

# Bridging the Gap Between Private Property & Public Resilience

Creating a Stormwater Resilient New York City

# Executive Summary

# Bridging the Gap Between Private Property and Public Resilience

**New York City is experiencing increasingly frequent and severe stormwater flooding driven by climate change, aging sewer infrastructure, and extensive impervious surface coverage.** Short, intense rain events routinely overwhelm the combined sewer system, triggering Combined Sewer Overflows, street flooding, and sewer backups into homes—sometimes during storms producing as little as 0.3 inches of rainfall per hour. These potentially fatal impacts fall disproportionately on low-lying neighborhoods, communities built on historic wetlands, and residents of basement apartments.

The City has invested in large-scale gray infrastructure, including the \$1.3 billion Gowanus Canal retention tanks. While necessary, these systems address stormwater only after it enters the sewer network and do not reduce runoff at its source. Approximately one-third of New York City's impervious surface area—primarily rooftops—is located on private property, placing a critical component of stormwater management outside the City's direct control.

**Field Form** is a New York City based landscape studio with a focus on distributed stormwater management. Their expertise comes from over a decade of installing, servicing and managing gardens and drainage systems throughout New York City. Their approach combines lot-level flood exposure mapping, infiltration suitability analysis, and designing stormwater runoff diversion systems. These systems intercept the majority of runoff in typical storm events at a fraction of the cost of large-scale gray infrastructure.

## Implementation as the Missing Link

Field Form's experience demonstrates that technical solutions alone are insufficient. Adoption is constrained by limited organizational capacity, complex policy environments, and funding gaps. To address these barriers, Field Form provides implementation support through their mapping and strategy resource—Flood Form—focused on community capacity building, policy navigation, funding access, and insurance alignment—enabling coordinated, neighborhood-scale action.

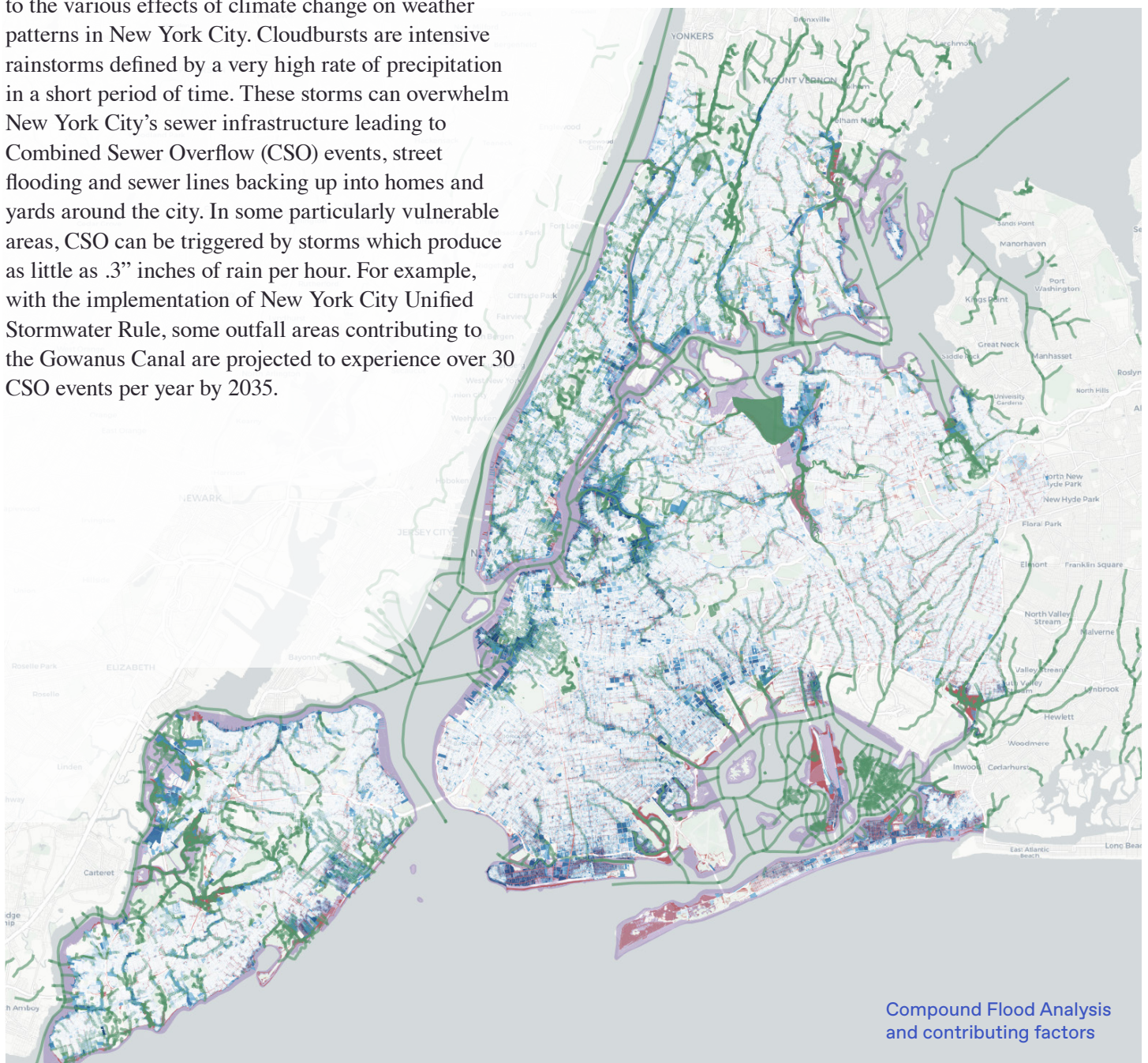
## Policy Implications and Collective Action

Translating this approach into measurable impact begins with piloting Stormwater Resilient Districts in high-impact sewersheds, using the Flood Form tool to identify priority blocks, organize property owners, and set clear runoff reduction targets. These efforts should be supported by a Stormwater Diversion Subsidy Program that ties public investment directly to gallons of stormwater diverted on private property, while streamlining access to existing funding mechanisms. At the same time, expanding standardized, neighborhood-level GIS reporting will equip community organizations, elected officials, and agencies with actionable data to guide investment, coordinate interventions, and advocate for resources.

To sustain and scale these efforts, the City must establish a dedicated stormwater implementation entity to coordinate across agencies, manage funding programs, and provide technical assistance to communities. By aligning public capital with neighborhood-based organizing and equipping residents with the tools and resources needed to act collectively, New York City will unlock the stormwater management potential of private property. This integrated model—combining physical infrastructure, data-driven planning, and social capacity—offers a practical pathway to reducing flood risk, meeting regulatory obligations, and advancing a more equitable and resilient urban future.

# Identifying the Gap

New York City is plagued by storm water flooding. It impacts infrastructure, homeowners, businesses, the broader city economy, and the entire watershed. The rainfall events most likely to create flooding conditions—cloudburst storms—are expected to become increasingly frequent in the coming years due to the various effects of climate change on weather patterns in New York City. Cloudbursts are intensive rainstorms defined by a very high rate of precipitation in a short period of time. These storms can overwhelm New York City’s sewer infrastructure leading to Combined Sewer Overflow (CSO) events, street flooding and sewer lines backing up into homes and yards around the city. In some particularly vulnerable areas, CSO can be triggered by storms which produce as little as .3” inches of rain per hour. For example, with the implementation of New York City Unified Stormwater Rule, some outfall areas contributing to the Gowanus Canal are projected to experience over 30 CSO events per year by 2035.





The impacts of storm water flooding are not evenly distributed around the city, or amongst demographics. Low-lying and coastal homes, blocks and neighborhoods bear a high proportion of the risk related to stormwater, and among these areas, low income, non-white and disabled residents are disproportionately represented. These risks are both chronic and acute. This was made painfully clear when New York City was hit by the remnants of Hurricane Ida in September 2021 and the city's stormwater infrastructure was overwhelmed by the intensity of the rainfall, eventually responsible for the deaths of 14 people, many of whom were occupying basement apartments.

The estimated costs of this storm alone in NYC were as high as \$9 billion. In addition to the costs to life, safety and well-being, the impacts of flood events create lasting social and emotional compound impacts that cannot be recouped solely through financial compensation.

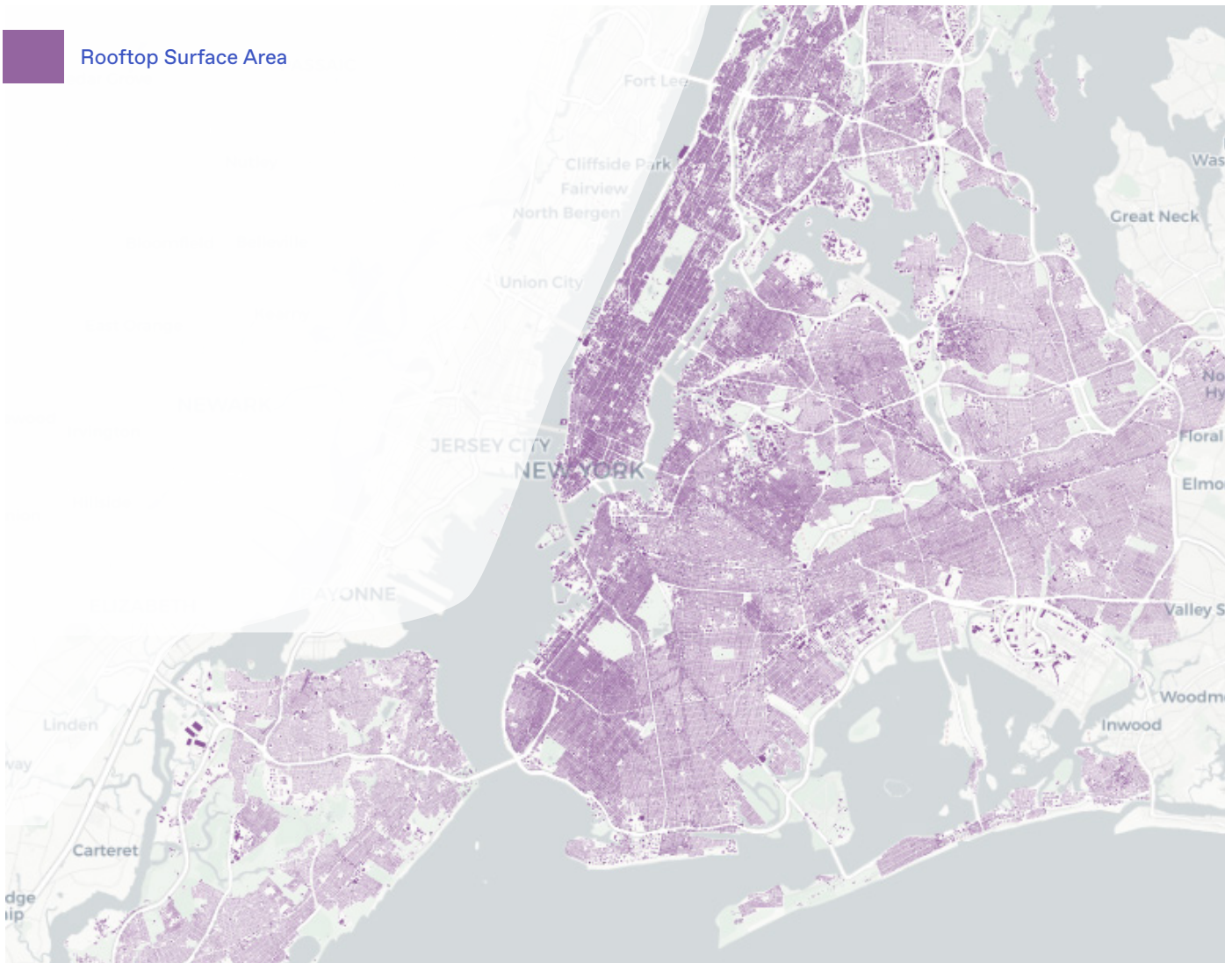
The impact of climate change on rainfall is a complicated, ongoing scientific problem. While theory is able to link increasing temperatures with more water vapor globally, specific impacts and change in risk to rainfall are best characterized in a regional manner. There are a few generalizations that can be made which apply to the Northeastern US, including NYC. One is that it is already a wet place that is predicted to get wetter. Another is that in the future, the variability in intensity for the most extreme storms is more uncertain and may be much higher than more 'regular' rainfall events. We may also see less frequent but more intense extreme rainfall events. There are many open scientific questions about how exactly rainfall will evolve globally and within NYC as a result of climate change, and so predictions and estimates of building standards will likely evolve over time. The uncertainty embedded in these projections suggest that adopting the widest range of mitigation strategies possible will be key to a resilient future.

The residents of the Gowanus Houses NYCHA complex are familiar with the full range of threats posed by this underperforming sewer system. Due to their location on filled wetland, residents of the Gowanus Houses are continually exposed to CSO driven pollution in the Canal and plagued by equipment failures and interior mold and moisture related to flood events during intense storms.

A primary driver of storm water flooding and CSO events is the city's substantial coverage of impermeable surfaces funneling storm water directly into the sewer system. Beyond the paved streets and concrete sidewalks managed by NYC Department of Transportation, rooftops comprise approximately 22% of the land cover in NYC, representing the largest single contributor to impervious surfaces in the city. While the city in recent years has outlawed the connection of private downspouts to public sewer or stormwater infrastructure, inadequate enforcement and minimal compliance has forced the city to pursue expensive grey infrastructure downstream.

In the outfall areas surrounding the Gowanus Canal, NYC Department of Environmental Protection (DEP) and the Federal EPA are attempting to address this issue on property they control at great cost. The city is spending \$1.3 billion dollars to build detention tanks at two points along the Canal. These tanks will have a combined capacity of 12 million gallons, and are intended to store untreated stormwater that would otherwise overflow to the Canal during CSO events so that it can be released after the immediate storm event to the appropriate water treatment facilities. To comply with the federal EPA and state DEC, NYC DEP is obligated to reduce their overflow volume by 41 million gallons compared to 2008 by 2030.





While such downstream infrastructure must be part of the city's toolbox for addressing stormwater flooding, it cannot fully address the issues related to stormwater flooding alone. (1) Downstream tanks do not reduce the quantity of water entering the city sewer infrastructure. Properties that experience sewer backup and overflowing storm drains will not experience reductions in these events because they stem from overtaxed conveyance infrastructure, rather than downstream pooling. (2) Such tanks do not address the unintended consequences of compliance with city laws to disconnect downspouts, as more private properties comply with this law and release their stormwater onto surfaces in their yards or onto public ROW, surface flooding could be exacerbated by these new unmanaged flows. (3) The siting, design, and construction of large scale gray infrastructure in New York City requires significant capital outlay and time to bring new systems online. These high costs and delays throttle the overall capacity of the systems the city can pursue, and reduce available funds for more efficient systems.

The Gowanus tanks represent just one of the city's many approaches to dealing with flooding risks. Agencies like NYC DEP and NYCCEM and executive teams like the former Mayor's Office of Climate & Environmental Justice (MOCEJ) have applied a range of strategies seeking to identify and address the variety of flood exposure risks that New Yorkers face. Research such as DEP's Citywide Parcel Based Impervious Area Study and the Flood Vulnerability Index map provide valuable reference material for understanding where specific risk factors are concentrated throughout the city. Direct interventions like the Unified Stormwater Rule, Cloudburst Hubs and increased enforcement of downspout rules seek to address flooding risks slightly further upstream by diverting rainwater into detention tanks and street runoff into bioswales and designated subsurface storage. Such interventions, if widely adopted, show promise for reducing the strain on the city's sewer infrastructure, however, they have failed so far to fully address the single largest contributor to stormwater runoff in the city - privately owned rooftops of existing buildings.



# Bridging the Gap

New York City will not be able to adequately address storm-water flooding and overflow issues without diverting a significant percentage of runoff from private hardscape into designated retention and infiltration areas. To achieve this, the gaps between government support, private interventions and public impact must be bridged. As evidenced by the range of approaches taken by city agencies, it is critical to accurately understand where flood risk is distributed geographically and to have flexible solutions which can be rapidly implemented at scale across distributed private properties.





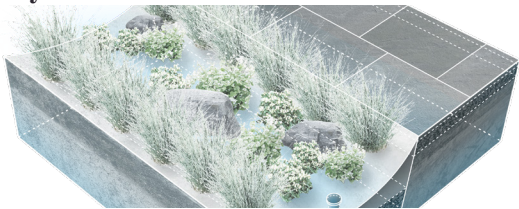


**In response to these needs Field Form is pursuing four primary layers of approach:**

**Data and Mapping**



**Repeatable Systems**



**Outreach**



**Implementation Support**



There is growing recognition of the need for a more comprehensive tool for understanding compound flood exposure both for addressing acute flooding risks and for determining the highest priority areas to locate mitigation infrastructure. This need has been reinforced for the Field Form team after years of working in areas in which community members were consistently sharing stories of flooding despite being unrepresented on existing flood risk assessments. Field Form conducted a review of the many existing mapping assets available in the city and determined that while many shared critical information about individual factors contributing to flooding, none provided a composite understanding of the wide range of elements which contribute to the potential for a given property to experience flooding. The full literature review is available in Appendix A.

NYC DEP recognizes four different types of flooding that the city must contend with: Street, Coastal, Groundwater and Sewer Backup. Each type of flooding has a range of data available which can be used to define a property’s exposure level to that type. Examples of data types associated with each factor are provided below.

The flood mapping and tracking tools surveyed variously utilize the datasets listed in isolation or with limited comparison.

**Street Flooding**

NYC DEP Stormwater Flooding Maps, 311 Street Flooding reports, Elevation, Impervious Surface Coverage, NFIP Claims, FloodNet Sensors

**Coastal Flooding**

FEMA Flooding Maps, Historic Storm Inundation Maps, NOAA Sea Level Rise Predictions, Elevation, NFIP Claims

**Groundwater Flooding**

Historical stream and pond maps, 311 Basement Flooding reports, USGS Groundwater Depth Rasters, DOB Soil and Geotechnical Reports

**Sewer Backup**

Historical stream and pond maps, 311 Basement Flooding reports, USGS Groundwater Depth Rasters, DOB Soil and Geotechnical Reports

To address these gaps, Field Form has developed the **Flood Form mapping tool**. This tool leverages the wide range of data available for all four of DEP’s flood types and generates aggregated exposure levels for each flooding type for every tax lot in the city. Users can query the tool and receive a Flood Form customized to the specific conditions found on the property in question along with recommendations and resources related to addressing their specific exposure types.

**The tool serves two primary purposes:**

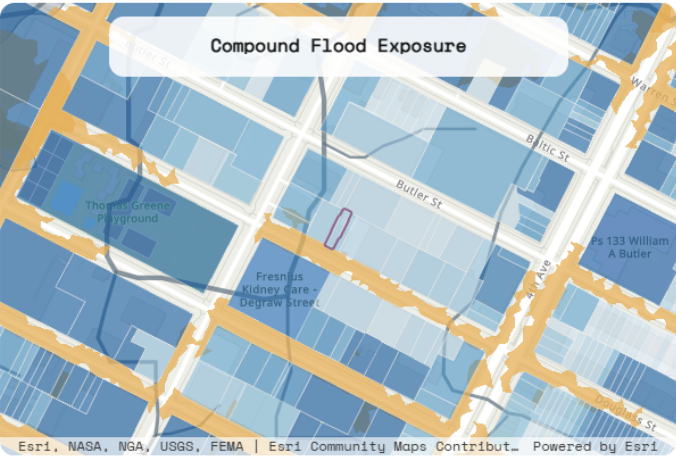
- (1) Allowing Field Form to quickly analyze the types of flooding that their clients may be dealing with and identify areas of the city that might benefit most from interventions.
- (2) As a publicly available resource, concerned residents, elected officials, advocates and other practitioners can use the tool to better understand the range of flood exposure that properties and whole areas might implement.

### 301 DOUGLASS STREET FLOOD FORM



**PROPERTY SUMMARY**  
This property falls into the 50% percentile of Compound Flood Exposure. This is a high index. This means that the combined exposure levels to the flood types described below are above average compared to other lots in NYC. Stormwater Flooding represents the highest exposure factor for this property. This property has relatively low potential for infiltration strategies, likely due to high groundwater, limited space for installation, or poor soil conditions. Alternatives such as detention tanks, retaining walls, and plumbing amendments are likely appropriate

|                     |                        |
|---------------------|------------------------|
| PROPERTY TYPE       | Commercial, Built 1960 |
| BUILDING FOOTPRINT  | 1,000 SF               |
| ROOF RUNOFF 1" RAIN | 624 Gallons            |
| ELEVATION           | 21'                    |
| GROUNDWATER DEPTH   | 11'                    |



Beyond the public-facing interface, the dataset assembled and processed by Field Form provides valuable opportunities for custom queries such as understanding where different types of flood exposure are prevalent, identifying high exposure areas within political boundaries (i.e. what is the exposure level of CB10 compared to the city averages) or calculating city-wide exposure levels.

proximity to known flooding complaints, sewer backup incidents, and areas of recurrent stormwater accumulation. This layer allows for a nuanced assessment of where infiltration-based practices—such as drywells, infiltration columns, and increasing permeable surface area—are technically viable and where they may pose risks or yield limited benefit.

To support more targeted and technically appropriate stormwater interventions, the Flood Form tool also uses an Infiltration Suitability Layer that evaluates the feasibility and performance potential of infiltration-based stormwater infrastructure on a lot-by-lot basis. The layer integrates building physical characteristics (including footprint, age, foundation type, and basement presence) with subsurface conditions such as soil permeability, groundwater depth, and bedrock elevation. These factors are analyzed alongside

Each tax lot in New York City is assigned a composite Infiltration Potential Score, reflecting both physical feasibility and flood mitigation potential. Lots with permeable soils, sufficient separation from groundwater and bedrock, and adequate open area receive higher scores, while parcels with shallow groundwater, impermeable soils, or high basement flood risk are flagged for alternative strategies such as detention, controlled discharge, or non-infiltrating diversion.





The Infiltration Suitability Layer functions as a decision-support and prioritization tool. It enables rapid identification of high-opportunity clusters where infiltration can be safely and effectively deployed at scale, informs outreach and funding strategies by aligning technical feasibility with areas of documented flood harm, and provides a transparent, data-driven basis for public investment on private property. When paired with Field Form’s compound exposure mapping and implementation support services,

this layer helps translate complex subsurface conditions into actionable guidance—ensuring that infiltration-based stormwater infrastructure is deployed where it delivers the greatest resilience benefit with the lowest risk.

### **Outreach**

Social infrastructure is required to gain enough support from individual property owners to install as many diversions as possible. While residents of New York City are increasingly aware of the threat posed by flooding,



The typical system can hold approximately 600 gallons of water, with an additional 50-60 gallons per hour of capacity from infiltration. Once the system has reached capacity, any additional runoff overflows to the sewer system, but at a drastically reduced rate. The median residential rooftop in NYC is approximately 800 SF, generating 500 gallons of runoff per 1" storm. This means these systems can prevent the majority of runoff from a standard roof from entering the sewer system in 99% of storms. In the case of a storm the size of Ida, this can have a drastic impact on reducing sewer backup, stormwater overflow on the streets, and deadly basement flooding.

These systems can be installed in less than a week at a landed cost of approximately \$15,000 per installation, or approximately \$27 / static gallon of capacity. The cost per gallon of static capacity for the Gowanus Retention Tanks is over \$108 while expanding sewer lines to increase capacity can cost as much as \$130 million per mile.

Starting with this system as a foundation, drainage solutions for a wide range of site conditions can be rapidly iterated and decided through a basic decision matrix comparing flooding symptoms, onsite conditions, and their associated strategies.

While the Field Form team periodically encounters on site conditions beyond those described in the matrix, this approach has been found to efficiently point to appropriate drainage strategies for a high proportion of site conditions encountered.





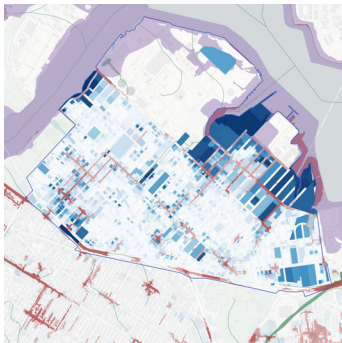
many—especially those away from the coast—do not believe they are at risk. Unfortunately water does not flow along property lines, and blockages, overflows and flooding upsewer can have negative impacts on properties that don't have issues on their immediate lot.

Field Form has addressed this issue by collaborating with block associations, neighborhood groups, advocacy organizations, local elected leaders and community liaisons to help educate residents about the responsibility and

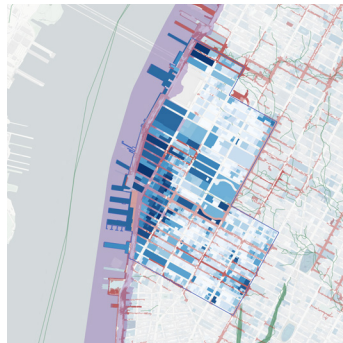
vulnerability that neighbors throughout New York City share. In this effort, the Flood Form tool has also proven invaluable in showing residents how different types of flooding can impact a wide range of neighborhoods and properties, helping to illustrate the need for collective action.

In the Combined Sewer Overflow outfall area Owls Head-007—serving much of Park Slope, Brooklyn—the tool has been used to translate abstract CSO and runoff metrics into block-level exposure profiles that residents

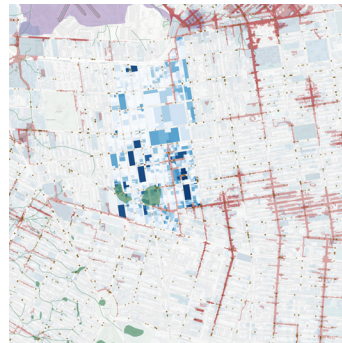
Astoria



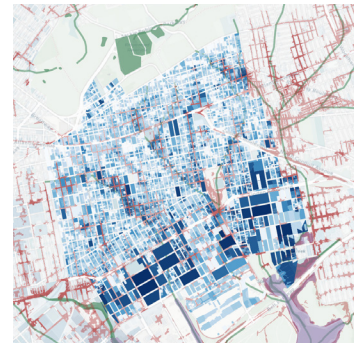
Chelsea



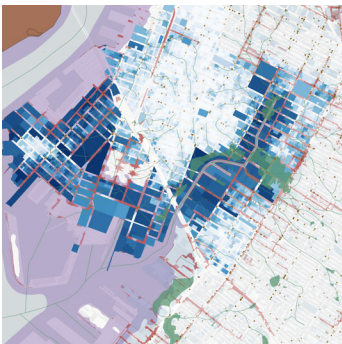
Clinton Hill



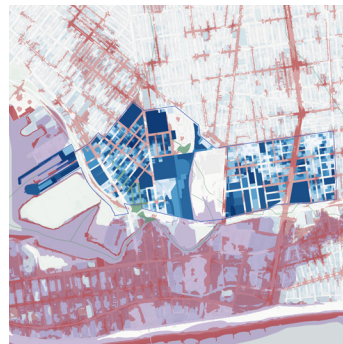
Cypress Hills



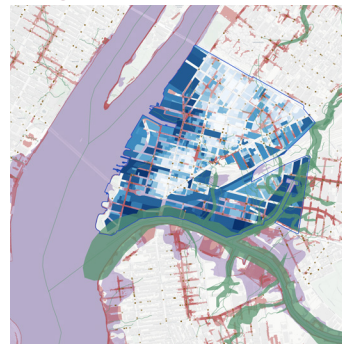
Gowanus



Gravesend



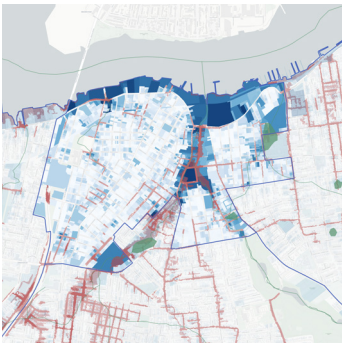
Long Island City



Park Slope



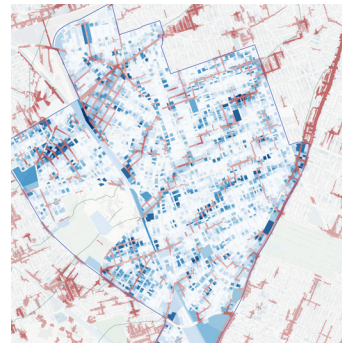
Port Richmond



Prospect Heights



St Albans



Selection of neighborhoods which have been analyzed using the Flood Form Tool in collaboration with property owners, advocacy groups and elected officials

can understand and act upon. By mapping rooftops, sewer drainage patterns, 311 flooding complaints, and macro contributing areas, the tool identifies clusters of properties that collectively contribute significant runoff to the OH-007 sewershed. In neighborhood workshops, this analysis allows neighbors to see how upstream roof downspouts, downstream low points, and known nuisance flooding locations are hydrologically connected. Rather than framing flooding as an isolated household issue, the Flood Form tool demonstrates shared system dynamics and highlights where coordinated downspout diversions could meaningfully reduce peak flows entering the outfall.

The tool has also been used to simulate the cumulative impact of group adoption scenarios within OH-007. For example, by modeling the effect of diverting runoff from a defined percentage of rooftops along a given block or corridor, Field Form can illustrate potential reductions in stormwater volume entering the combined sewer during a design storm. These visualizations provide community groups and elected officials with concrete, evidence-based targets—such as the number of rooftops required to divert a specified number of gallons during a one-inch rain event. This type of scenario planning empowers residents to organize around achievable goals and positions neighborhood associations to pursue coordinated funding applications or policy advocacy grounded in data.

The map has been used in service of a wide range of educational and analytical exercises for elected officials and community groups alike. These activities are critical for building the collective action necessary to have a notable impact on the flooding outcomes in a given area. Field Form has shown that by promoting group adoption of these drainage strategies, the per-lot costs can be reduced and installations can be batched to reduce installation times

and disruption to the neighborhood. To date, the Flood Form Tool has been used to generate exposure reports and strategy recommendations for a range of communities and districts around the city, listed below.

- Assembly District 44
- Assembly District 56
- City Block 1087
- City Block 1094
- Council District 39
- Cypress Hills Local Development Corporation
- Fifth Avenue Committee
- Gowanus Canal outfall sewershed
- Long Island City Business Improvement District
- Octagon Neighborhood Association
- Southeast Queens Residents Environmental Justice Coalition
- Whitestone Neighborhood
- Jewel Street Planning Area

These reports provide visual and numeric data sharing the aggregated exposure levels of all lots in the study area broken out into each type of flooding, compares them to city wide averages, and identifies high priority areas by flooding type. Where needed, closer analysis is conducted at the block and lot level which is often necessary due to the hyper-local nature of storm, street and groundwater flooding. Such reports provide community members with accurate, focused information that can help them understand how they might address flooding issues directly, as well as providing clear communication tools they can use to advocate for further support.



## Implementation Support

As Field Form has grappled with the challenges faced by New Yorkers related to flooding, it has become clear that some of the most persistent and widespread issues faced by individual homeowners and neighborhood organizations alike are related to the infrastructure of implementation. Barriers such as murky organizational structures, lagging and unclear policy, insufficient funding, and opaque insurance arrangements all contribute to slow implementation of necessary flood mitigation strategies. Field Form supports implementation efforts in the following areas:

- Organizational capacity building
- Policy navigation
- Funding access
- Insurance alignment

This support is structured to complement, rather than replace, public agency responsibilities, while addressing gaps that prevent private-property interventions from contributing meaningfully to citywide resilience goals.

### *Capacity Building*

Flood mitigation at the neighborhood scale requires a level of coordination and sustained engagement that many informal or volunteer-led organizations are not structured to provide. Block associations, tenant groups, and neighborhood coalitions often emerge organically in response to shared flooding experiences, but they frequently lack the administrative capacity, technical knowledge, and continuity needed to plan and execute multi-property interventions. Critically, many funding paths are only available to formally organized groups, a large barrier to entry for many property owners.

Field Form supports these groups by providing technical assistance that strengthens internal capacity rather than substituting for it. This includes helping organizations formalize governance structures, clarify decision-making processes, and develop shared project scopes that reflect collective priorities. Field Form also assists with translating technical flood data and engineering concepts

into accessible language, enabling community leaders to confidently communicate risks, solutions, and tradeoffs to their members.

By building organizational capacity, Field Form enables neighborhood groups to move beyond isolated, reactive projects toward coordinated, scalable interventions. This approach increases participation, reduces per-property costs through economies of scale, and positions community organizations to engage more effectively with public agencies, funders, and elected officials over time.

### *Policy Advocacy and Navigation*

Policy complexity and ambiguity represent a significant barrier to flood mitigation, particularly on private property. Regulations governing stormwater, wastewater, building codes, zoning, and environmental review are distributed across multiple agencies and levels of government, often with overlapping or unclear jurisdiction. For homeowners and organizations seeking to install green stormwater management practices, understanding the mix of applicable policies and incentives in New York City and New York State is critical to improving implementation outlooks.

Field Form provides targeted policy guidance to help communities understand and leverage existing regulatory frameworks and incentive programs that surround green stormwater management. A key example is the NYC Unified Stormwater Rule (USWR).

The USWR requires significant redevelopment projects to implement on-site stormwater capture and reuse measures to reduce runoff volumes. While the rule applies primarily to larger developments, its provisions and guidance materials establish standards (e.g., stormwater capture volumes per impervious area) that homeowners and small organizations can reference when designing voluntary green infrastructure practices. It is also triggered any time a new sewer connection is filed, subjecting smaller properties and projects to similar levels of scrutiny as large development projects.

Homeowners and environmental groups often require assistance to interpret these frameworks, determine which policies apply to their projects, and align their proposals with regulatory expectations and funding opportunities. Where policies are misaligned or create unnecessary obstacles—for example, permitting thresholds that treat small infiltration systems as complex construction projects—Field Form supports advocacy for targeted policy adjustments and helps define compliant pathways that do not add dramatic cost increases.

Field Form synthesizes flood risk and implementation data from the Flood Form mapping tool to generate policy-relevant insights. By aggregating this data at neighborhood and political boundaries, Field Form helps articulate where existing regulations fall short and where tailored policy support—such as expanding grant eligibility to smaller residential systems or creating streamlined permitting for backyard stormwater practices—could unlock significant public benefit.

#### *Funding Access and Financial Structuring*

While distributed stormwater mitigation on private property offers strong public return on investment, access to appropriate funding remains a central barrier to implementation. Field Form focuses its financial support work on high impact funding strategies that are both active and well aligned with neighborhood-scale stormwater interventions in New York City, helping communities match project types to the most effective capital sources.

Adoption of programs like the Resilient Retrofit Grants from NYS DEC are often stifled by difficulties informing property owners of the fund availability and the opacity of eligibility and requirements tied to such funds.

#### *Insurance*

Insurance plays a critical role in shaping how property owners perceive and respond to flood risk, yet conventional insurance products are poorly aligned with the realities of urban stormwater flooding. Standard homeowners insurance typically excludes flood damage, National Flood Insurance Program (NFIP) policies are oriented toward coastal and

riverine flooding rather than sewer backup and groundwater intrusion, and mitigation investments are rarely reflected in premiums or coverage terms. This disconnect weakens incentives for proactive risk reduction and leaves many property owners vulnerable.

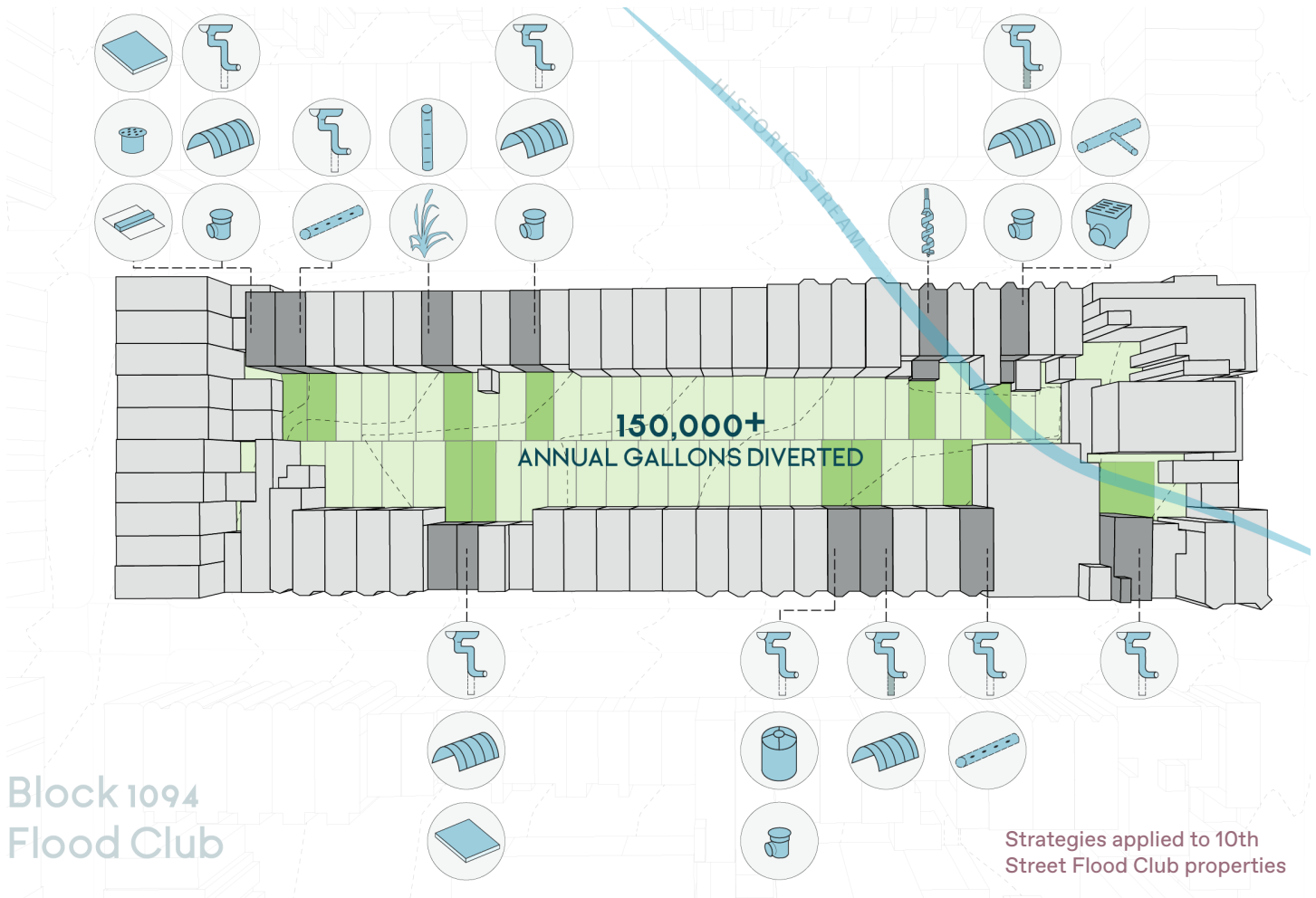
In response, Field Form assists communities in understanding and evaluating emerging flood insurance options that are better suited to urban stormwater conditions. Products such as FloodFlash and Neptune Flood’s parametric offerings provide coverage based on measurable flood triggers—such as rainfall intensity, surface water depth, or sewer surcharge thresholds—rather than on post-event damage assessments. When a predefined trigger is met, payouts are issued automatically, often within days, providing rapid liquidity for cleanup, temporary relocation, or emergency repairs. This structure is particularly relevant for basement flooding and flash flood events that may not qualify for traditional flood insurance claims.

At the neighborhood scale, Field Form explores the potential for group or cooperative insurance models, where multiple property owners participate in shared parametric coverage tied to local rainfall or flood sensors. When paired with on-site stormwater diversion and detention, these products offer a pathway toward aligning risk reduction, financial resilience, and rapid recovery—ensuring that proactive communities are better protected while longer-term infrastructure solutions are deployed.



Example of Flood Flash insurance installation





### 10th Street Flood Club Case Study

The 10th Street (city tax block 1087) Flood Club provides an example of the efficacy and challenges of pursuing broad distribution of backyard interventions. More than half of the residents on the block were experiencing some form of flooding during heavy rain storms, and this shared issue surfaced in conversations between homeowners.

Following an inquiry by the 10th Street Block Association Field Form was invited to present a basic overview of the historic and current conditions which might be contributing to flooding on their block. Because of the shared experiences of residents with flooding, the presentation of considerations that extended beyond property lines was well received and understood. Twelve participants in the introductory meeting indicated their interest in pursuing

onsite drainage strategies further, whether to address flooding in their own home, or out of a broader concern for their neighborhood.

Field Form conducted site visits for each property in two batches, and worked with the interested property owners to offer reduced rates for visits due to the large number of them in close proximity. For each property the following data points were collected, in addition to the unique concerns and issues shared by owners.

- Roof and lot square footage
- Surface conditions and permeability
- Downspout and other existing drainage infrastructure
- Soil conditions and infiltration rate



Drywells being installed at one of the 10th Street properties

Following the completion of these site visits, a generic design agreement was drafted offering three levels of design services along with price estimates for design and construction for review by all members of the block association. Group discounts were again offered as a means to lower barriers to participation for the widest range of owners possible.

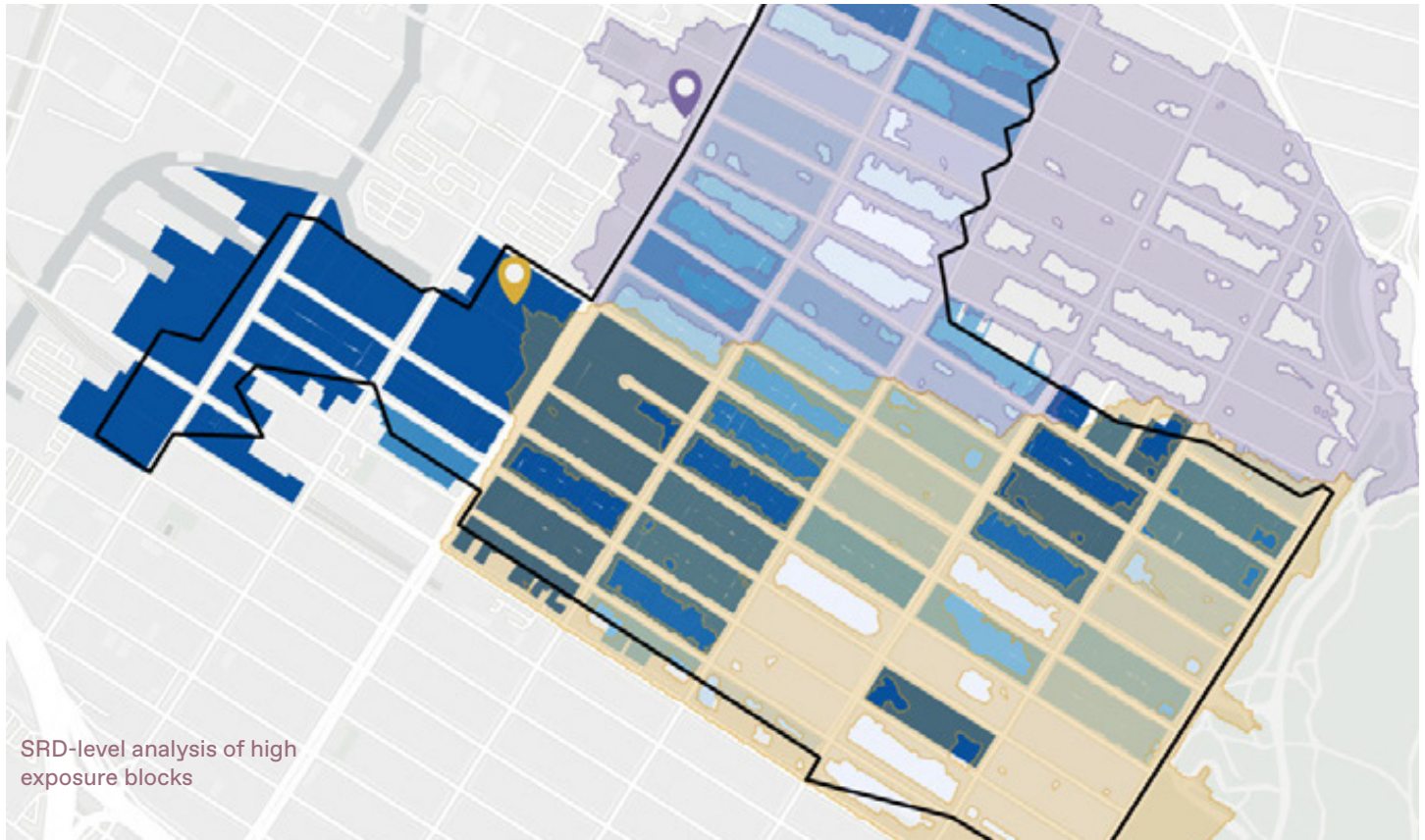
Following significant discussion between Field Form and interested members, six property owners made the decision to proceed with drainage strategies. The reasons for deferring diversion or drainage work for most owners came down to simple cost-benefit perception. While many voiced their understanding of the importance of diverting and managing stormwater on site, the abstract vulnerability to future flooding did not counter the prospect of the outlay

necessary for a basic diversion and detention system. The outreach, operational efficiency and cost savings of grouping projects and good intentions of the block association resulted in six properties on the block selecting significant diversion interventions ranging from simple drywell installations to full regrading and surfacing of backyards in addition to downspout diversions. The specifications of each project are illustrated in the graphic below. The full drainage capacity and component breakdown is available in appendix B. The resulting interventions are capable of diverting 150,000 gallons of runoff from the sewer system each year.



# Introducing the Stormwater Resilient District

## A Field Form Initiative



The Stormwater Resilient District (SRD) model, a Field Form Initiative, proposes building directly on the neighborhood organizing demonstrated through the Flood Club case study by scaling that collaborative approach to the level of the sewer drainage basin.

Organized around the boundaries of a Combined Sewer Overflow outfall catchment, an SRD treats stormwater management as a collective responsibility shared by thousands of properties across multiple blocks. Beginning in June 2026, Field Form will pilot the SRD model in the district encompassing the Owls Head-007 outfall, which serves much of Park Slope and includes over 3,400 properties and nearly 21,000 residents. The Flood Form tool will be leveraged to translate complex runoff and CSO dynamics into clear block-level exposure profiles. These visualizations—incorporating rooftop impervious cover, drainage patterns, flood complaints, and contributing areas—allow residents, community groups, and elected

officials to better understand how individual properties influence neighborhood-wide flood outcomes. By organizing around these shared drainage conditions, a Stormwater Resilient District enables coordinated action across an entire sewershed. Modeling scenarios can demonstrate how diverting runoff from a defined portion of neighborhood rooftops could significantly reduce the volume of stormwater entering the combined sewer during heavy rainfall. This structure allows residents to pursue bundled projects, coordinate installations, and advocate collectively for targeted public investment. In doing so, SRDs create community-based implementation partners capable of accessing public funding programs, attracting new investment, and complementing large-scale infrastructure projects with distributed stormwater solutions and ongoing maintenance structures which strengthen neighborhood resilience.

# Bridging the Gap Between Private Property and Public Resilience

The most frequently cited barrier among residents who recognize the need for downspout diversion and on-site stormwater management is cost. While some homeowners are able to invest in protecting their properties from future flooding, many others cannot—particularly in neighborhoods facing housing cost burdens, insecure tenure, and elevated flood exposure, such as Southeastern Queens. Yet financial barriers are only part of the challenge. Even where funding is available, implementation is often stalled by limited organizational capacity, policy complexity, and uncertainty around long-term maintenance, insurance, and regulatory compliance.

New York City stands at a crossroads in its stormwater management strategy. Despite significant public investment in large-scale, city-owned infrastructure such as the \$1.3 billion Gowanus Canal retention tanks, nearly one-third of the city's impervious surface area remains on private property. Without directly addressing runoff from rooftops, driveways, and patios, the city will be unable to meet its CSO reduction goals or its legal obligations under DEP's Long Term Control Plans in Gowanus and beyond. Developing new ways to efficiently fund and support stormwater management interventions on private property is essential.

Field Form's pilot interventions, mapping tools, and neighborhood case studies demonstrate that distributed, low-cost stormwater diversion systems on private property are technically effective, rapidly deployable, and financially strategic. With costs of approximately \$27–35 per gallon of capacity, these systems deliver a three-to-fourfold cost advantage over large-scale gray infrastructure.

We propose expanding the use of the Flood Form tool as a city-wide platform for organizing and coordinated action using Stormwater Resilient Districts as a medium to pursue such an expansion. By translating complex hydrologic and infrastructure data into clear, lot-level exposure profiles and providing a prioritized list of intervention strategies, the tool enables residents to identify shared risk patterns and recognize where collective intervention would have the

greatest impact. Rather than approaching flood mitigation as an isolated household decision, the mapping framework supports the formation of block to neighborhood sized groups—Stormwater Resilient Districts—that can pursue bundled projects, coordinate stormwater diversion strategies, and advocate for targeted public investment. In this way, the tool functions not only as an analytical resource, but as civic infrastructure—connecting neighbors around shared exposure and shared opportunity.

By merging flood exposure types and their associated strategies, the mapping platform is designed to link communities to actionable resources that close the gap between large-scale financing and policy initiatives and the practical challenges residents face on the ground. By pairing exposure data with guidance on funding eligibility, technical feasibility, maintenance considerations, and relevant public programs, the system helps translate citywide resilience strategies into implementable neighborhood plans. This integrated approach ensures that capital commitments and regulatory reforms are matched with organized, informed communities capable of advancing localized, distributed stormwater solutions that contribute meaningfully to broader public resilience goals.

Flooding is not merely an environmental nuisance—it is a public health crisis, a housing justice issue, and a growing economic liability. It is also a solvable problem if New York City commits to pairing physical infrastructure investments with the social infrastructure required to implement them. By supporting residents with funding, tools, guidance, and institutional backing needed to act, the city can transform private property into a cornerstone of public resilience and establish itself as a national leader in decentralized, equity-driven climate adaptation.



# Critical Implementation Pathways

To translate the strategies outlined in this paper into measurable reductions in stormwater runoff and flood risk, a coordinated set of near-term actions is required. The following steps are intended to advance the integration of private property interventions, community-based organization, and public sector support into an operational framework capable of scaling across New York City.

## **Pilot Priority Stormwater Resilient Districts**

Initiate 2–3 pilot Stormwater Resilient Districts (SRDs) in high-risk Combined Sewer Outfall areas, including Owls Head–007 in Park Slope/Gowanus. These pilots should leverage the Flood Form tool to identify priority blocks, recruit participating property owners, and define neighborhood-scale runoff reduction targets. Building on the Flood Club model, these districts would formalize local organizing structures, coordinate installations across multiple properties, and establish baseline performance metrics to evaluate impact over time.

## **Establish a Stormwater Diversion Subsidy Program**

The New York City Department of Environmental Protection (DEP), in coordination with the Mayor’s Office, should design and administer a dedicated subsidy program to support installation of private property stormwater diversion systems. Modeled on the existing Green Infrastructure Grant Program, funding should be directly tied to gallons of stormwater retention or diversion capacity installed. DEP would establish technical standards, verification process, and integration with Long Term Control Plans, while MOCEJ would ensure alignment with citywide climate adaptation priorities and equity goals. Initial funding allocations should prioritize SRD pilot areas to maximize near-term impact and demonstrate cost-effectiveness relative to gray infrastructure investments.

## **Deploy Flood Form Reporting**

The NYC Department of Environmental Protection (DEP), in partnership with the Department of City Planning (DCP) and Field Form, should formalize and expand the production of sewershed level flood exposure and infiltration reports using the Flood Form tool. SRDs, supported by community-based organizations— groups such as the Fifth Avenue Committee and local development corporations— would serve as implementation partners, using these reports to support neighborhood organizing, inform local planning processes, and guide participation in subsidy programs.

## **Create a Dedicated Stormwater Implementation Entity**

The Mayor’s Office, in coordination with the New York City Council, should establish a dedicated Stormwater Department or interagency Stormwater Implementation Office to coordinate distributed stormwater management efforts. This entity could be modeled on the Berlin Rainwater Agency and headed by the city’s Chief Climate Officer. Establishing such an entity would consolidate responsibilities currently fragmented across DEP, NYC Emergency Management (NYCEM), and many others, and would be charged with administering subsidy programs, coordinating interagency policy, and providing direct technical assistance to property owners and SRDs. The City Council would authorize its formation, define its mandate, and allocate baseline funding through the capital and expense budget. This body would also be responsible for tracking performance metrics, ensuring compliance with regulatory requirements, and prioritizing investments in high-risk and historically underserved communities.

Collectively, these steps establish a clear pathway from analysis to action—linking data, design, funding, and community organization into a cohesive model for reducing stormwater impacts. By investing in both the physical and social infrastructure required to manage runoff at its source, New York City can accelerate progress toward its CSO reduction goals while building a more resilient and equitable urban environment.

# Glossary of Terms

## **ACS – American Community Survey**

An ongoing survey administered by the U.S. Census Bureau that provides annual data on social, economic, housing, and demographic characteristics. ACS data is used in flood exposure analysis to understand population vulnerability and housing conditions.

## **Basement Flooding**

Flooding that occurs in below-grade residential or commercial spaces due to sewer backup, groundwater intrusion, or surface water infiltration. Basement flooding poses elevated life-safety, health, and housing stability risks, particularly in informal or unregulated dwelling units.

## **Bedrock Depth**

The vertical distance from the ground surface to underlying bedrock. Shallow bedrock can limit the feasibility of infiltration-based stormwater management practices by reducing available storage volume and infiltration capacity.

## **Bioswale**

A vegetated, engineered channel designed to convey, store, and infiltrate stormwater runoff. Bioswales are commonly installed in the public right-of-way but may also be used on private property.

## **Cloudburst**

A short-duration, high-intensity rainfall event characterized by extremely high precipitation rates over a limited area. Cloudbursts are a primary driver of urban flash flooding and Combined Sewer Overflow (CSO) events in New York City.

## **Combined Sewer Overflow (CSO)**

The discharge of untreated sewage and stormwater into surface waters when combined sewer systems exceed capacity during rainfall events. CSOs are regulated under federal and state water quality laws.

## **Combined Sewer System**

A sewer system that conveys both sanitary sewage and stormwater runoff in a single pipe. Much of New York City is served by combined sewers, making it particularly vulnerable to CSO events during heavy rain.

## **Compound Flood Exposure**

The cumulative flood risk experienced by a property or area due to the interaction of multiple flooding mechanisms, including street flooding, coastal flooding, groundwater flooding, and sewer backup.

## **DEC – New York State Department of Environmental Conservation**

The state agency responsible for environmental regulation and oversight, including water quality standards, stormwater permits, and compliance with the Clean Water Act.

## **DEP – New York City Department of Environmental Protection**

The city agency responsible for managing New York City's water supply, sewer system, and wastewater treatment facilities, as well as stormwater regulation and green infrastructure programs.

## **Downspout Diversion / Disconnection**

The practice of redirecting roof downspouts away from direct connections to the sewer system and toward on-site detention, infiltration, or controlled discharge areas.

## **Drywell**

A subsurface structure designed to temporarily store stormwater and allow it to infiltrate into surrounding soils. Drywells are a common infiltration-based stormwater management practice.

## **EPA – United States Environmental Protection Agency**

The federal agency responsible for enforcing environmental laws, including the Clean Water Act, and overseeing CSO consent decrees and Long Term Control Plans.

## **Flood Vulnerability Index (FVI)**

A composite index developed by NYC agencies that combines physical flood risk with social and economic vulnerability indicators to identify communities at heightened risk from flooding.

## **GI – Green Infrastructure**

Stormwater management practices that use natural or engineered systems—such as vegetation, soils, and infiltration—to manage runoff and improve water quality.

## **Gray Infrastructure**

Traditional engineered stormwater and wastewater infrastructure, such as pipes, tanks, and pumping stations, designed to convey or store water.

## **Groundwater Flooding**

Flooding caused by rising groundwater levels, often influenced by historic waterways, soil conditions, or tidal forces, which can infiltrate basements and underground spaces.

## **Impervious Surface**

Surfaces such as rooftops, pavement, and concrete that prevent water from infiltrating into the ground, increasing runoff to storm drains and sewers.

## **Infiltration**

The process by which water penetrates the soil and moves into subsurface layers. In stormwater management, infiltration is used to reduce runoff volumes entering sewer systems.

## **Long Term Control Plan (LTCP)**

A federally required planning document outlining how a municipality will reduce CSO frequency and volume over time, typically through a combination of gray and green infrastructure investments.

## **NFIP – National Flood Insurance Program**

A federal insurance program administered by FEMA that provides flood insurance primarily for riverine and coastal flooding risks.



# Glossary of Terms

**Parametric Flood Insurance**

An insurance product that pays out based on predefined, measurable triggers—such as rainfall intensity or flood depth—rather than documented physical damage.

**Permeability**

The ability of soil or surface materials to allow water to pass through. Low permeability soils reduce infiltration capacity and influence stormwater management design.

**Right-of-Way (ROW)**

Publicly owned land used for transportation and utilities, including streets and sidewalks, where some stormwater infrastructure may be installed.

**SBS – New York City Department of Small Business Services**

A city agency that administers programs supporting small businesses, including flood risk assessment and mitigation grants through Business PREP.

**Stormwater Diversion**

The redirection of stormwater away from sewer systems toward on-site storage, infiltration, or controlled discharge locations.

**Unified Stormwater Rule (USWR)**

NYC DEP regulations requiring certain development and sewer connection projects to capture and manage stormwater on-site to reduce runoff volumes.

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# Appendix A

| Tool / Resource                                | Agency / Party        | Updated | FEMA Maps                           | NPCC Tide                           | Stormwater Maps                     | Historic Storm Maps                 | Historic Water Maps                 | 311                                 | ACS Data                            | Proprietary Data                    | NOAA                                |
|------------------------------------------------|-----------------------|---------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|
| <a href="#">Hazard History and Consequence</a> | NYCEM                 | 2023    | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | <input type="checkbox"/>            |
| <a href="#">Flood Zone NYC</a>                 | NA                    |         | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | <input type="checkbox"/>            |
| <a href="#">FloodHelpNY</a>                    | Center for New York C | 2025    | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/>            |
| <a href="#">Coastal Flood Exposure Mapper</a>  | NOAA                  | 2025    | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/>            |
| <a href="#">Sandy Foundation Zone</a>          | NYC S6S               | 2024    | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/>            |
| <a href="#">NYC Flood Hazard Mapper</a>        | NYC DCP               | 2017    | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/>            |
| <a href="#">NYC Stormwater Flood Map</a>       | NYC DEP               | 2024    | <input type="checkbox"/>            | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/>            |
| <a href="#">Flood Vulnerability Index</a>      | MOCEJ                 | 2024    | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/>            |
| <a href="#">First Street</a>                   | First Street          | 2025    | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/>            |
| <a href="#">Mapping Hazard of Hotspots</a>     | NYC Health            | 2025    | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |
| Compound Flood Exposure                        |                       | 2025    | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/>            |

# LONG ISLAND CITY PARTNERSHIP COMPOUND FLOOD EXPOSURE ANALYSIS

## LONG ISLAND CITY PARTNERSHIP STUDY AREA

The Long Island City Partnership study area (LICP), covering a large swath of Long Island City Queens, is comprised of 791 unique tax lots and 20,000 dwelling units and 580 lots with a wide range of commercial uses. **The study area's average Compound Flood Exposure Index is at 12.1 while the average Compound Flood Exposure Index in New York City is 7.8, suggesting a broadly elevated exposure to flood factors.**

### EXPOSURE SUMMARY :

The study area shows above average exposure in every flood exposure type, however groundwater threats from high water table, historic water bodies, and evidence of basement flooding affect 430 lots in the area, approximately 60% of the total. Further, high exposure to Stormwater flooding, Sewer flooding and Coastal result in an above average Compound Exposure. This can be attributed to a its low relative elevation, proximity to the coast, likely inadequate sewer systems, and numerous documented incidents of sewer flooding.

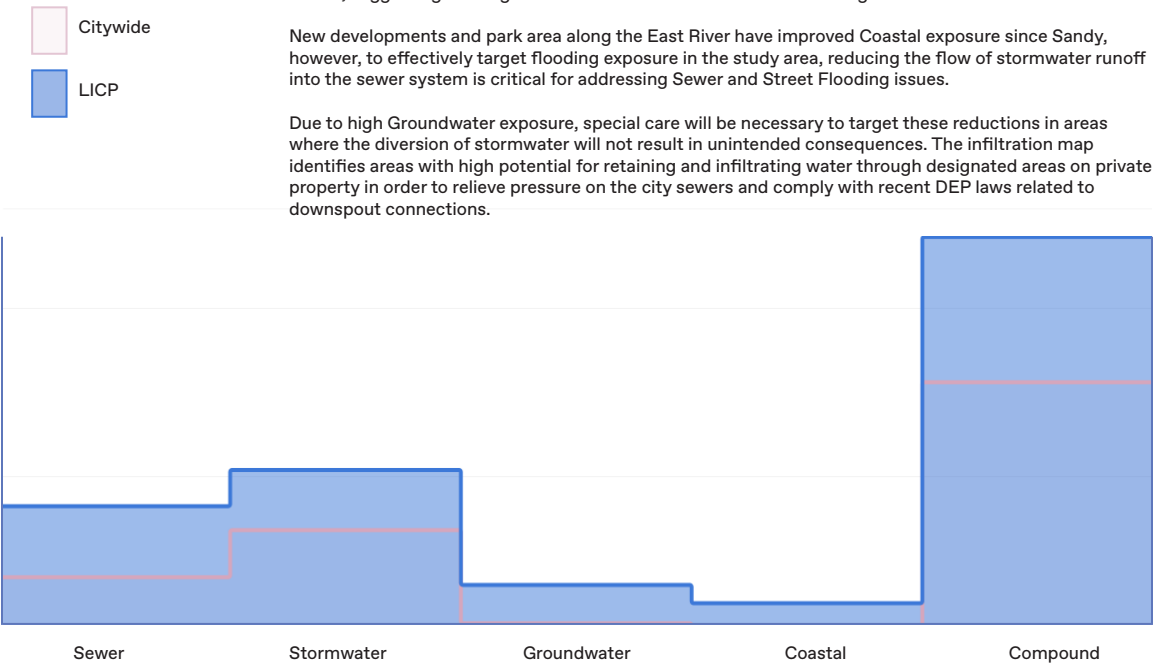
### TAKEAWAYS

The neighborhood's low relative elevation and position in relation to many historic water bodies exacerbates its vulnerability to groundwater and basement flooding events.

Many streets in the study area have experienced significant instances of sewer flooding on their blocks, suggesting blockages or under sized sewer infrastructure along those stretches.

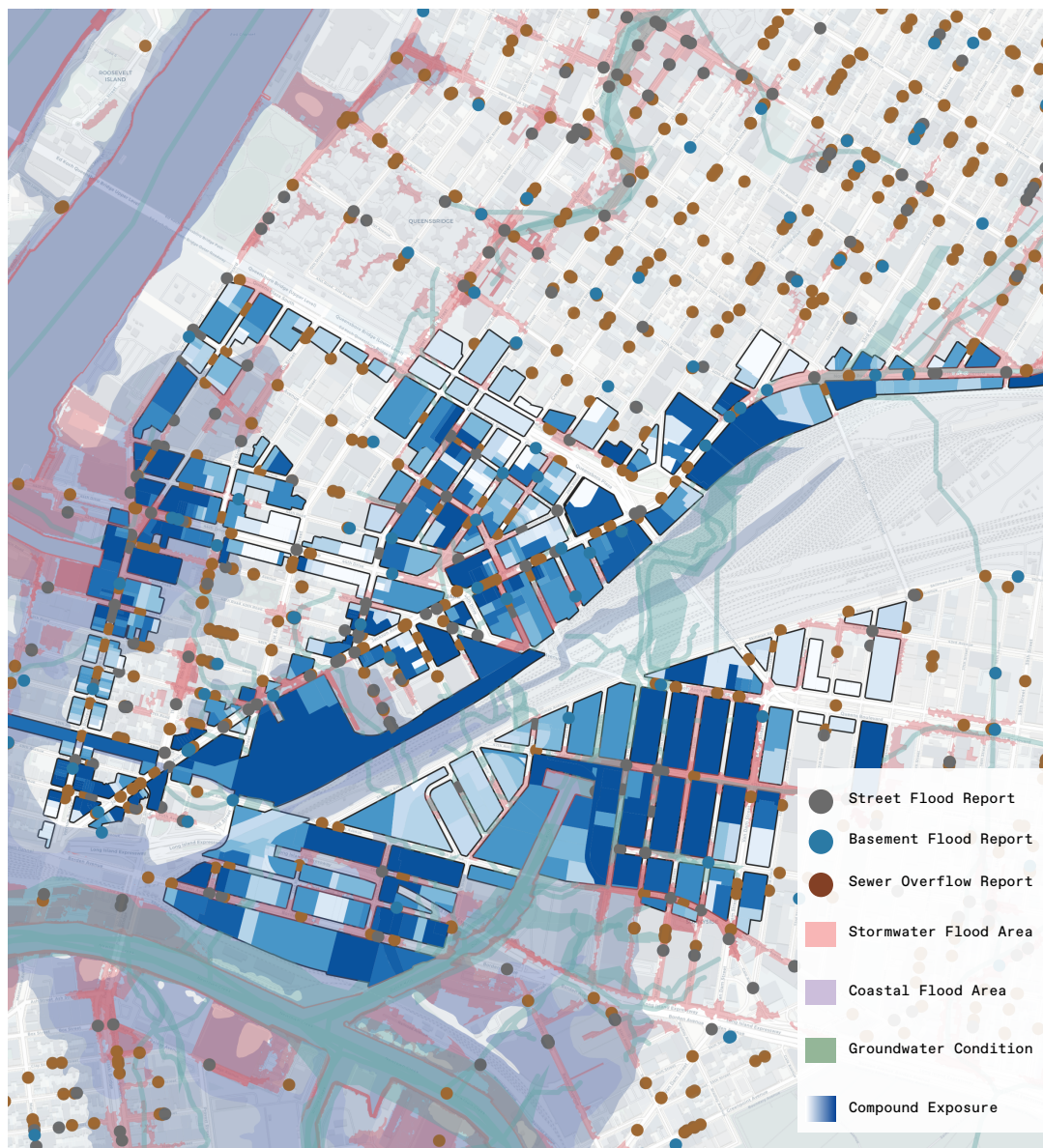
New developments and park area along the East River have improved Coastal exposure since Sandy, however, to effectively target flooding exposure in the study area, reducing the flow of stormwater runoff into the sewer system is critical for addressing Sewer and Street Flooding issues.

Due to high Groundwater exposure, special care will be necessary to target these reductions in areas where the diversion of stormwater will not result in unintended consequences. The infiltration map identifies areas with high potential for retaining and infiltrating water through designated areas on private property in order to relieve pressure on the city sewers and comply with recent DEP laws related to downspout connections.



# Appendix B

## COMPOUND EXPOSURE SUMMARY



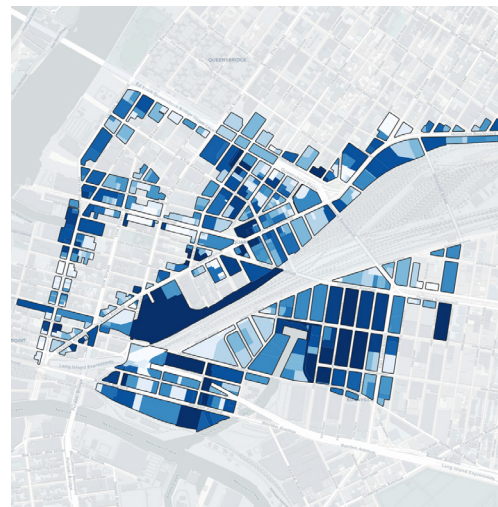
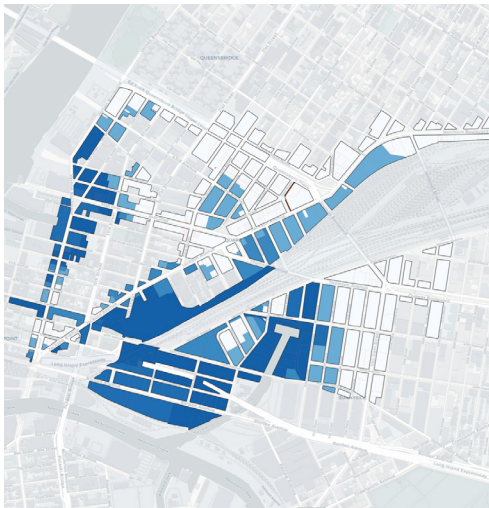


# Appendix B

## EXPOSURE BY FACTOR

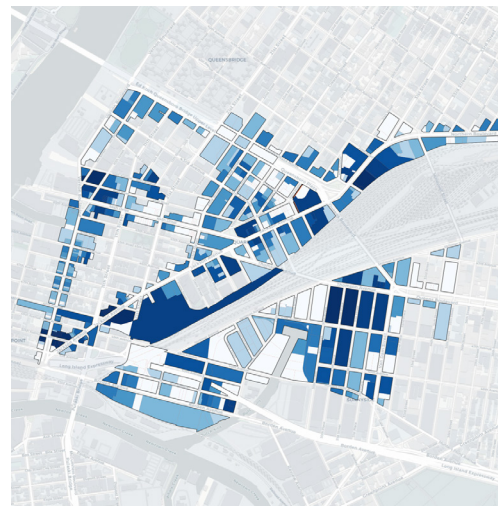
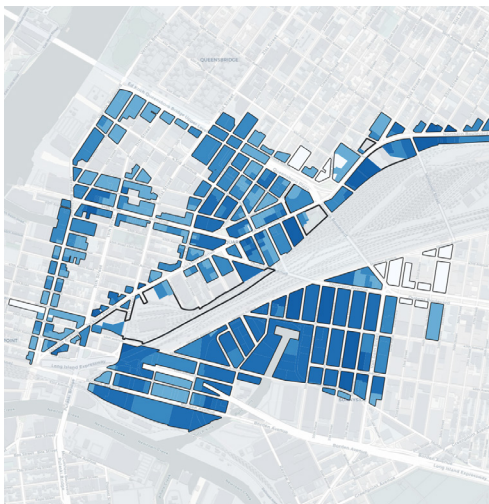


COASTAL EXPOSURE



STORM EXPOSURE

GROUNDWATER EXPOSURE



SEWER EXPOSURE