Flooding and Storm Resilience in Downtown Jersey City, New Jersey

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Bio

I am from New Jersey and grew up close to Jersey City, going there often with my parents who worked there. I love the city and am really passionate about sustainability from an urban standpoint, so this report was very fitting for me.

Abstract

Jersey City, New Jersey is the second largest city in the state and is extremely diverse and densely populated. As Jersey City is located on the coast of two rivers, it is very vulnerable to storms and flooding. Downtown Jersey City is 2.2 square miles, has a population of 84,000 – around 30% of the city's total population, and is one of the wealthiest areas in Jersey City. Despite being a wealthier neighbourhood, Downtown Jersey City's waterfront geography makes it very vulnerable to flooding. The policy so far in the city on flooding and storm resiliency consists of two policy documents created in 2019. Through these documents, the government aims to build resilience by using innovative design and infrastructure solutions to protect the valuable social, historical, and economic assets of the city from flooding and storms. My recommendations for the community include ways to strengthen the social resilience in Downtown Jersey City on top of strengthening physical resilience among residents.

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This briefing for Downtown Jersey City, New Jersey will give an overview of storm resilience and flooding, an analysis of current policy in the city on storm and flood resilience, and

recommendations for action to be undertaken by the community. The hope for this briefing is to give the Downtown Jersey City community actionable ways to make the city more resilient to future storms and flooding alongside government-backed plans, by building physical resilience through infrastructure and green spaces and building social resilience in the community through volunteering and joining neighbourhood associations.

Storm and Flood Resilience

Major storms and flooding are a global issue affecting communities more and more each year. Extreme weather events are becoming more intense and frequent as sea levels rise and temperatures increase. This is driven by an increase in greenhouse gases in the atmosphere and the consequent melting of icecaps, causing higher water levels and temperatures (Jacob 2015). This leads to stronger storms and increased rainfall and flooding. This rise in natural hazards brings with it increasing risks for communities and devastating impacts, including financial losses and damage to infrastructure and homes. This issue is especially prevalent for coastal communities, as they experience frequent flooding and the effects of sea level rise more due to their geography. Because of this, coastal communities need to build storm and flooding resilience in order to thrive in the long term.

Resilience is defined by Colten, Kates, and Laska (2010, 38) as “a community or region’s capability to prepare for, respond to, and recover from significant multi-hazard threats with minimum damage to public safety and health, the economy, and national security”. While there are many definitions of resilience, this definition was chosen as it includes anticipation, response, and recovery to disasters, which are all important when grappling with the increasing threat of storms and flooding. Beyond this baseline definition, there are many debates in the sphere of

defining storm resilience. Many of these debates centre around a tension between being reactive and resistant to storms versus being proactive and adaptive (McCylmont et al 2019). McCylmont et al argue that resilience is about robustness, adaptability, and transformability and that communities can learn from past disasters to become resilient in the future. They assert that we need to move away from resistance-based approaches towards resilience-based approaches. Similarly, Jacob (2015) argues that there is an overall need to be proactive instead of reactive when it comes to storms and sea level rise. There is also a debate around what builds resilience in a community. Laurien et al (2020) argue that resilience is built upon a community having a balance between social capital and financial capital. Cagney et al (2006) argue that there should be more focus paid to social capital, such as trust and connectivity among the community, and that too much focus is currently paid to physical infrastructure. This briefing will focus on building both physical and social capital for the Downtown Jersey City community.

Jersey City

Jersey City, the second largest city in New Jersey, is a diverse, densely populated city known as Wall Street West due to its proximity to New York City and lower living costs. The median household income is $81,693 and the population is 262,075 (City Data 2021). The cost of living index in Jersey City is 122.5, which is high compared to the US average of 100 (City Data 2021). The city has been experiencing a large growth in population and development and is on track to "soon becoming the largest city in the state" (Resilient Jersey City Summary Doc 2019, 36). The city sits between the Hackensack River and Newark Bay to the west, and the Hudson River and Upper New York Bay to the east and has 21.7 miles of waterfront (Resilient Jersey City

Summary Doc 2019). As Jersey City is located on the coast of two rivers, it is very vulnerable to storms and flooding.

Downtown Jersey City is 2.2 square miles, has a population of 84,000 – around 30% of the city's total population, and is one of the wealthiest areas in Jersey City (City Data 2021). It is comprised of nine neighbourhoods, includes three subway stations and six light rail stations, and is directly across the Hudson river from New York City. Its population density is high compared to the total city density, and the household income in 2019 was $97,189 (City Data 2021). Despite being a wealthier neighbourhood, Downtown Jersey City's waterfront geography makes it very vulnerable to flooding, as most of the special flood hazard areas, as identified by the Federal Emergency Management Agency (FEMA), are along the coastline. This wealth also makes it one of the most promising neighbourhoods in terms of creating and funding solutions to make the area more resilient to storms and flooding. As Laurien et al (2020) say, having financial capital is particularly important for building flood and storm resilience.

The city experiences three types of flooding, including coastal, surface water, and combined sewer overflow. Coastal flooding is experienced in Downtown Jersey City as a result of extreme tidal conditions from severe weather and storm surges. Surface water flooding occurs from rainfall since the city is covered in impervious surfaces such as pavement and rooftops that cannot absorb water (Resilient Design Handbook 2019). This causes flooding and pollution to be carried into the rivers. Because of the combined sewer system in Jersey City where wastewater and stormwater enter into the same pipes underground, sewer overflow can happen when the pipes are overfilled (Ibid). When this happens, storm and wastewater spill from the sewers into nearby rivers.

In 2012, Superstorm Hurricane Sandy hit the East Coast and flooded over 38% of the land in Jersey City (Ibid). Sandy had severe impacts on the city, including social impacts, as it forced many in low-lying properties to evacuate, and financial impacts, as the storm caused tens of millions of dollars in damage. It caused damage to buildings and infrastructure, disrupted critical infrastructure, caused power blackouts, contaminated stormwater, disrupted public transportation, and overall "revealed a region-wide exposure to multiple hazards and risks" (Resilient Jersey City Summary Doc 2019, 19). Although devastating, Hurricane Sandy revealed to Jersey City its need to be prepared for future storms and sea level rise. As Jacob (2015) says, Sandy can be an opportunity for urban renewal, and as McCylmont et al (2019, 1159) similarly say, "learning from these disturbances leads to genuine adaptation to floods and an opportunity for resilience". This is because resilience is built through learning from and adapting to extreme storms and floods over time.

Policy

The Jersey City government created a “Resiliency Master Plan”, an “Adaptation Master Plan” and an “Urban Environmental Green Infrastructure Plan” in 2019, based on two studies done by the city after Hurricane Sandy. Two policy documents convey these plans, including the Resilient Jersey City Summary Doc and the Resilient Design Handbook. Through these documents, the government aims to build resilience by using innovative design and infrastructure solutions to protect the valuable social, historical, and economic assets of the city “against the changing environment and increased risk of storms” (Resilient Jersey City Summary Doc 2019, 6).

The Resiliency Master Plan focuses on defining priority areas for resiliency efforts. It first identifies the different risks in the city stemming from rising temperatures and rainfall, including social, economic, and physical risks. The social risks identified are areas with higher elderly and youth populations, low income populations, and non-English speakers who may struggle to communicate. The economic risks stem from local universities and employment hubs that may be damaged. Lastly, the physical risks are from crucial facilities and infrastructure like hospitals and power stations being damaged. The Resiliency Master Plan also identifies priority areas in the city that are more at risk, since each neighbourhood is different and requires different approaches. One of the vulnerable areas identified is Downtown Jersey City.

The Adaptation Plan identifies strategic implementation efforts for each area, with a focus on infrastructure. For Downtown Jersey City, various adaptation measures are recommended, including building a street levee, a waterfront boardwalk levee, a rail yard flood protection barrier, and a wet weather pumping station. For each of these infrastructures, the policy document outlines where it should be built, in what order, and what effect it might have on the city. The street levee, which is the most affordable recommendation, is recommended to be implemented on Dudley and Washington Streets, which would be raised three to four feet above ground. They say this would have no impact on the historic character of the area or its eastern views. The boardwalk levee is suggested to be placed at the Hudson River Waterfront Walkway with a height of up to 14 feet. This would also give space for more outdoor recreation and would hopefully be accepted by the public. A flood protection barrier is recommended for the Rail Yard, a critical facility for the community. Lastly, a wet weather pumping station is recommended to be placed in North Downtown Jersey City for when the combined sewer system overflows. Additional recommendations in the Adaption Plan include enhancing sewer

maintenance, wet and dry floodproofing, disconnecting downspouts, backwater valves, and lastly green infrastructure. Wet floodproofing is making a building able to withstand submergence for short periods of time, where electrical and mechanical utilities are elevated or protected. Dry floodproofing is sealing a building to prevent water from entering using watertight barriers, however this requires ongoing maintenance and adequate warning time to prep (Resilient Jersey City Summary Doc 2019).

The Green Infrastructure Plan outlines potential green infrastructure for the city in order to capture stormwater and reduce localized flooding. Green infrastructure can be simple or complex and employed by the government or by citizens. As previously mentioned, the city is covered in impervious surfaces like pavement and rooftops that cannot absorb water (Resilient Jersey City Summary Doc 2019). Green infrastructure is a solution to this problem as it mimics "the natural hydrological cycle by capturing, treating, and/or using stormwater" (Resilient Jersey City Summary Doc 2019, 37). Through this plan, the government says its goal is to capture the first inch of rainfall through green infrastructure, which according to the document could have a significant positive impact during major storms and flooding. For Downtown specifically, the plan recommends levees, revetments, and embankments, all which are essentially walls made up of natural materials. The Resilient Design Handbook goes more in depth into green infrastructure recommendations for the city. This handbook starts by saying that major changes are needed, including modifying the design of the city and investing in major infrastructure through creative solutions. This handbook appears to take on a more radical change-oriented approach than the other, although both written by the same branch of the government. The document defines green infrastructure as pervious soft surfaces that act to divert and retain stormwater. The green infrastructures covered in this document are green roofs, rain gardens, stormwater planters, eco-

friendly landscaping, bioswales, rain barrels, street trees, pervious paving systems, and underground storage. The document describes each including who can install them, how they can be installed, and how they act to intercept stormwater. The document also outlines resilient design techniques, including wet and dry floodproofing, modular panels, and elevation of critical systems. These design techniques are targeted towards residential, commercial, and public properties, all of which can implement these resilient designs.

Analyses of Policy

The policy responses above fall short for several reasons. While the policy does a good job of covering physical infrastructure and stormwater management suggestions, it fails to give actionable ways of building social resilience. One of the objectives in the Resiliency Master Plan is to create a socially resilient community, but it fails to mention how. The specific recommendations for Downtown Jersey City completely fail to recognize a need to build social resilience in the community and it focuses solely on what physical attributes can be implemented. To have a more complete and holistic approach, which is necessary in building storm and flood resilience, social resilience recommendations are needed (Laurien et al 2020). Some ways to address this are to build infrastructure that facilitates social interaction or support more activities that encourage sociability in the community (Cagney et al, 2016).

The policy also fails to touch upon addressing the root cause of worsening flood and storms: climate change and greenhouse gases. The policy should make a point of highlighting the need to burn less fossil fuels and switch to renewable energy in Jersey City. The fact that this is not mentioned suggests that the government is still in denial of the long-term consequences of burning fossil fuels or does not want to admit that the root cause of the issue is also what drives

profits for many in the city. The policy needs to recognize the financial potential of renewable energy and natural capital, as well as the long-term financial benefits of halting the burning of fossil fuels. The documents could link Jersey City's plan to have 100% clean energy by 2050 to this document, noting the connection between this goal and the objectives in the resiliency plans.

Lastly, the policy seems to have a disconnect between humans and natural systems, as it focuses on fighting and resisting water, flooding, and storms with physical barriers. Instead, literature suggests moving away from fighting the water towards living with the water, where humans integrate the natural world into the urban environment (McClymont et al 2019). This stems from "a lack of human knowledge of how to integrate the natural world into the urban environment" (McClymont et al 2019, 1166). Beyond green infrastructure, which is a solid start, policy recommendations could suggest ways to use flooding as an opportunity for resilience instead of a disaster. One way to do this is to implement water turbines, taking advantage of the Hudson River and its tide to generate renewable tidal energy for Downtown Jersey City. Jacob (2015) agrees with McClymont that communities should steer away from resistant structures towards working with the water and natural resources. In a more radical approach, Jacob recommends that to sustainably accommodate to rising waters, cities could build floating houses and buildings and waterborne transportation like a modern Venice or Amsterdam. This is not to say that the policy needs to take such a radical approach, but it could aim to work with the water instead of resisting its effects.

Community Recommendations

As a community, there are many ways that citizens of Downtown Jersey City can help build storm and flood resilience without involving the government. As Laurien et al (2020) say, much

effective action to build flood resilience occurs at the community level. It is important to note however, that these actionable plans work best when done in parallel with government plans such as the infrastructure mentioned before. This is because protective adaptation options like levees and pumping systems are costly and need maintenance and upgrades which the government can provide. There is also a need for community-based action beyond these physical barriers to build more long-term resilience, since infrastructure to protect against sea level rise and storms are often seen as short term solutions and not sustainable in the long run (Jacob 2015). Nonetheless, these recommendations will start with ways to build physical resilience then move towards ways to build social resilience.

There is large potential for building developers in Downtown Jersey City to have a positive impact on the city's resilience in terms of building physical capital. Those working in real-estate, architecture and design, and in building development can start by thinking long term when designing and planning new buildings. They can flood-proof their buildings by implementing wet or dry floodproofing. To wet-proof, they can make the building able to withstand water submergence for short periods of time and move electrical and mechanical utilities higher up. They can dry-proof by sealing their buildings to prevent water from entering by using watertight barriers. They can elevate critical systems like gas and electric, which is easy for architects to implement. Lastly, they can shift development away from the waterfront and Hudson River towards areas in Downtown Jersey City with higher elevations and out of the FEMA 100 year flood line. This is a good financial move for the long-term as well because "any high ground in the city is safer and more valuable real estate than unsafe waterfronts" (Jacob 2015, 46). Developers can add green infrastructure to their buildings and outside which would benefit the community in many ways, making it a valuable investment. For any developers hesitant due to

the cost of implementing these resilient designs, these investments are worthwhile for the long term financial, physical, and social benefit of the city. As Jacob (2015, 48) says, "for every dollar spent on disaster risk mitigation and resiliency, we earn an average of four dollars by avoiding losses".

There are also many actionable steps that can be taken by individual property owners. Raising a house's elevation can help increase short-term resilience. Implementing green infrastructure such as rain gardens, rain barrels, or even pervious driveways is a great option for homeowners. Households, as well as renters, can switch to using renewable energy in their homes such as solar panels or using energy from green providers. Anyone in the city who pays their own electric bill can choose where their electricity is coming from and choose a provider that uses renewable energy sources. In terms of installing solar panels, the price of solar in New Jersey has decreased by over 50% in the last 5 years, so it is becoming a more affordable option. Both of these actions address the problem at the root cause, since avoiding greenhouse gases can slow down the rate of climate change and sea level rise (Jacob, 2015).

Locals can crowd-fund to raise money to make community-led green spaces and infrastructure such as levies, street trees, bioswales and green roofs. For help initiating this, residents can turn to organizations like Sustainable Jersey City, which has a green infrastructure program and resources for the community to incorporate green infrastructure in their neighbourhood. This organization also has a Community Garden Network that residents can reference to help locals increase the number of community gardens. Residents can get involved with Sustainable Jersey City by signing their charter, donating, and using it as a platform to fund-raise.

Building social resilience and social capital is also important for building flood and storm resilience (Cagney et al 2016). Residents can join one of six local neighbourhood associations in Downtown Jersey City. These associations help build social resilience by fostering community among residents in the area and giving residents a forum to voice their opinions on local matters. They also help keep the community informed on local news and offer resources on different local issues. Other ways to build social resilience are through activities in the community that encourage social interaction. Residents can organize events to increase interaction, sociability, and support in the community. Having social cohesion and social exchange is really important for building storm resilience, because feeling a sense of trust and community helps encourage residents to volunteer and help out the vulnerable in disaster situations like Hurricane Sandy (Cagney et al 2016). As Cagney et al (2016, 14) say in reference to Superstorm Sandy, "facilitating social connections and harnessing the capital that arises from them may create resilience at the community-level that is comparable to, or exceeds, an investment in physical infrastructure."

Residents can also volunteer through local organizations to help out throughout Downtown Jersey City in several ways. For example, residents can volunteer with non-profits such as Friends of Van Vorst Park and Hamilton Park Conservancy to help maintain gardens and other green infrastructure essential to retaining flood and stormwater. This is called greenspace volunteering and has many community benefits including strengthened resilience, increased mental health, and increased environmental awareness (Miller 2019). After storms, residents can volunteer to help restore damaged housing, help provide essential services, and volunteer at shelters. An excerpt from Miller (2019, 3) explains why greenspace volunteering is important for strengthening social resilience: "from the community resilience side, community greening can

help facilitate social contact and improve the social network and multicultural relations… and help foster a sense of community that can include more neighbour to neighbour assistance" (Miller 2019, 3). As previously mentioned, social resilience is vital to storm and flood resilience. Overall, greenspace volunteering and volunteering post-storm increases both social resilience and physical storm and flood resilience.

Conclusion

The coastal city of Jersey City faces many challenges due to climate change, with storms and flooding arguably the most pressing. Eight years after Hurricane Sandy the city government opened an office of sustainability and released two policy documents to strengthen the cities' resiliency. The policy is a strong start and does a good job of explaining flood and storm-related issues and the vulnerabilities in the city as well as makes solid recommendations in terms of infrastructure. However, the plans could be more comprehensive by suggesting ways to strengthen the social resilience in the city and by taking a more adaptive approach. The suggestions in this community briefing aim to fill this gap in the policy by strengthening the social resilience in Downtown Jersey City on top of strengthening physical resilience among residents.

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