency and Associated City Spending as of 03/31/19

Agency Name	Cost Estimate	Grants Awarded	City Spending	Percentage of Federal Grants Spent By the City
Department of Correction	$92,742,723	$88,957,620	$15,037,843	16.9%
Department of Cultural Affairs	$192,229,266	$106,076,891	$40,460,368	38.1%
Department of Education	$37,497,526	$37,497,526	$32,817,986	87.5%
Department of Environmental Protection	$1,175,369,088	$1,175,745,579	$689,459,406	58.6%
Department of Parks and Recreation	$1,146,739,036	$1,148,206,578	$641,247,860	55.8%
Department of Sanitation	$216,817,489	$180,463,084	$154,708,020	85.7%
Department of Transportation	$784,567,699	$768,560,003	$324,529,910	42.2%
Economic Development Corporation	$143,205,190	$143,205,190	$7,284,942	5.1%
Fire Department	$234,115,752	$229,060,596	$60,419,128	26.4%
Health and Hospitals Corporation	$1,872,480,885	$1,864,902,539	$370,624,149	19.9%
New York City Housing Authority	$3,177,052,262	$3,177,052,262	$1,314,162,808	41.4%
Other Agencies	$501,112,014	$505,888,089	$274,303,951	54.2%
Police Department	$293,089,999	$284,503,446	$227,614,446	80.0%
School Construction Authority	$799,277,146	$789,273,320	$457,366,066	57.9%
Total	**$10,666,296,075**	**$10,499,392,723**	**$4,610,036,883**	**43.9%**

Beyond FEMA dollars, the City has spent 79.5 percent of available HUD CDBG-DR funding as of March 31, 2019. However, the City has spent only 14.0 percent—some $66 million of $473 million made available by the federal government—towards large-scale

coastal resiliency projects like the East Side Coastal Resiliency plan, the Hunts Point Lifelines plan, and raised shorelines in Coney Island, Breezy Point, and Sheepshead Bay.[24]

Federal CDBG-DR Grants by Agency and Associated City Spending as of 03/31/19

Program	Action Plan Allocation	Adjusted City Spending	Percentage of Federal Grants Spent By the City
Build It Back Single-Family	$2,213,056,000	$2,067,828,372	93.4%
Build It Back Multifamily	$426,000,000	$331,540,695	77.8%
Build It Back Temporary Disaster Assistance Program	$8,581,270	$8,570,310	99.9%
Build It Back Workforce Development	$2,535,960	$2,533,243	99.9%
Public Housing - NYCHA	$317,000,000	$207,971,486	65.6%
Hurricane Sandy Business Loan and Grant Program	$58,000,000	$56,968,746	98.2%
Resiliency Innov. for a Stronger Economy (RISE:NYC)	$30,000,000	$13,943,630	46.5%
Business PREP	$3,000,000	$1,366,250	45.5%
Public Services	$223,107,101	$223,107,101	100.0%
Debris Removal/Clearance	$6,654,089	$6,654,089	100.0%
Rehabilitation/Reconstruction of Public Facilities	$90,930,000	$71,582,281	78.7%
Interim Assistance	$97,129,396	$97,129,396	100.0%
Raise Shoreline	$7,700,000	$2,618,163	34.0%
Coney Island Resiliency Improvements	$15,000,000	$0	0.0%
Breezy Point Risk Mitigation	$14,537,000	$285,384	2.0%
Sheepshead Bay Courts Infrastructure	$20,000,000	$8,985,013	44.9%
Resiliency Property Purchase Program	$5,000,000	$0	0.0%
Staten Island University Hospital	$28,000,000	$0	0.0%
Rebuild by Design - East Side Coastal Resiliency	$338,000,000	$50,978,104	15.1%
Rebuild by Design - Hunts Point Lifelines	$45,000,000	$3,566,622	7.9%
Planning	$78,017,325	$78,017,325	100.0%
Administration	$186,627,859	$116,180,970	62.3%
Total	**$4,213,876,000**	**$3,349,827,180**	**79.5%**

Several City initiatives have planned completion dates far into the future. For instance, the City's Raised Shoreline initiative is not expected to conclude until December 2022, more than 10 years following Sandy.[25] Other City efforts have seen their anticipated completion dates pushed progressively further into the future, among them the East Side Coastal Resiliency project, which meant to break ground in 2017.[26]

Putting these federal dollars to work is critical to safeguarding City infrastructure and government finances. Estimates by the National Institute of Building Sciences suggest that investments in mitigation efforts can save government "$6 in future disaster costs, for every $1 spent."[27]

Designing and constructing large-scale, innovative resiliency projects necessitate careful planning, community input, and quality construction, which all require time. Federal dollars were also slow to arrive to New York City, with the complete sum of HUD CDBG-DR funds only made available for City use in April 2015 and only 66 percent of FEMA funding available by the close of 2013.[28] It is also noteworthy that the City is continuing to do a commendable job winning new grants that have not yet been obligated. The figures reported above may include some federal dollars that have not yet come to the City.

Red tape and onerous reporting requirements are also associated with federal funding and resiliency projects. For example, just one program covered by FEMA-PA reimbursement, the City's Rapid Repair program, required the City to provide 100 million pages of documentation to the federal government.[29] The City also has been obligated to undertake as many as 12,841 environmental reviews to access CDBG-DR funding, each of which take time. A report by the U. S. Government Accountability Office examining the slow pace of spending relating to the 2017 hurricane season found that complex and constantly changing regulations issued by HUD impeded Texas, Florida, Puerto Rico, and the U.S. Virgin Islands from quickly accessing available funding.[30] Before the next disaster strikes, the Federal Government implement policy changes that allow disaster aid dollars to be released to resiliency and recovery projects and quickly reach those most in need.

That said, given the urgency associated with these recovery and resiliency projects, every effort should be made by all parties to speed the deployment of all federal resources. The City must foster better coordination between agencies, clear decision-making accountability for resiliency projects, and prioritization within the capital plan.

Develop a Comprehensive Coastal Resiliency Plan:

The City needs to ramp up its planning efforts by undertaking a comprehensive coastal resiliency assessment. A comprehensive coastal resiliency plan should assess the particular risks faced by every mile of shoreline and should propose a range of interventions that can be deployed to make neighborhoods safer. While neighborhoods may differ in their exposure to flooding, the uncertainty inherent in sea level projections and the quickening pace of climate change demands an approach that takes a broad view of protecting the whole city.

The City has made significant progress in planning resiliency projects. Starting with Mayor Bloomberg's landmark NYC Special Initiative for Rebuilding and Resiliency, the City—especially the Department of City Planning—has made commendable progress in issuing building and zoning rules that promote resilient neighborhoods. The City has also embarked on an ambitious program of resiliency measures, coordinated by the Mayor's Office of Resiliency and the Economic Development Corporation.

The most prominent of the City's resiliency efforts is Mayor de Blasio's $10 billion Lower Manhattan Climate Resiliency plan, which would extend a new, resilient shoreline into the East River. The plan consists of $500 million in capital projects to be commenced in the short term, and $9.5 billion in as yet unrealized funding to create new landmasses in New York Harbor.

While protecting the City's financial center is crucial, the expense of the Lower Manhattan Climate Resiliency plan is enormous. The City has not offered a definitive funding source, instead suggesting that the project could include dollars from the City, State, Federal government or private development opportunities, and its scale will demand that the City have what the Mayor calls "an honest conversation with the community, with the people of this city, about choices."[31] Before choices are made to devote finite pools of money to any particular project, the City should undertake an assessment about the funds necessary to develop resiliency in all of New York City's neighborhoods, not just Lower Manhattan.

The City's comprehensive coastal resiliency plan should blend data about sea level rise and other vulnerabilities from the latest science, information about the state of good repair of waterfront assets, and a deep level of community engagement and dialogue. Plans can be jointly devised by the Mayor's Office of Resiliency and by other agencies, including the proposed the Mayor's Office of the Waterfront which could help break down silos between various stakeholders.

Only by studying the shoreline as a whole, can the City make more informed decisions about how to more equitably deploy finite resiliency dollars.

Expand Optional Neighborhood-Based Buyout Programs for Targeted Neighborhoods:

While New York City has a moral and financial obligation to do all that it can to safeguard its shorefront communities, the City must also unflinchingly confront the implications of the most recent scientific estimates about the scope of sea-level rise. Within the span of a 30-year mortgage issued today, large swaths of the city's coast will face unprecedented danger from sea-level rise and storm related flooding. Portions of the coastline already susceptible to repeated flooding may be rendered effectively uninhabitable.

The City should act proactively to extend help to New Yorkers who live in homes at risk of extreme flooding. Before the next storm arrives, the City should expand on programs offering optional residential buyouts to help homeowners living in harm's way. Based on sea-level rise projections, the City should begin to engage interested communities on the outlines of a targeted and fully optional program. Willing homeowners who meet eligibility standards should be compensated at the full market value of their homes, with a potential relocation bonus paid to New Yorkers who move to other housing within the five boroughs. No resident would be required to participate and no community should suffer any loss of resiliency investment based on its participation in the program.

Currently, the City has devoted $5 million of its $4.2 billion HUD CDBG-DR grant package to a pilot "Resiliency Property Purchase Program", which aims to purchase private property "necessary to support or facilitate another flood mitigation or resiliency project in the City's portfolio."[32] This program was initiated in winter of 2018 and is intended to purchase up to 40 properties through spring 2021. As of March 31, 2019, the program has not expended any dollars.

The City's Resiliency Property Purchase Program is a commendable first step in developing a viable buyout program, but efforts should be made to expand the program to target areas that while at risk from flood waters, may not be directly adjacent to planned resiliency projects. By coupling federal dollars with City dollars, the program can do more to facilitate the creation of resiliency improvements, like shorefront wetland restoration. The creation of a City funded program, larger than the federally funded pilot of 40 homes, could also allow the program to more quickly scale following local or major flooding events.

While an expanded buyout program will require an outlay of City funds, such a program would repay dividends in the future. Having acquired flood-prone homes, the City should use the land to create resilience easements designed to absorb the brunt of future flooding, protect other area homes, and provide green space. HUD requires that buyouts facilitated with CDBG-DR grants are "dedicated and maintained in perpetuity for a use that is compatible with open space, recreational, or wetlands management practices."[33] While not required, this approach should be reflected in any equivalent program funded by City dollars. Rather than allowing spaces to be given over to redevelopment, resilience easements could be structured to allow for the restoration of natural habitats and wetlands which provide unparalleled protection from storms.[34] Tidal marshes are thought to reduce "wave action" by up to 50 percent, while undeveloped land has a remarkable capacity to soak up rainfall.[35] Indeed, wetlands are estimated to have averted approximately $138 million in damages to New York during Sandy.[36] If properties can be acquired on a contiguous stretch, the City can invest even further in developing resiliency features like

dune reclamation. Naturally resilient infrastructure or "green infrastructure" like wetlands can even allay the need for "hard," "grey" infrastructure like seawalls.[37] Often, the two types of infrastructure can work in concert to provide maximum protection benefits.[38]

Buyout programs also protect government against the costs associated with repeatedly repairing and rehabbing flood prone homes. According to FEMA, the National Flood Insurance Program (NFIP) paid as much as $5.5 billion to repair and rebuild more than 30,000 "severe repetitive loss properties" between 1978 and 2015.[39] The Natural Resources Defense Council has estimated that if sea levels rise as expected, "NFIP could pay between $143 billion and $447 billion in flood insurance claims to the owners of 820,000 to 2.57 million repeatedly flooded homes in coastal areas."[40]

As more frequent and ferocious storms come to batter our coasts, finite Federal and City resources will be increasingly stretched to cover more regular and more costly recovery efforts. By removing at-risk homes and providing protection to homes further inland, government can reduce the costs associated with any future iteration of Build it Back and make recovery dollars go farther. Indeed, the inflated per home reconstruction costs associated with Build it Back vastly exceed the value of homes in many of the areas affected by Sandy. Targeting buyouts of homes at risk of flooding multiple times in the next ten years could save untold dollars in future reconstruction and repair costs.

Buyout participants would also be spared the ordeal of going through a protracted City-managed home repair process like Build it Back in the event their home is flooded in a future storm. The City would also potentially limit costs relating to emergency services rendered during a storm, including evacuation, sheltering, and debris removal, if a community participates en masse.

Buyout programs can also help rescue homeowners facing increasingly unaffordable flood insurance premiums. A 2017 RAND study found that within a sample of New York City areas prone to flooding, the median flood insurance premium for one to four family homes is $3,000 per year.[41] The same report found that the cost of flood insurance is economically burdensome for lower income residents. The National Flood Insurance Program currently holds approximately $20 billion in debt, and proposed reforms to the program could potentially raise rates in New York City.[42] Forced to either undertake an expensive resiliency retrofit of their home, including elevation, or pay increasingly onerous flood insurance premiums, low and middle-income homeowners may not be able to afford to stay in their homes. Should they qualify, a buyout program could help liberate them from a tenuous financial situation.

Ample precedent exists for how to successfully structure a buyout program. Nationwide, FEMA has funded more than 55,000 buyouts for flood-damaged properties.[43] New Jersey

has operated an optional home buyout program called Blue Acres that has closed on the purchase of approximately 648 homes as of September 2018.[44] The program is expected to purchase up to 1,300 homes in areas hit by Sandy and areas suffering from other forms of flooding. The program relies on $300 million in federal grant money and has been heralded as a success. A similar program operates in Charlotte-Mecklenburg, North Carolina. More than 400 flood prone homes have been purchased via $67 million in funding sources from federal, state, local, and other funding. Charlotte-Mecklenburg estimates that "these buyouts have avoided $25 million in losses and will ultimately avoid over $300 million in future losses."[45] Harris County, home to the City of Houston, also boasts a long running buyout program with more than 3,100 properties acquired as of 2017, comprising approximately 1,060 acres.[46]

Buyouts have also proven a success in New York City. Following Superstorm Sandy, New York State's New York Rising Buyout Program targeted three neighborhoods in southern Staten Island to promote voluntary buyouts. Ultimately the State would purchase 473 homes — 300 in Oakwood Beach, 86 in Ocean Breeze, and 87 in Graham Beach. The program was aimed at homeowners who suffered substantial damage from Sandy. Participants were offered their home's pre-storm, full market value as well as an additional 5 percent incentive bonus to those who would relocate within the five boroughs.[47]

The Staten Island buyouts are widely considered a success. A survey of Staten Island buyout participants commissioned by the NRDC found that the vast majority of participants were pleased to have "had the opportunity to leave the cycle of flood-rebuild-repeat and begin anew."[48] In many cases, program participants were spared the ordeal of having to repair their homes through the City's Build it Back program. Demolitions have helped bring waterfront areas into ecologically thriving areas that provide tangible resiliency benefits.[49]

While the City's pilot Resiliency Property Purchase Program is a relatively new endeavor, the City has experimented with buyout programs under Build it Back. Following Sandy, the City offered different buy out programs including an "Acquisition for Redevelopment" program.

Ultimately 94 applications took advantage of the City funded "Acquisition and Buyout Program."[50] The City attempted to encourage buyouts by offering resettlement incentives to relocate families into new homes. Only 10 applicants took advantage of this incentive. The City sought to purchase homes at post-storm fair market value rather than pre-storm value, a policy choice which markedly reduced the generosity of the program. Significantly, instead of returning purchased lots to nature through conservation easements, the City's acquisition for redevelopment program outlined a policy which allowed for the disposal "of properties to residential developers, non-profits or other private owners,

including the owners of neighboring properties."[51] By promoting re-development on these properties, the City potentially stands to lose out on substantial resiliency benefits that could be realized by returning bought-out plots to wetlands or other forms of green infrastructure.

New York City should review these models to develop a series of best practices that can guide a City buyout program. Rather than confine the program to strictly Sandy-impacted areas, the City should undertake outreach to any coastal community with sufficient interest and the chance to benefit.[52]

Increase Access to Low-Cost Resiliency Loans:

The City must also explore new options to help homeowners and business owners unable or unwilling to participate in a buyout program. The City should consider new mechanisms for financing much needed resiliency oriented retrofits in single-family homes, especially those owned by low-income populations. One option could include a voucher system or low-interest loan program aimed at providing homeowners with upfront capital to both finance elevations and secure housing during construction.

The City should also expand the parameters of its newly minted Commercial Property Assessed Clean Energy (C-PACE) program to allow business owners to take out resiliency loans repaid by an annual assessments on property tax bills. Assessments could be partially or wholly offset by reduced flood insurance premiums. By drawing on low-interest funding to elevate businesses, participants in the program can finance effective interventions like high-cost elevations. Commercial PACE programs in San Francisco and Florida permit resiliency investments.[53] Should the City extend its PACE program to cover residential buildings, resiliency improvements should also be permitted.

Develop New Revenue Sources for Resiliency Projects, including Instituting an Insurance Surcharge on High Value Policies:

Given the scale of the threat New York City faces from climate change and the costs associated with large scale infrastructure projects, the City and State must explore new and creative options to produce dedicated revenue streams to fund resiliency. One proposal that deserves serious consideration by New York State lawmakers is applying a small surcharge on high-value property and casualty insurance policies. The insurance surcharge is a model that is used for disaster recovery in states like Florida, Louisiana, and Texas and has been proposed in a New York City context by both Mayor Bloomberg's *A Stronger, More Resilient New York* and the Regional Planning Association's Fourth Regional Plan.[54] These proposals would level a surcharge of one to two percent on "automobile, homeowner, general liability, commercial multi-peril, and certain other forms of

insurance."[55] In 2016, the State Department of Financial Services recorded that over $41.9 billion dollars of property and casualty insurance premiums were written within the state.[56] The Regional Planning Association estimates that the cost of a 1.5 percent surcharge may only amount to $2 in costs per month for the mean area household.[57]

Using surcharges on insurance policies to fund resiliency improvements makes sense given the dividends that resiliency projects will pay in terms of protecting insured consumer assets, including homes, cars, and other properties. For instance, Hurricane Harvey is estimated to have flooded about 130,000 cars in Houston alone and 478,000 nationwide.[58] In the wake of the storm, auto insurers quickly raised rates within Texas to compensate for the enormous underwriting losses. By using proceeds from small insurance surcharges, infrastructure can be developed that would protect property against these types of losses – potentially forestalling insurance rate increases based on disasters.

Implementing an insurance surcharge could also yield a revenue stream which could be used to fund debt service on green or "blue", resiliency oriented bonds. By creating a class of green resiliency bonds based off of proceeds from an insurance surcharge, the State could yield enough revenue to fund an ambitious program of resiliency construction and grant making. The City and State should jointly pursue a workable framework to develop an insurance-based revenue that targets high value policies and generates meaningful funding for resiliency.

Improve Upon the Build it Back Model to Prepare for Future Storms:

In the wake of the devastation wrought by Superstorm Sandy, over 20,275 New Yorkers turned to City government for help repairing homes damaged by winds and water. As of January 1, 2019, only 8,306 homeowners were served by the City's principal recovery program, Build It Back. Even as program applicants dwindled, costs associated with Build It Back rose from $1.7 billion to $2.2 billion. In certain phases of the program, costs for home reconstructions nearly doubled from initial projects of $600,000 to more than $1,108,940 per home.[59] Issues with the program's design and administration are well documented in a 2015 audit by the Comptroller's Office.[60]

It behooves the City to draw on its experiences from the Superstorm Sandy recovery process to conduct a thorough post-mortem on the beleaguered Build it Back Program to investigate failures in service, applicant attrition, and ballooning costs associated with the program. By planning before the next disaster strikes, the City can develop the nucleus of an improved program that can be deployed in the future. The Office of Housing and Recovery, the Department of Design and Construction, Housing Preservation and Development, or the Economic Development Corporation could all play a role in designing, implementing, and overseeing the next iteration of a housing recovery program.

The City should begin by reevaluating its model for a program to provide immediate housing assistance to families in need of help. Rapid Repairs was an innovative program launched after Sandy with the goal of making expedited repairs to restore structural integrity, heat, plumbing and electricity to homes in order to make them minimally habitable. Within 100 days, the program had repaired approximately 11,740 buildings, which together were home to over 54,000 New Yorkers. Rapid Repairs allowed City residents to begin rebuilding while living in their own homes and buildings, rather than in a FEMA trailer or emergency shelter. However, issues with the program's design became evident in the months following the storm. In its initial weeks, Rapid Repairs operated without formal, signed contracts, instead relying on quickly drafted term sheets that based payment off extemporized terms and pricing plans. Contractors, operating without the protections afforded by a contract, were left without a clear legal framework that plainly spelled out what constituted eligible work and appropriate pricing.

The City should work now to outline potential program parameters for a Rapid Repairs program before a storm or disaster strikes. While every disaster is distinct in its ramifications, the City should take steps now to assemble lists of pre-qualified contractors, create model contracts, develop standard designs for emergency repairs, develop toolkits and training regimes for contractors, and plan constituent outreach efforts to inform residents of the program's purpose and scope.

The City should also seek to overhaul the administration of Build It Back. Principally, the City should work with federal authorities to develop sample guidance on eligibility standards for future disaster recovery programs. While the City cannot totally anticipate the generosity of future federal funding or the conditions attached to future federal funding, it can work with federal partners to try and forestall the endless parade of on-the-go policy changes and program eligibility changes which characterized Build It Back. Indeed, the Comptroller's 2015 audit identified more than 100 procedural changes made to the program between August 2013 and July 2014. The City should create a toolkit designed for homeowner outreach which can be deployed after a storm that accurately and succinctly summarizes eligibility requirements associated with recovery programs.

Indeed, Build it Back has acknowledged many of the challenges that characterized its early years and has done a commendable job experimenting with new construction pathways such as the deployment of prefabricated housing units and with offering a buy-out option to homeowners. An evaluation of Build it Back's record of success can ensure that these hard-won lessons are reflected at the outset of a future program.

Methodology

The New York City's Comptroller's Office analyzed building structures located within the Federal Emergency Management Agency (FEMA) National Flood Zone Hazard Layer (NFHL) for years FY 2010 and FY 2020 using assessment data from the Department of Finance's website.

The office identified building structures by using the Building Footprints shape file available on New York City's open data website. In order to determine which properties were affected by flood insurance requirements, the Office selected boundaries within the Special Flood Hazard Area (SFHA) that will be inundated by the flood event having a 1-percent chance of being equaled or exceeded in any given year, also known as the base flood or 100-year flood. Labels included were Zone A, Zone AO, ZONE AH, ZONES A1-A30, Zone AE, ZONE A99, ZONE AR, ZONE AR/AE, ZONE AR/AO, ZONE AR/A1-A30, Zone AR/A, Zone V, Zone VE, Zones V1-V30. Moderate flood hazard areas having a 0.2-percent-annual-chance of being inundated by the flood event were also included. These areas were labeled Zone B or Zone X (Shaded). Areas labeled Zone C or Zone X (Unshaded) where there was a minimal flood hazard with an elevation higher than the 0.2-percent-annual-chance flood were not included. The building footprints were geospatially selected using the Boundary referenced above.

Once the Office determined which building structures were affected they were geospatially joined to the New York City Department of City Planning "Pluto Data" to determine tax lots that overlapped with the structures, which removed all duplicates where multiple structures in the identified floodplain boundary coincided on one lot. If a lot with multiple structures had at least one structure within the boundaries of the identified floodplains boundary, the entire lot was assumed to be impacted. Tax lots were further geospatially joined to Property Assessment data for Tax Classes 1, 2, 3, and 4 for FY 2010 and FY 2020 using the "CUR_FV_T" field, which identified DOF market value assumptions. Tallies were compiled by borough for each year and compared to determine the total difference.

Endnotes

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[23] All data sourced from OMB and the City's Sandy Tracker, which notes "Federal Grant Awards include FEMA, FHWA, FTA, National Emergency Grant funding, Social Service Block Grants, and Head Start; CDBG-DR funding for breakage, 404 HMGP funding, and other Sandy resiliency projects are not included." On spending, the City notes that "The cumulative amount of all funding spent on Sandy-related needs, both capital and expense. The expenditure amounts include personnel costs and direct costs other than personnel. Please note that these costs do not include $640M of expenditures that cannot be tied to a federal grant stream at this time but may be related to Sandy recovery efforts.": https://www1.nyc.gov/content/sandytracker/pages/fema-pa-and-other-grants

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