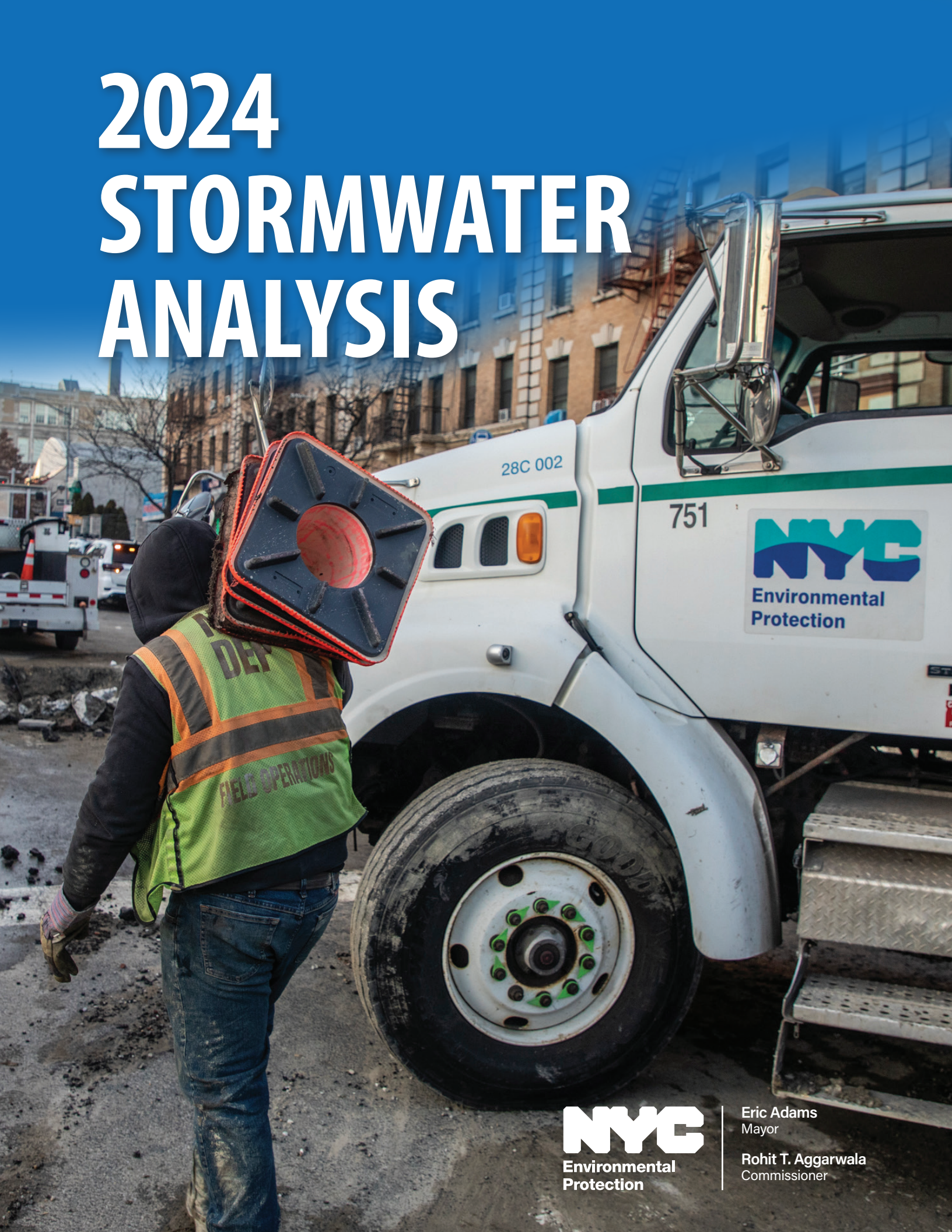
2024 STORMWATER ANALYSIS



NYC Environmental Protection

Eric Adams
Mayor

Rohit T. Aggarwala
Commissioner

To My Fellow New Yorkers:

As global and ocean temperatures rise, New York City is experiencing increasingly frequent and intense storms. As a result, New Yorkers are seeing more flooding in their communities than ever before, especially in low-lying, inland areas of the city.

The NYC Department of Environmental Protection (DEP) has a longstanding commitment to managing stormwater. We have accelerated this effort since the devastating flooding impacts of Hurricane Ida in September 2021 and are delivering work and developing plans to make New York City resilient to climate change-induced stormwater flooding.

This document is a brief progress report on this ongoing work. First, DEP is ensuring that existing infrastructure – from catch basins to rain gardens – is functioning well. While these efforts are critical, they alone cannot fully address the increased demands posed by changing rainfall patterns. The agency is ramping up to deploy more than $1 billion per year towards infrastructure investments, and we are already moving forward with urgently needed capital projects using our full toolkit of stormwater management solutions.

DEP has also achieved a major milestone with the completion of a citywide hydraulic model of our sewer system – a digital tool that has allowed us to efficiently evaluate solutions for some of the city's most flood-prone locations. This report estimates that based on DEP's current funding levels for stormwater management, it would take around 30 years to address major street flooding only in these priority areas. We also present several site-specific case studies where we have assessed in detail a combination of solutions, which offer lessons for the overall stormwater resilience effort.

With this report, DEP is starting the complex work of re-evaluating the level of service to which the stormwater management system is designed. These standards will shape how much investment is needed and how much flooding New Yorkers should expect during rain events. But even with significant new investments, we cannot achieve stormwater resilience on our own. True stormwater resilience will require property owners to evaluate their individual property risks and take measures to ensure that, when rain comes, they are protected or can recover quickly from a flood.

DEP is approaching the challenge of stormwater with great urgency because that is what our city deserves. Our commitment to stormwater management is not just about infrastructure; it is about safeguarding the well-being of every New Yorker. Together, we can weather any storm.

Sincerely,

Rohit T. Aggarwala,
Commissioner

NYC Chief Climate Officer

Green infrastructure construction, Queens

Table of Contents

Storm sewer construction, Staten Island

Executive Summary

Climate change is bringing more severe rainstorms to New York City. For decades, the “five-year storm” (so called because it is estimated to have a 20% chance of happening in any given year) typically produced 1.75 inches of rainfall in a one-hour period. But, in 2023, the city experienced five "five-year” storms. Heavy storms that were once exceptional have become commonplace.

For two years now, at Mayor Adams's direction, the NYC Department of Environmental Protection (DEP) has been working aggressively to address flooding caused by climate change-induced storms. DEP has undertaken short-term improvements to the extent that staff and budget have allowed, including improvements to catch basin inspections and targeted cleaning of sewers in areas of known flooding. This year, the agency will break ground on the city’s first cloudburst infrastructure and will continue to pursue expansion of green infrastructure across the city.

DEP has also begun planning for true stormwater resilience for New York City. Among other things, this has required an unprecedented level of joint planning between the agency’s green infrastructure and grey infrastructure teams and the development of a first-ever computer model of the entire sewer system. DEP also undertook several in-depth assessments of sample locations to see what challenges and solutions emerged.

A full stormwater resilience plan will require several more years of planning and engineering design work, and it will have implications both for other City agencies and for the public. While this work is far from finished, this *Stormwater Management Update,* pursuant to DEP’s commitment in PlaNYC 2023 to publish a stormwater flooding adaptation plan, offers some key findings from the last 18 months of work:

1. **DEP can and should take near-term actions to improve drainage, but these will not solve the significant flooding created by more intense rain.** For example, DEP is piloting the installation of manhole covers with slots to provide an alternate drainage point in the event the curbside catch basin is blocked by debris. While steps like this can reduce the instances of flooding, they cannot increase the overall capacity of the system, which is what will be necessary to handle the kinds of storms New York faces in the future.

2. **Even achieving a basic increase in overall system capacity will require dozens of projects across the city.** As an initial exercise, DEP assessed what would be required to have the stormwater management system absorb 2.1 inches of rainfall per hour in those locations across the city most prone to flooding. At that target – which is still far below what Hurricane Ida delivered on September 1, 2021 – there are more than 80 areas in the city that would require significant investment.

3. **The level of service, or standard of performance, to which the stormwater management system is designed will shape how much investment is needed and how much residual flooding New Yorkers will experience.** At DEP's current rate of funding to manage stormwater, which is roughly $1 billion per year, it would take approximately 30 years to implement capital projects in the 80+ priority areas. But even with this investment, neighborhoods across the city would still experience flooding during storms like that of September 29, 2023, and Hurricane Ida. DEP has not yet estimated the costs for higher levels of protection in detail, but it is likely to be greater than $250 billion and in some locations there is simply not enough space underground to implement a solution.

4. **Nature-based stormwater management tools are effective but unlikely to be a solution for major flooding on their own.** The case studies DEP conducted assessed grey infrastructure tools, like sewers, nature-based solutions, like rain gardens and bluebelts, and combined strategies. While nature-based solutions were often a viable, sustainable and cost-effective part of a solution, in many locations it was insufficient to handle the total quantity of stormwater produced. In most cases, traditional sewer upgrades will be necessary to achieve target levels of stormwater management.

5. **If coordination and management challenges can be solved, nature-based infrastructure can be useful components of a combined approach.** Bluebelts, cloudburst management projects and green infrastructure can often be implemented more quickly than grey infrastructure and have added community and environmental benefits. However, selecting sites for these nature-based tools can be complex because they frequently require adaptation of public spaces or even private land acquisition and pose ongoing maintenance demands.

6. **There will also likely be locations where buyouts of private property are more cost effective than an engineered stormwater solution.** DEP estimates that 15-20% of the total cost of stormwater resilience could be in the form of funding buyouts of properties that are difficult to protect. DEP would seek to use these properties, to the extent possible, as green infrastructure and bluebelts to protect the surrounding neighborhood. Generally, DEP would only seek buyouts where no cost-effective solution exists to protect the location to a reasonable standard.

7. **Reinventing the city's stormwater management system to address climate change will take years of planning, decades of construction and additional tens of billions of dollars.** This update is a precursor to an upcoming Stormwater Master Plan, a multi-year planning and engineering effort during which DEP will evaluate setting a more ambitious level of service for stormwater management. In parallel, DEP will continue with near-term actions to optimize existing infrastructure and implement capital projects to improve capacity.

8. **Recognizing that some level of flooding may be inevitable, New Yorkers will need to prepare their homes and businesses for that reality.** Managing stormwater is a shared responsibility that will require action from property owners, both public and private. DEP will encourage, help and, in some cases, require building owners to manage more stormwater on their own premises and prepare their properties for the risk of flooding.

This update comes as DEP begins to re-envision how it approaches stormwater management. Making New York City more resilient to increasing rainfall will be as much an economic and social challenge as it is an engineering one. Given that the approach to stormwater resilience will impact all New Yorkers and have significant financial and property management impacts, these are not decisions that DEP can make alone.

Stormwater Management Toolkit	
Sewers	Often called "grey infrastructure," these are the pipes and pumps that drain stormwater from the streets. Sewers have traditionally been the first line of defense in a storm. New York City has approximately 7,500 miles of sewers. Sewers work in every rainstorm and protect fully against 98% of rain events. However, just like roads are not designed to handle Memorial Day Weekend traffic, sewers are not designed to handle hurricane-level rain. The sewer system can get overwhelmed when the amount of water produced by a storm is greater than the capacity of the pipes.
Green Infrastructure	Green infrastructure absorbs water into the ground in areas with good soil. Green infrastructure reduces street flooding by capturing and slowing stormwater before it enters the sewer system, freeing up drainage capacity and reducing sewer overflows into local waterways. It can also green neighborhoods, reducing urban heat island effect. Examples of green infrastructure include curbside rain gardens, greened medians with underground stormwater retention, or permeable pavement – a special roadway pavement designed to absorb and drain rainwater.
Bluebelts	Bluebelts divert rainfall away from sewers, provide retention and create rich ecological areas. This solution preserves or restores natural drainage corridors like streams, ponds and wetlands to store and filter stormwater. DEP manages 545 acres of bluebelts and natural areas in the Bronx, Staten Island and Queens.
Cloudburst Management System	A cloudburst is a sudden, heavy downpour that drops a lot of rain in a short amount of time. Cloudbursts can overburden the sewer system and cause flooding. Cloudburst management systems use a combination of grey and green infrastructure to capture and retain or detain stormwater until the sewers can handle the flow.

Bluebelt, Staten Island

Planning Progress

Setting the level of service is the foundation for stormwater management planning across the city. The level selected will drive the overall cost to New Yorkers and set expectations of stormwater capture by the City. To maintain affordability, the City may have to consider a level of service that accepts some amount of flooding.

Level of service is a term that describes the expected performance of the stormwater system to capture and divert rainfall and minimize street flooding. Public safety is the top priority in determining the level of service, but it must also balance the protection of the environment and property with the cost of implementation. As the desired level of service increases, the cost of implementing stormwater management solutions increases rapidly.

DEP's current level of service for new sewer construction citywide is set to capture 1.75 inches of rainfall per hour. This has historically been representative of the amount of rain that would fall in a storm with a 20% chance of happening in any given year (also known as the "five-year storm" because, statistically, it has a probability of occurring once every five years). However, not all sewers in New York City can handle that capacity. Prior to 1973, each of the five boroughs set an individual level of service for sewers in their jurisdiction. As a result, the sewer networks in Brooklyn, Queens and the Bronx can generally handle 1.5 inches of rain per hour; Manhattan and Staten Island can typically handle 1.75 inches per hour. Other factors, including the topography of a neighborhood and duration of the rainfall, affect how stormwater is drained, for better or for worse.

As climate change continues to impact storm patterns, the five-year storm for the New York City region will likely be redefined as one that produces 2.1 inches of rain per hour, rather than 1.75 inches per hour. This means New Yorkers will see storms that produce flooding more frequently. With this in mind, later this year DEP will launch a comprehensive Stormwater Master Plan, and one of the early tasks of that planning process will be to define the appropriate level of service across the city.

The constructability and timeline of upgrades will be key factors in determining the level of service. Sewers can only be built so large because New York City's streets are a set width and are often congested with underground utilities. Further, wide-scale reconstruction of sewers would take decades, so a reasonable delivery schedule for improvements must also be taken into account. The cost to New York City for stormwater management upgrades will also need to be carefully considered in setting a new level of service.

The City will therefore need to evaluate in what instances it is acceptable to allow for safe, shallow flooding for short durations while the stormwater system continues to drain and divert water from the streets. The City will also need to contend with the small number of areas experiencing significant and chronic flooding, due to multiple contributing factors, where it may be cost-prohibitive to provide meaningful stormwater protection. In these site-specific cases, acquisition of private property in these areas may be the prudent financial option.

DEP is converging on some general findings as it studies the level of service:

- **Hurricane Ida-level stormwater management across the city is unattainable**
- **Design of solutions should consider climate change over a 70-to 100-year horizon**
- **With affordability in mind, allowing some places to flood safely will need to be a part of the strategy**
- **Land acquisition should be considered where properties can provide meaningful flood protection for a community and/or the cost of engineered solutions are exceedingly high**

Rain garden during rainy weather

Modeling is one of the most important tools for understanding where rainfall will generate flooding and what modifications are needed to prevent it.

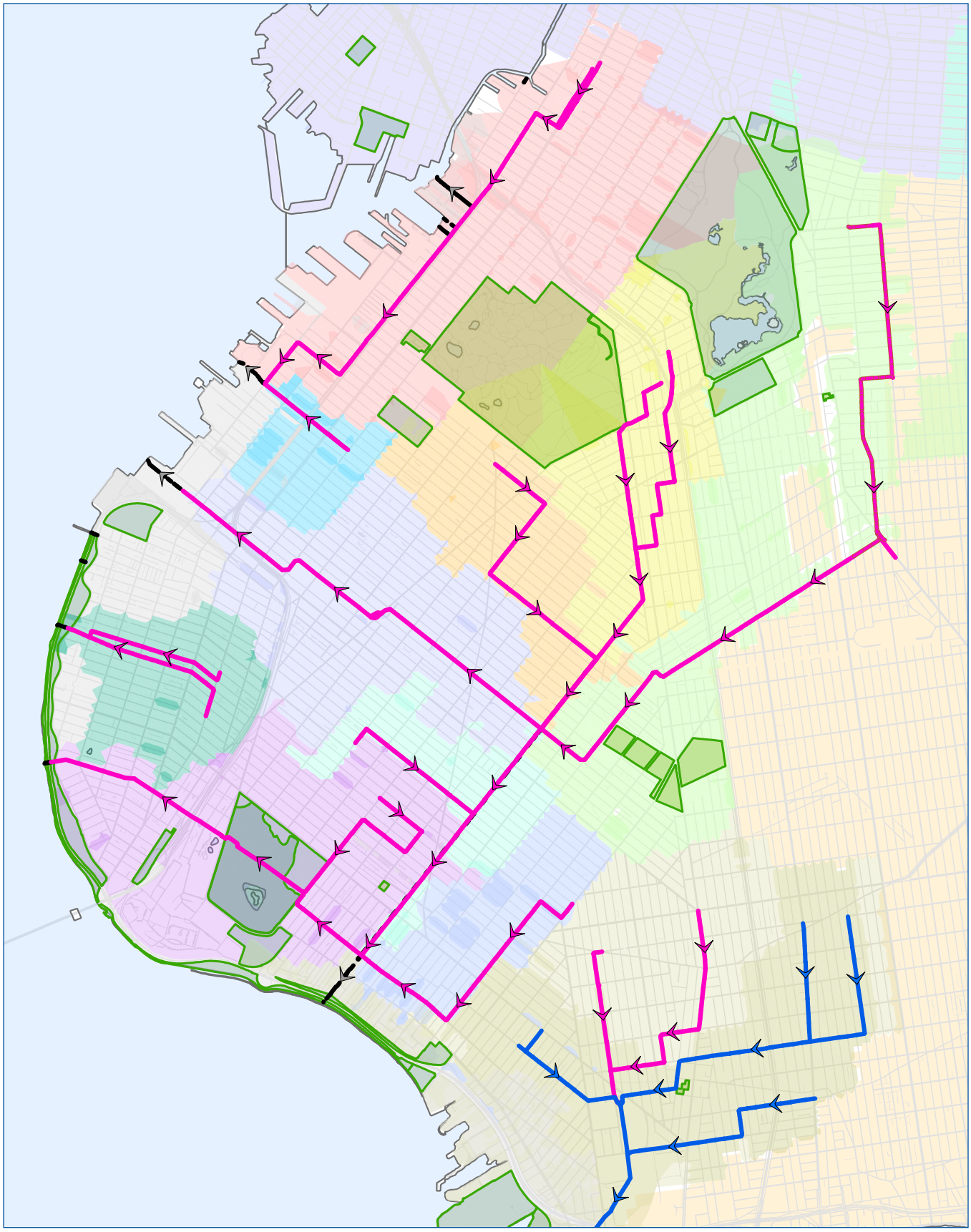
Modeling Flooding & the Sewer System

To help New Yorkers understand and prepare for flooding related risks, the City created rainfall-based flooding maps. The maps predict flooding under moderate to severe flooding scenarios compounded by sea level rise under existing and future predicted conditions. The City will continue to further define flood hazard areas related to various storm events.

DEP has recently completed a citywide hydraulic model that includes all 7,500 miles of sewers in New York City. The model allows DEP's engineers and planners to simulate how the sewer system performs under a range of storm scenarios, focus on areas most susceptible to flooding and test various solutions. These two planning tools allow DEP to work faster than ever before to identify the most cost-effective solutions to areas with chronic flooding.

DEP's planning analysis focuses on the critical components of the sewer system, including the trunk mains. These large arterial pipes are the backbone of the system and are responsible for moving large volumes of stormwater. The typical approach to resolving localized flooding has been to upsize the existing sewer pipes in that given area. Sewer upsizing is expensive and slow work. By studying the most consequential components of the sewer network, DEP can maximize the potential of the existing system and identify cost-effective solutions for an entire neighborhood. For example, DEP can identify trunk mains with unused capacity in a storm scenario and, with relatively small capital investments, modify the network to shift stormwater flows from pipes that are over capacity and causing flooding to those with free space.

DEP aims to create a "smart sewer" network by installing hundreds of sewer sensors that will allow the agency to monitor stormwater flow levels in real time. Eventually, with future installation of gates and valves within the sewer system, DEP could use this sensor data to automatically divert flows from pipes that have reached capacity into others with excess capacity, thereby utilizing all available space in the system.



Citywide hydraulic model trunk main capacity analysis in southwest Brooklyn

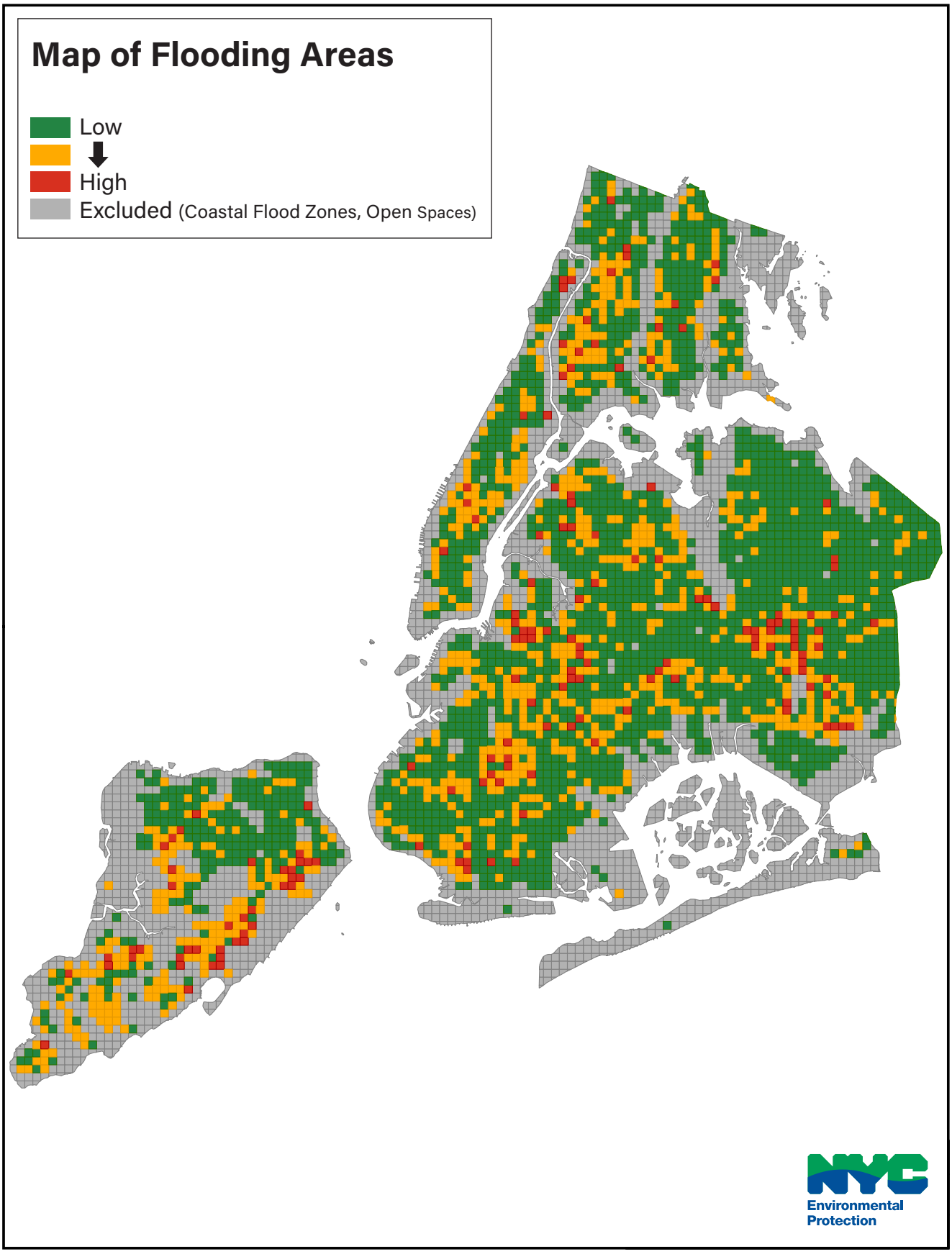
Identifying Priority Areas

Upgrading the entire city to a higher level of service would be a massive undertaking. DEP therefore performed a prioritization study to identify areas of the city most in need of stormwater flooding relief. Coastal areas were excluded from the study, as addressing flooding in these areas will require advanced studies to integrate the effects of tidal flooding, storm surge and sea level rise.

The study divided the city into smaller, more manageable units of analysis, resulting in a grid of 5,600 areas of 40-acres each. DEP evaluated the performance of the stormwater system in each area under a storm scenario that produced 2.1 inches of rain in an hour. This modeled data was combined with other validating data including 311 calls and known sewer design capacities. The exercise identified more than 100 areas that suffer from chronic stormwater flooding and sewer back-ups.

Fifteen of these locations were in Southeast Queens (Community Boards 12 and 13), where DEP is already working to address local drainage needs through an ongoing, $2.5 billion investment. Excluding these locations in Southeast Queens, more than 80 "Priority Areas" remain. While these areas ranked highest in the prioritization process, they represent only approximately 20% of all the area across the city subject to some level of street flooding during storms that produce 2.1 inches of rain per hour.

Flooding at McCarren Park, Brooklyn



Map of Flooding Areas

Commissioner Aggarwala meets Queens residents impacted by flooding from Hurricane Ida

Case Studies

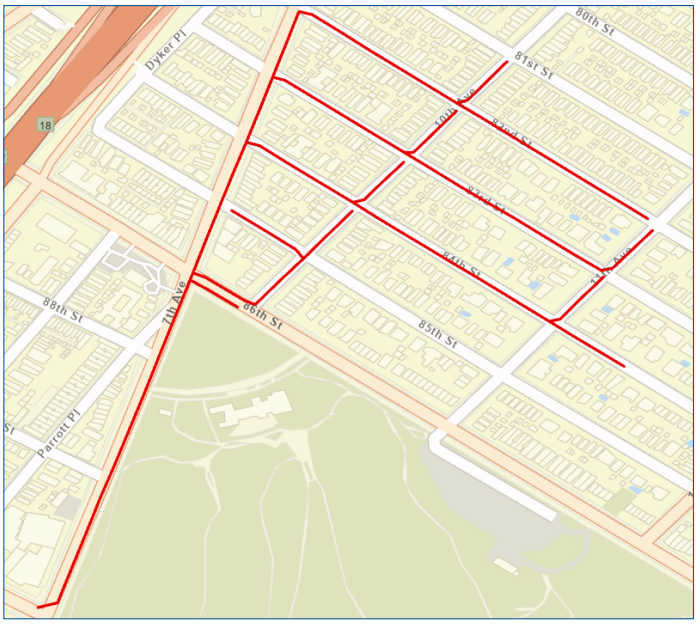
DEP selected four of the Priority Areas to develop case studies to model the site-specific performance of various combinations of stormwater management tools. The analysis assumed a storm scenario of 2.1 inches of rainfall an hour. DEP is already moving forward with capital planning for some of the interventions identified through this case study process.

Dyker Heights

The capacity to handle significant rainfall is not evenly distributed around the city. Diverting stormwater flows to neighboring drainage infrastructure with excess capacity is one of the most cost-efficient methods of flood mitigation.

Dyker Heights in Brooklyn is served by sewers constructed in the early 20th Century. While the sewer system generally performs well, it can become quickly overwhelmed during heavier rain, resulting in sewers surcharging and backing up into basements.

DEP evaluated the possibility of implementing a bluebelt in the Dyker Golf Course but found that additional sewer upgrades were required to fully manage the stormwater. DEP identified excess capacity in a nearby trunk main and through modeling showed that upsizing the network of street pipes that drain into that trunk main would be sufficient to capture 2.1 inches of rain in an hour. This over $60 million solution relieves flooding for 14,300 residents in a 145-acre area. The project has been turned over to NYC Department of Design and Construction (DDC) for design. Should additional stormwater management be required in the future, a bluebelt in the golf course could be considered.



Dyker Heights drainage plan upgrade

Knickerbocker

Building larger trunk mains can be the most efficient solution to drain large volumes of stormwater from flood-prone locations.

The Knickerbocker area of Bushwick in Brooklyn, roughly centered around the intersection of Knickerbocker Avenue and Myrtle Avenue, is served by sewers built in the early 20th Century. The area is also at a lower elevation than the surrounding neighborhood, increasing its vulnerability to flooding. This area experiences frequent sewer back-ups and street flooding.

DEP's modeling found that the trunk main needs to be expanded in order to manage the increasingly intense rainfall caused by climate change. To alleviate flooding, the agency plans to upsize the trunk main, estimated to be a roughly $300 million DEP investment to increase the system's stormwater capacity more than eight-fold, benefitting many businesses and over 12,000 residents across 2,238 acres. The project has been turned over to DDC to initiate the design process.

Commissioner Aggarwala and Council Member Sandy Nurse visit Knickerbocker Avenue to review new slotted manhole covers

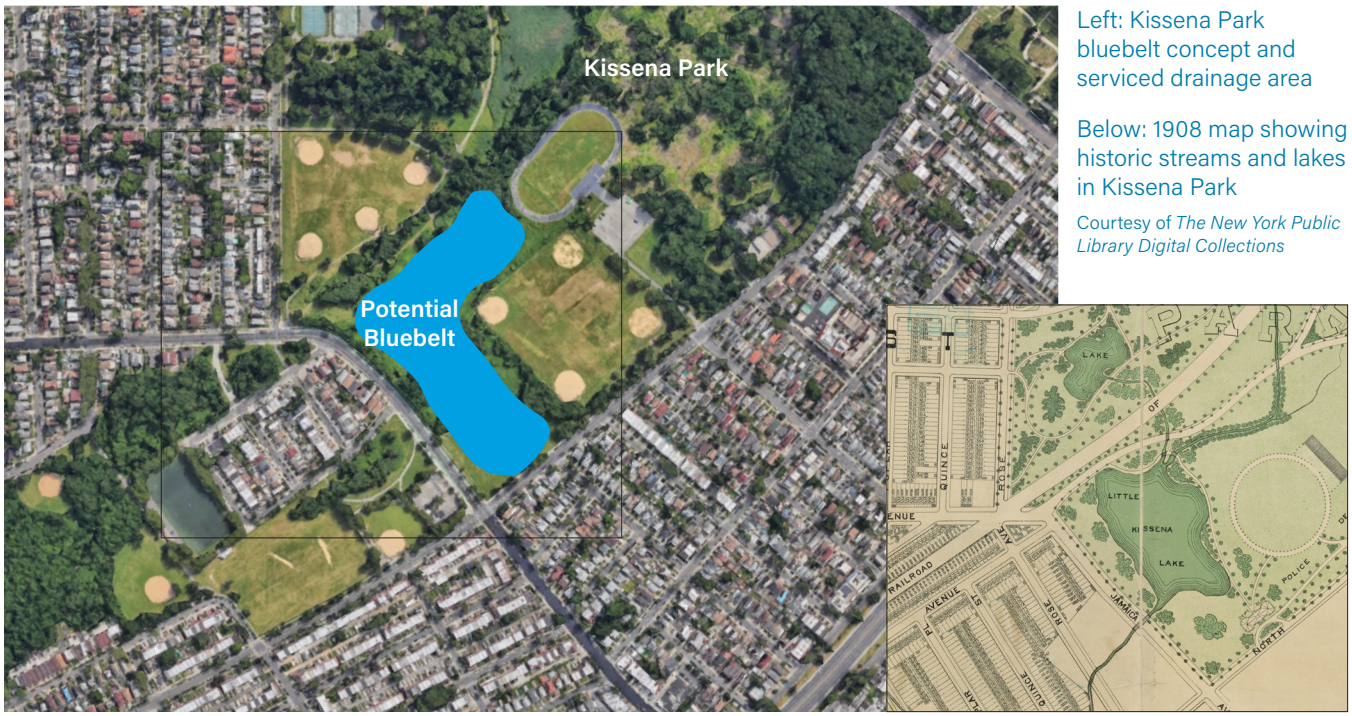
Kissena Park

There are opportunities to repurpose open space to store large volumes of stormwater runoff relatively quickly, but this can present trade-offs between using parkland for recreation versus flooding mitigation.

The Kissena Park area in northeast Queens is one of the city's most vulnerable areas to severe flooding. During Hurricane Ida in 2021, three people drowned in a converted cellar apartment when that illegal dwelling rapidly filled with rainwater runoff from the streets. The neighborhood was built over a former waterway and sits at a lower elevation than the surrounding land. In addition to challenging topographical conditions, the Kissena Park area is part of a large and complicated drainage area that conveys millions of gallons of stormwater from miles away during heavy rain.

DEP is already underway designing solutions to alleviate flooding in the area. In January 2023, the City announced a cloudburst management project in the Kissena Park Corridor. This cloudburst project is a first step that can be implemented relatively quickly to target flooding associated with short intense storms. Given the broader challenges in this area, DEP evaluated a case study focused on the flooding within the Peck Avenue community, which is adjacent to several acres of open space with Kissena Park.

DEP modeled the effectiveness of a bluebelt within Kissena Park to detain large volumes of stormwater and slow the rate of stormwater flow into the sewer system. Modeling results confirmed that a bluebelt could be a very effective solution and implemented in a shorter amount of time than grey infrastructure. This nature-based solution was estimated to cost roughly $40 million and would mitigate flooding in a 90-acre area, providing relief to an estimated 3,000 residents. DEP is working closely with NYC Parks to further develop the concept and validate the feasibility of locating a bluebelt in the park. DEP also continues to study the feasibility of sewer upgrades in the area.



Left: Kissena Park bluebelt concept and serviced drainage area

Below: 1908 map showing historic streams and lakes in Kissena Park

Courtesy of *The New York Public Library Digital Collections*

Jewel Streets

In areas with especially challenging topography and high groundwater levels, an engineered solution to flooding may be very costly and require dramatic changes to the streetscape.

The Jewel Streets neighborhood on the Brooklyn-Queens border is one of the most challenging stormwater management cases anywhere in the city. The neighborhood was built over a historic stream that drained stormwater into Jamaica Bay and sits at the lowest elevation in the surrounding area, essentially at the bottom of a topographical bowl. The neighborhood has only limited sewers and relies on a small pumping station to pump stormwater to the sewer network in higher ground.

After storms, certain street segments can remain flooded while the pumping station gradually drains the area to a nearby trunk main. In 2023, DEP completed targeted storm sewer infrastructure upgrades in the area, greatly reducing the length of time that street flooding remained after a storm, but much more work is required to address the neighborhood's chronic drainage challenges.

Through this case study, DEP modeled the build out of a complete, traditional gravity sewer system but found that would require raising the streets by about six feet in some locations, well above the front doors of many neighborhood homes. DEP modeled an alternate solution that combined multiple infrastructure tools: a bluebelt to capture and hold stormwater and increased pumping station and trunk main capacity to effectively drain it. In addition to slowing the flow of stormwater into the sewers, the bluebelts would add green space to lower urban heat island effect and provide habitat for wildlife. However, building a bluebelt would require acquisition of privately-owned land, which adds cost and time to implementation.

DEP continues to advance these engineering analyses to identify solutions that are both cost effective and acceptable to the community. This work is informing DEP's participation in the Jewel Streets Neighborhood Plan, led by the NYC Department of Housing Preservation and Development, which aims to deliver infrastructure improvements and affordable housing to improve quality of life in the neighborhood.

Storm sewer construction to alleviate flooding in Jewel Streets, Brooklyn/Queens

Aftermath of Hurricane Ida, Staten Island

Cost Estimates

DEP has made significant progress in understanding the potential cost of various levels of service. Incremental improvements in how much stormwater is captured can come with a steep price tag.

For the exercise performed this past year, DEP estimated the cost of managing flooding associated with a storm that brings 2.1 inches of rain in an hour in the Priority Areas. For a point of comparison, the agency also looked at managing an extreme weather event like Hurricane Ida, focusing on areas across the city anticipated to see more than 12 inches of flooding. These estimates are preliminary and based on historical unit rates of cost per foot of buried pipe installation and cost per gallon of stormwater capture for a variety of green infrastructure solutions.

The cost estimates that follow raise important questions that the City and New Yorkers must consider in setting a new level of service:

- How do we keep costs affordable for New Yorkers while implementing stormwater management improvements to protect them?
- What level of responsibility is expected from New Yorkers for protection of their personal property?
- What levels of real property damage can be tolerated in extreme storm events?

Mayor Adams and Commissioner Aggarwala posting a water shutoff notice for non-payment of water and sewer charges

Cost of Flood Relief in Priority Areas

Flood mitigation even just in the Priority Areas will not be cheap or fast. DEP's current ten-year capital plan directs approximately $10 billion towards stormwater management projects, including sewers, bluebelts, green infrastructure, and cloudburst projects. This means that it would take at least 30 years to implement stormwater management upgrades in the Priority Areas alone. Among other factors, the long timeframe is driven by upfront planning and design capacity, coordination with other City agencies to minimize neighborhood disruptions from construction, contractor capacity and the need to spread projects over time for prudent cost management.

DEP developed rough cost estimates for each of the Priority Areas using cost data derived from historical capital project costs. In total, roughly $30 billion would be needed to address flooding in the 80+ Priority Areas (in current dollars). Roughly 60% of the total cost is associated with increasing sewer capacity and 40% for nature-based stormwater management solutions.

This preliminary cost estimate does not include the costs that might be incurred by other City agencies that may contribute to many of these projects, such as the NYC Department of Transportation (DOT) or NYC Parks. Whenever possible, the City's capital agencies coordinate their work in the same area to minimize neighborhood disruption. This non-DEP work can range in cost, and in some cases, can be more expensive than DEP's portion. Likewise, if DEP accelerated the pace of this work, it would be necessary to ensure that funding required by other City agencies to meet the new construction timelines and new maintenance responsibilities, was also available. For example, DOT, with whom DEP closely coordinates around construction in the right-of-way, finances its capital projects through General Obligation Bonds, which could be constrained due to ongoing City capital commitments.

Stormwater Management Tool	Capital Cost ($) Preliminary Estimate	% of Cost
Sewer Infrastructure Construction / Upsize	$18 B	60%
Bluebelts	$8 B	27%
Green Infrastructure / Cloudburst Management Infrastructure	$4 B	13%
Total	**$30 B**	**100%**

Protecting Against Extreme Storms

As a point of comparison, it is valuable to evaluate the extraordinarily high conceptual cost to protect the city from an extreme storm, such as Hurricane Ida, which broke the City's record for the most single-hour rainfall on September 1, 2021, dropping more than three inches of rain in an hour.

Focusing on areas across the city anticipated to see more than 12 inches of flooding in such a storm, DEP determined that handling such a volume of water would require the construction of a fully separate storm sewer system. DEP estimates that such a system would cost more than $250 billion to build. Anything in this investment range would require 50 to 100 years to implement.

Paying for Stormwater Management Equitably

In 2023, DEP launched a Sustainable Rate Study to help evaluate rate structures that would fairly allocate the costs of the significant stormwater investments that lies ahead. Currently, DEP bills its customers for water and wastewater based upon use that is measured at a property's water meter. However, there is little correlation between the volume of water that a customer uses and the volume of water that runs off a property and into the sewer system. Consequently, properties that have large impervious surfaces but use little drinking water pay disproportionately small bills compared to the water they contribute to the sewer system.

As part of the study, DEP surveyed how other public water and wastewater utilities have raised revenue to pay for their stormwater capital programs. In 2024, DEP will continue to dive deeper into promising alternatives and, alongside the New York City Water Board, evaluate whether to pursue them in the future.

Storm sewer construction, Queens

Shared Responsibility

Regulation has evolved over the past few decades to establish a shared responsibility for controlling stormwater flooding between public and private property owners. Private property owners are required by Federal, State and City regulations to do their part in managing stormwater to lessen the burden on the sewer system. DEP is also working with other City agencies to ensure that as many infrastructure investments as possible collect rainwater to take pressure off the sewer system and reduce flooding.

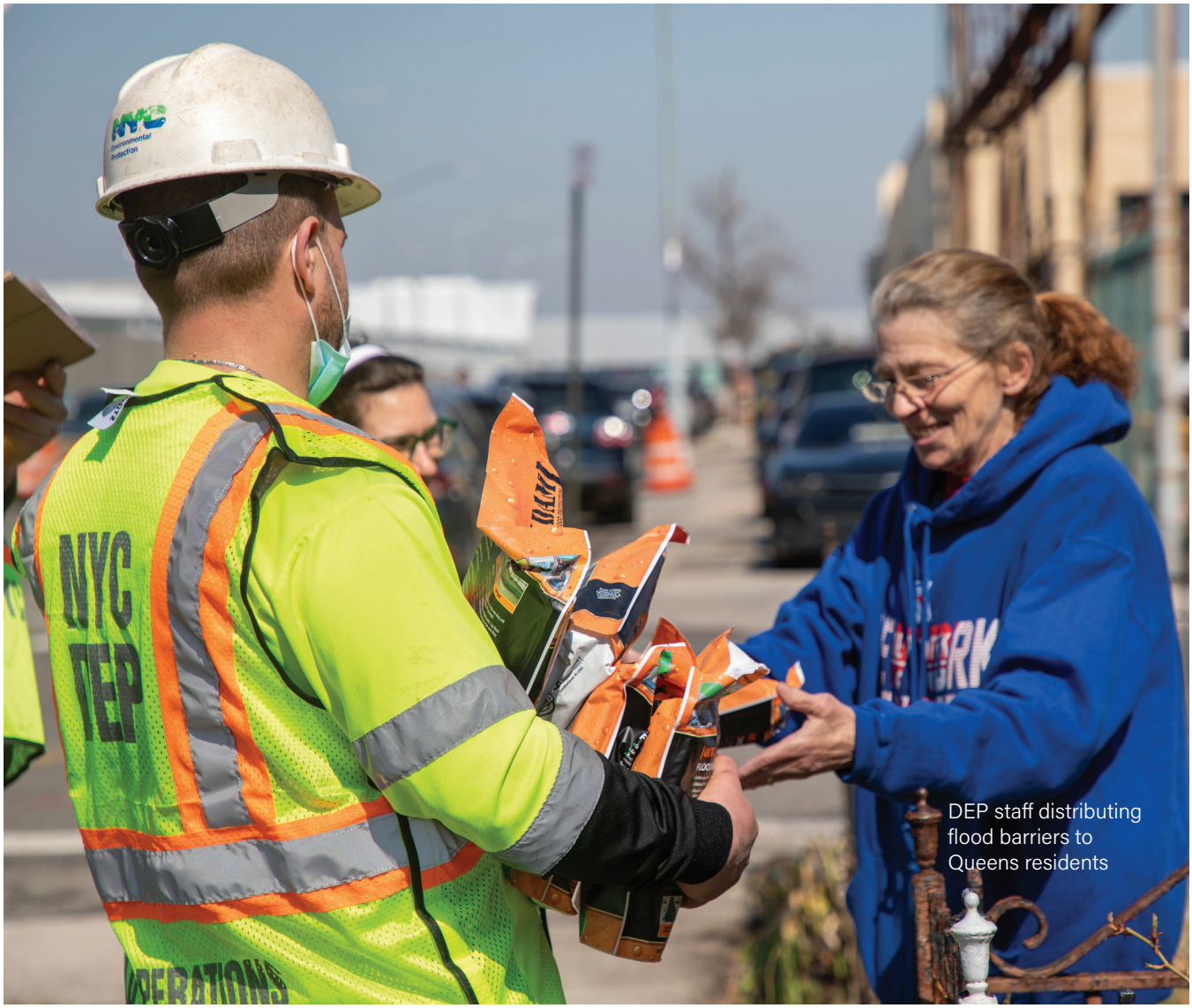
In 2022, the City promulgated the landmark Unified Stormwater Rule. The 2022 rule provides a crucial tool to help address a changing climate ensuring that development and infrastructure projects – public or private – incorporate stormwater management measures. It increases the amount of stormwater that property owners must detain on-site and divert from the sewer in new or redeveloped properties and requires prioritization of green infrastructure stormwater management tools like green roofs. Since 2022, DEP has

Green Roof, Steiner Studios, Brooklyn Navy Yard

approved permits for 500 properties that have implemented projects to capture nearly 40 million gallons of stormwater per year.

But the City will not be able to eliminate all flooding, everywhere, in all types of storms. True stormwater resilience will require property owners to evaluate their individual property risks and take measures, both physical and financial, to ensure that, when rain comes, they are protected or can recover quickly from a flood. Over the past few years, the City has partnered with community leaders to distribute emergency preparedness materials like flood barriers and educate private property owners about how to protect their homes and businesses.

DEP is also studying the benefits of devices called backwater valves in sewer lines in private property. Backwater valves are designed to allow sewage to flow in only one direction – out – and prevent it from backing up into homes when sewers are overwhelmed due to heavy rainfall. Over the next year, DEP will work with City agency partners to design a program that provides financial assistance to property owners to install backwater valves.



DEP staff distributing flood barriers to Queens residents

Project Implementation Progress

Over the past year, DEP has continued to invest in stormwater upgrades across the city. The most significant investment continues to be upsizing the sewer network, and those improvements will serve New Yorkers well for the next several decades. While this is a core part of DEP's investment, the agency is also ramping up programs to deliver nature-based stormwater solutions, including green infrastructure, permeable pavement, bluebelts and cloudburst management projects, which can often be deployed more quickly to provide relief from flooding in localized areas. In addition to capital infrastructure investments, DEP is investing in catch basin and sewer cleaning programs to ensure the capacity of the system to capture stormwater is fully available during a storm. This section briefly highlights some of the progress DEP has made in these areas over the past year – all work that continues to move New York City along the path toward a more resilient future.

Sewer/Stormwater Capacity Upgrades

The current DEP 10-year capital plan for sewer system upgrades is approximately $8.2 billion, and the agency currently has over 100 active sewer projects in the pipeline totaling $3.6 billion. These projects are in various states of implementation from planning through construction and are all expected to be completed in the next five years.

Storm sewer construction, Queens

Green Infrastructure

Launched in 2011, DEP's green infrastructure program has grown into the largest of its kind in the nation. DEP has constructed more than 10,500 rain gardens and infiltration basins that absorb stormwater off the streets and has committed to spending $3.5 billion on green infrastructure over the next two decades to improve water quality and stormwater resilience.

Green infrastructure medians, Queens

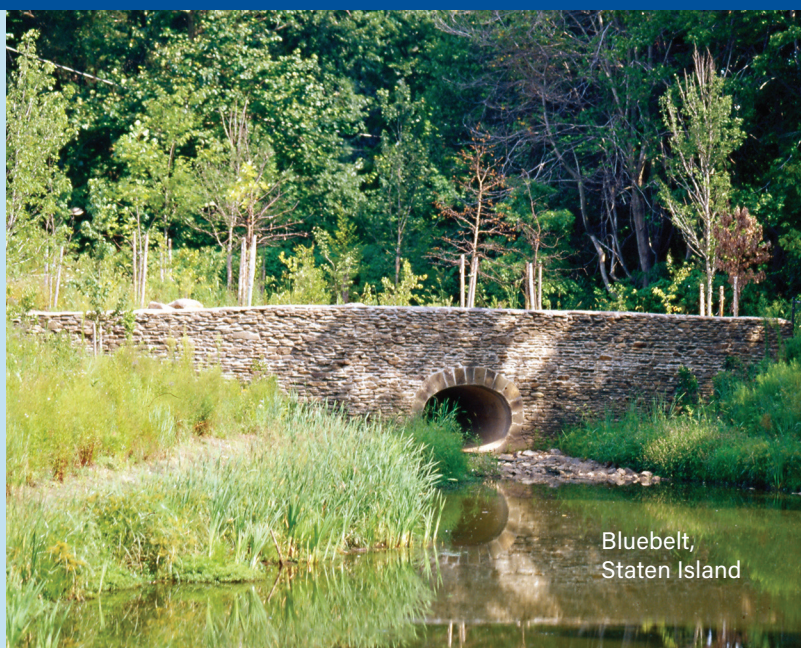
Permeable Pavement

To date, DEP has constructed three miles of permeable pavement within New York City streets. DEP has permeable pavement design contracts planned for 10 miles in the Bronx and another 35 miles in Brooklyn.


Permeable pavement demonstration

Bluebelts

DEP's successful Bluebelt program has expanded beyond Staten Island to other areas with chronic flooding where the local land use and topography create opportunities to construct large stormwater detention basins. DEP currently has four major bluebelt projects in construction at a total cost of approximately $32 million. DEP also has 20 bluebelt projects in design with the goal of expanding the program to all five boroughs.



Bluebelt, Staten Island

Cloudburst Management Projects

The City has dedicated nearly $400 million over the next several years to cloudburst management projects. In 2023, DEP announced five areas where cloudburst management projects will be pursued, including communities in Corona/Flushing Park, Kissena, Parkchester, Brownsville and East New York. A pilot cloudburst management project is currently under construction at NYCHA's South Jamaica Houses in Queens and four more pilots are in design.

Data-Driven Maintenance

In addition to building new infrastructure, DEP invests in maintaining the existing stormwater management system to ensure it performs as expected when it is needed.

DEP has more than 150,000 catch basins – the grates typically found on the edge of a road through which stormwater flows into the sewer system. In 2023, DEP launched a data-driven catch basin inspection program to prioritize the catch basins most prone to clogging. Roughly 15,000 catch basins in commercial areas are inspected twice a year and the remaining catch basins inspected either annually, biennially, or every three years depending on 311 complaints and work order history. This program has optimized the agency's resources and systematically addressed the most problematic basins to ensure that rainfall can flow unimpeded into the sewer.

DEP is also piloting slotted manhole covers designed to provide an alternate drainage point in the event the curbside catch basin is blocked by debris. Additionally, DEP will upgrade the 8,500 most problematic basins, using the new design for catch basin covers that improves drainage, starting with 1,500 over the next two years at a cost of $45 million.

In 2023, DEP also cleaned nearly 700 miles of sewers to help keep the flows moving during storms. DEP will accelerate the trunk main sewer cleaning program, prioritizing segments that are most prone to either clogging or surcharging, in particular the "siphons" that dip to cross under subway lines. Clogs occur more frequently in these siphons and severely hamper flow, causing back-ups and street flooding. These clogs can also create a pathway for stormwater to enter subway tunnels, where it may disrupt train service.

DEP staff cleaning a catch basin

Next Steps

DEP has made great strides building the foundation for the future of stormwater management in New York City. The completion of the citywide hydraulic model and the planning exercises and case studies evaluated to date are the cornerstones of the future decision-making. In addition, DEP continues to invest in maximizing the potential of the existing infrastructure and building out new and innovative stormwater management systems.

DEP will continue to innovate in its approach and accelerate its implementation of stormwater management tools. The urgency of the matter is clear – coastal and inland stormwater flooding are among the most pressing issues in the city today – and significant progress must be made to maintain the City's economic, social, and cultural vitality. Proper funding and staffing are crucial to realizing effective stormwater management.

Creating a more resilient city requires big thinking and big projects but also thousands upon thousands of small and localized fixes. Every raindrop that can be captured and diverted is important.

Build Stormwater Dashboard

DEP is building a publicly accessible web-based Stormwater Dashboard to help New Yorkers understand flooding risks and what work is being done to address them. The dashboard will have interactive maps to highlight stormwater-related projects to provide information on costs, schedule and expected performance. The dashboard will highlight areas vulnerable to flooding under a range of storm events and show declines in risk as projects come online. This will be a valuable tool to help New Yorkers understand the progress the City is making as well as what they need to do to protect themselves.

Initiate Stormwater Master Plan

DEP plans to issue a Request for Proposals (RFP) to select internationally recognized experts to collaborate on the master plan, specifically to:

- Define a citywide standard for level of service
- Develop stormwater management plans for remaining Priority Areas
- Develop stormwater management design standards for the public realm
- Develop an approach to integrate traditional and nature-based stormwater management tools to deliver faster and cheaper results
- Enhance the hydraulic model and build out "smart sewer" network

Ramp Up Stormwater Design and Construction Program

DEP will ramp up the stormwater design and construction production rate from approximately $500 million a year to more than $1 billion a year. Additionally, over the next year, DEP will work to hire additional planning engineers to develop solutions for the Priority Areas. Just as important, DEP will work with City agency partners to expand their project delivery capacity.

Rainproof NYC

The Adams Administration launched a public-private partnership called "Rainproof NYC" to develop innovative solutions for increased heavy rainfall and collaborate with communities on housing mobility. This partnership brings together City agencies, non-profits and thought leaders, including Rebuild by Design, One Architecture, the Mayor's Office of Climate and Environmental Justice, the Mayor's Office of Housing Recovery Operations and DEP, to develop innovative policies and creative solutions to our changing climate. Rainproof NYC and DEP will work in parallel to advance stormwater solutions.

Collaboration with MTA

In addition to the siphon cleaning program, DEP will continue to collaborate with the MTA to develop solutions for approximately 20 locations in the system that experience severe flooding. As DEP continues with this work, the City must consider how to prioritize investments that primarily protect private property versus transit or other infrastructure.

Finalize Water Rate Study

DEP will finalize a study that evaluates rate structures to more equitably distribute the cost of investments in stormwater management to protect New Yorkers.

Flood Monitoring

To provide real-time and localized information about flooding, DEP will complete installation of the network of 500 flood sensors and deploy hundreds of new smart sewer sensors. DEP will also deploy additional rain gauges at facilities citywide.

Catch Basins

DEP will upgrade 1,500 flood-prone catch basin covers to provide better drainage during heavy rain events and reduce need for manual cleaning.

Cloudburst Management Program

DEP has submitted federal grant funding through FEMA's Building Resilient Infrastructure and Communities program for cloudburst management projects in East Elmhurst and Central Harlem.

Pumping Station Upgrades

Pumping stations transport stormwater and sanitary waste to wastewater treatment plants when gravity cannot naturally carry it. DEP will upgrade four pumping stations in the Bronx, Queens and Manhattan to ensure reliability and redundancy during a storm event to minimize sewer back-ups.

Tide Gates

DEP will install tide gates to prevent sea water from flowing back through sewers and flooding streets in coastal areas, primarily focused on the Rockaways and Staten Island.

Climate Budgeting

DEP will participate in the City's climate budgeting initiative, which is a process that incorporates science-based climate and sustainability considerations into the City's budget decision-making process by evaluating how actions and spending today contribute to meeting longer-term climate targets. The climate budgeting process is expected to focus on both achieving net-zero emissions and bolstering resilience, including against intense rain events.

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