Cloudburst Flooding

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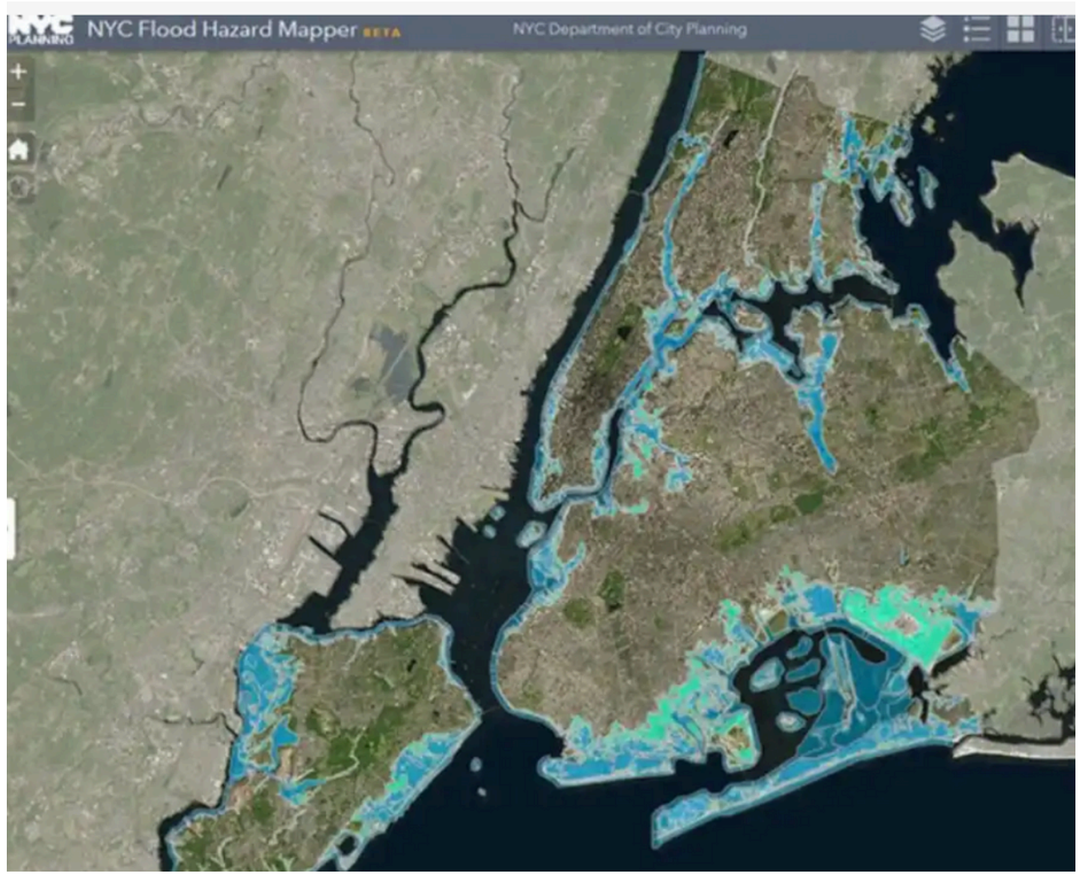
Overview & Cloudburst Definition

A cloudburst is an extremely intense rainfall event that commonly exceeds 2 inches per hour, overwhelming drainage systems and causing rapid flash flooding.

New York City is increasingly vulnerable due to climate change, aging infrastructure, dense impervious surfaces, and high exposure in low-income neighborhoods.

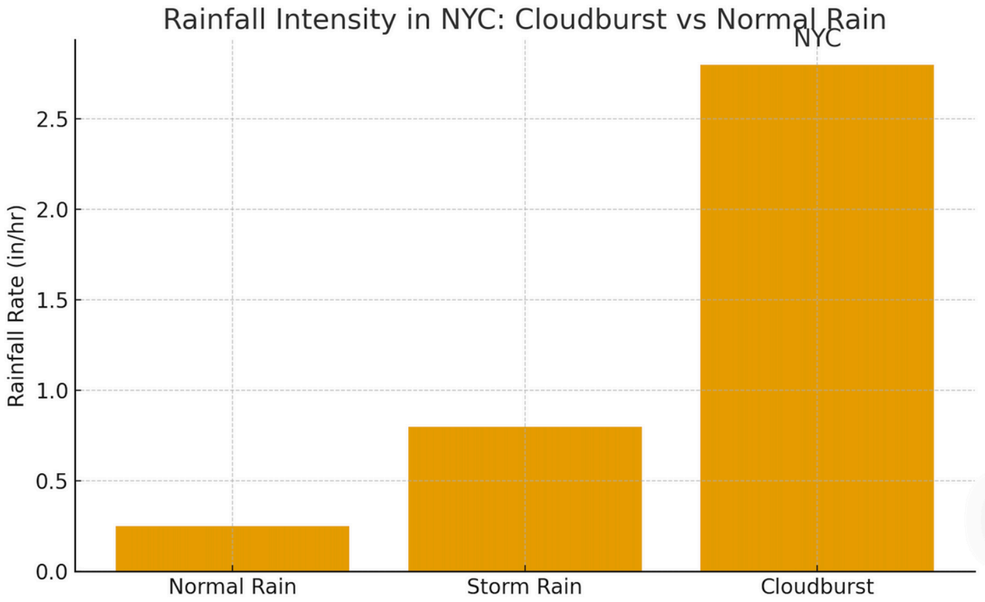


NYC Flood Hazard Mapper

Why NYC Floods Easily

NYC's urban landscape accelerates flooding during cloudbursts:

- Most surfaces are impermeable (streets, sidewalks, rooftops).
- The city relies on a century-old combined sewer system not designed for modern rainfall intensities.
- Natural drainage pathways have been removed or built over.
- Dense development leaves little space for water storage or infiltration.



Primary Causes

Aging sewer and drainage systems with limited capacity.

Climate change, increasing short-duration extreme rainfall.

Impervious urban surfaces, preventing natural absorption.

Socioeconomic vulnerabilities, especially in basement apartments.

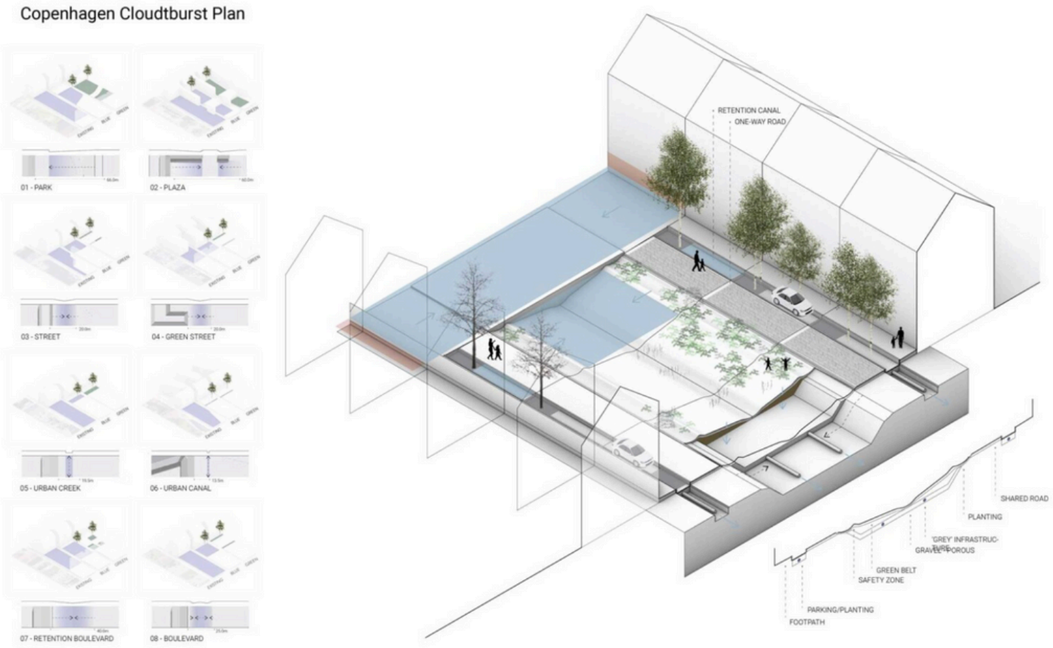
Infrastructure Limitations

- Much of NYC's sewer system is over 70–100 years old and based on outdated rainfall design standards.
- Combined sewers in most boroughs surcharge quickly because stormwater and wastewater enter the same system.
- Many neighborhoods have undersized pipe diameters, creating hydraulic bottlenecks during cloudbursts.
- Post-storm field inspections show a high percentage of clogged or restricted catch basins, reducing intake capacity.
- With minimal system redundancy, local overloads spread quickly, causing widespread street and basement flooding.

Global Precedent: Copenhagen, Denmark

- 2011 cloudburst caused ~US$ 1B in damage → triggered city wide adaptation.
- Adopted a “blue-green first” strategy: use streets, parks, plazas to absorb or channel stormwater.
- Implement “sponge parks,” permeable streets, green open spaces plus drainage tunnels where needed.
- Projects prioritized by flood-risk mapping, ease of retrofit, & ongoing redevelopment zones.
- Combines flood mitigation with improved urban public spaces enhancing resilience and liveability.

COPENHAGEN CLOUDBURST PLAN



Copenhagen Cloudburst Plan, Copenhagen, Denmark, 2012. Realized/Envisioned by: City of Copenhagen. Scale: 21810 acres. 26 feet above sea level. Drawing: Lucas Dobbin, Nastassja Lafontant, Donguk Lee.

Global Precedent: Rotterdam, Netherlands

- Built Water Squares that store stormwater during cloudbursts and act as plazas when dry.
- Uses sponge-city streets, green roofs, and permeable surfaces across urban districts.
- Part of the Rotterdam Climate Proof program to protect low-lying areas.
- Flood measures double as public amenities, improving livability while reducing risk.

Climate Change Impacts

NYC now experiences extreme rainfall events far more often than historical design standards assumed.

CMIP6 climate models project a 47% increase in severe short-duration precipitation by mid-century.

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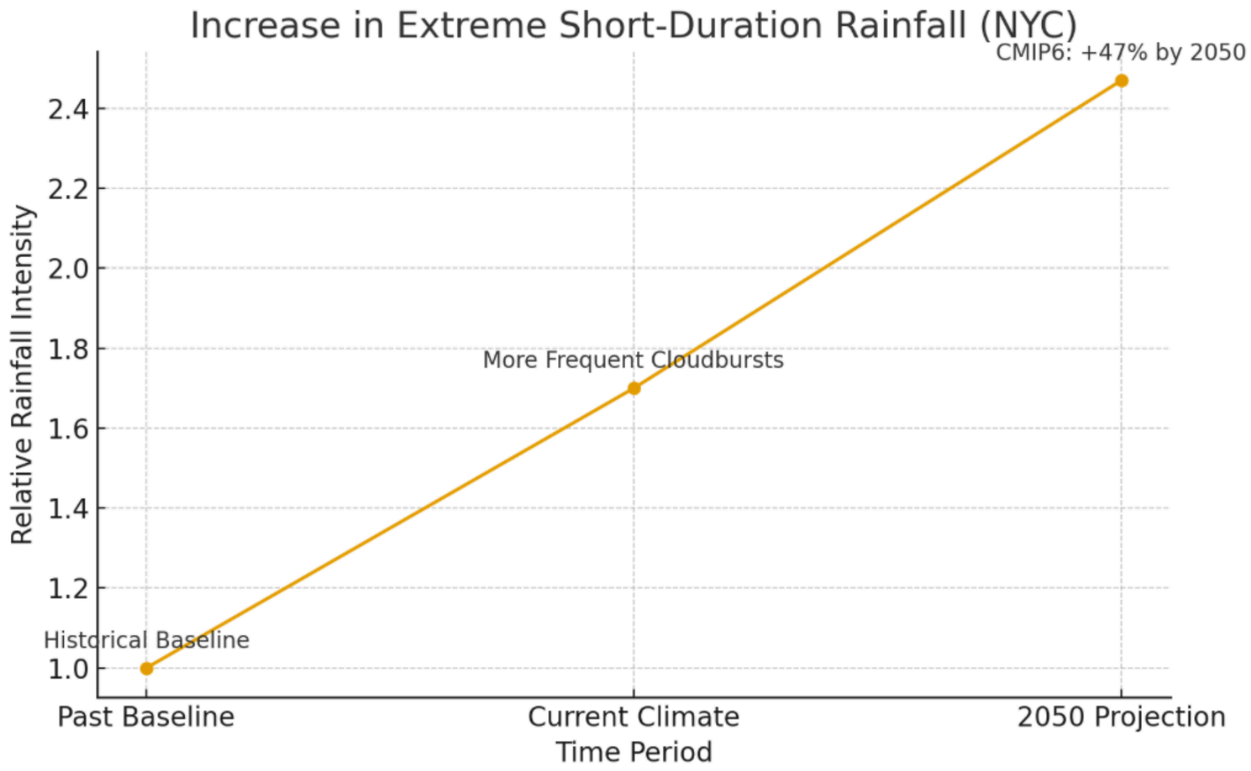

Will Mamdani Prioritize Cloudburst Mitigation?

- Aligns with climate justice goals—outer-borough, low-income, and immigrant communities face the greatest flooding risks.
- Protects basement renters and NYCHA residentsissues Mamdani frequently highlights.
- Supports green streets, public-space improvements, and local job creation in climate infrastructure.
- Must compete with major priorities: housing affordability, transit improvements, public safety.
- High capital costs and long environmental-review timelines may slow large drainage projects.
- No dedicated “Cloudburst Plan,” but Mamdani’s platform strongly aligns with flood-mitigation and resilience strategies.

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3 Case Studies

2025 Queens Cloudburst

In October 2025, Queens experienced 1.85 inches of rain in less than an hour.

- The Glendale underpass filled within minutes, resulting in two fatalities.
- Over 3,000 flooding complaints were filed.
- Streets equipped with green infrastructure (bioswales, permeable pavement) showed visibly lower flood depth.
- This event clearly demonstrated how upgraded drainage reduces peak flooding.

The Cooper Avenue underpass in Glendale flooded on Oct. 30

2023 Brooklyn Floods

Between September 28–29, 2023, Brooklyn received nearly 10 inches of rainfall in 48 hours.

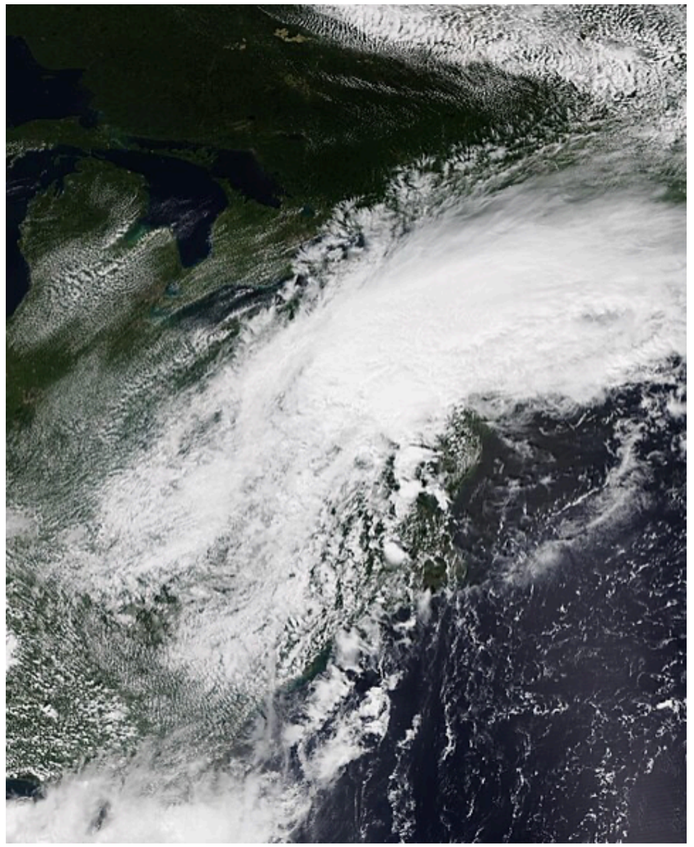
- Hourly rainfall exceeded 2.5 inches.
- Subway lines (2, 3, 4, 5, G) shut down due to tunnel flooding.
- Schools closed, businesses were inundated, and damages surpassed $150 million.
- This case highlighted the vulnerability of older industrial drainage systems.

Flash flooding across roadways in Flatbush, Brooklyn, New York

2021 Hurricane Ida Flash Floods

Remnants of Hurricane Ida produced rainfall rates above 3 inches per hour.

- 13 New Yorkers died, most trapped in illegal basement apartments.
- Emergency responders conducted over 1,200 water rescues.
- Forced major updates to NYC's basement housing codes and emergency alert systems.
- Ida exposed the deadly intersection of climate change and vulnerable housing.



Ida as a powerful extratropical storm over the Northeastern United States

Key Takeaways from the Case Studies

- Cloudburst rainfall exceeds NYC sewer capacity within minutes, causing rapid and widespread street and basement flooding.
- Neighborhoods with aging infrastructure and low green space experience the worst impacts, especially in Brooklyn, Queens, and basement-heavy housing areas.
- Basement apartments consistently show the highest life-safety risk, as seen in the fatalities during Hurricane Ida.
- Transit, schools, and businesses are highly vulnerable, with subway shutdowns and multi-million-dollar economic losses in 2023.
- Green infrastructure areas performed noticeably better, suggesting that distributed stormwater systems reduce peak flooding

Social, Economic & Environmental Impacts

SOCIAL

Transit shutdowns, school closures, basement flooding, displacement.

Economic

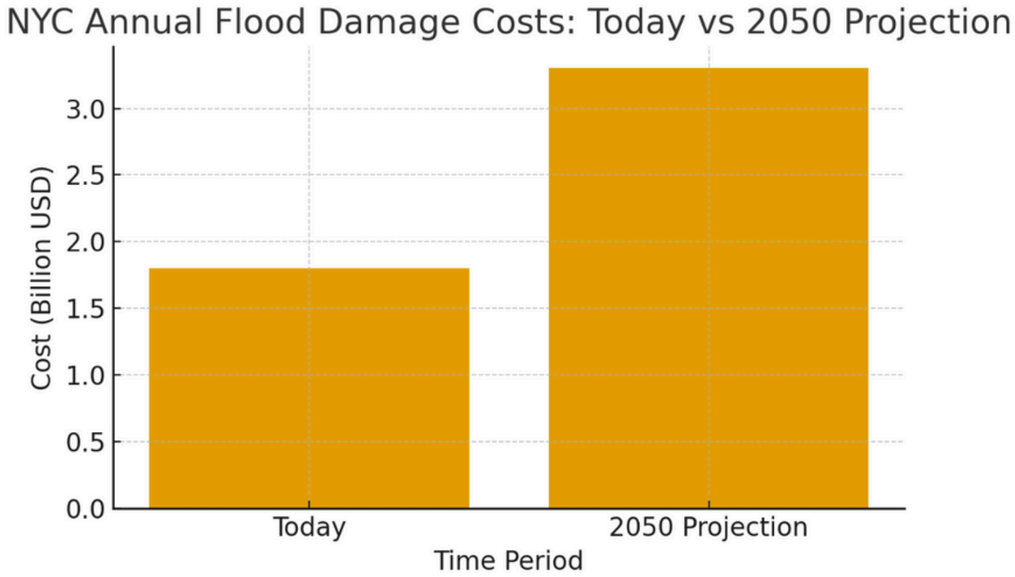
Annual damages range from $200M–$300M uninsured losses rise.

Environmental

Combined sewer overflows pollute waterways with debris, chemicals, and untreated wastewater.

Economic Cost of Cloudburst Flooding in NYC

- Annual flood damages in NYC reach hundreds of millions, much of it uninsured
- Disruptions to transit, schools, and small businesses create large indirect losses
- Outer-borough neighborhoods experience the highest economic vulnerability
- Climate change = more cloudburst events → cost of inaction grows every year



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Solutions: Grey & Green Infrastructure

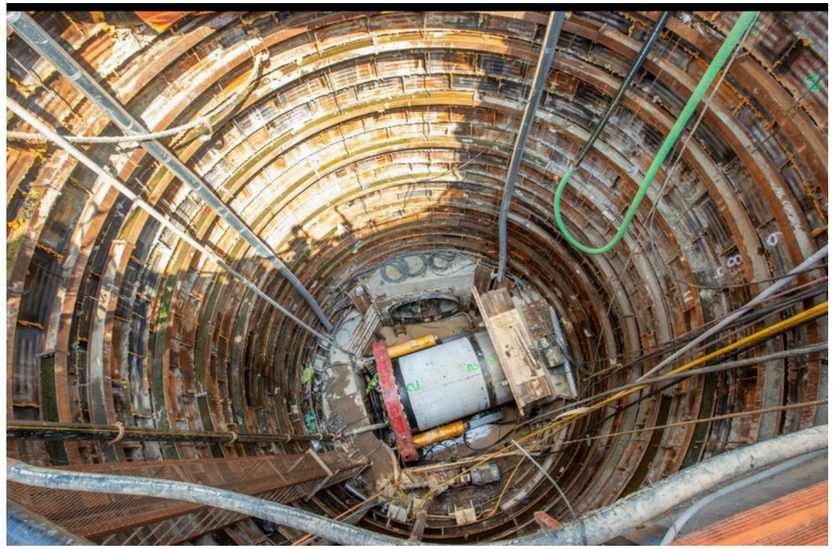
Grey Infrastructure

- Bluebelts (Staten Island & SE Queens): Large-scale drainage corridors that store, slow, and convey stormwater using engineered wetland systems.
- High-capacity sewer upgrades: Increasing pipe diameters and improving conveyance in chronic flooding zones.
- Gowanus Stormwater Retention Tunnel: A large deep-tunnel system that diverts peak stormwater flows to reduce sewer surcharging and CSOs.

Green Infrastructure

- Bioswales & rain gardens: Increase infiltration and delay runoff entering sewers.
- Permeable pavements: Reduce surface runoff and increase temporary storage.
- Green roofs: Reduce rooftop runoff volumes and peak flow.
- Cloudburst Districts: Designed to temporarily store stormwater in plazas, schoolyards, and open spaces during extreme rainfall events.

Grey Infrastructure



Phase 2 of Massive Queens Sewer Program Completed in Maspeth

Stuyvesant Cove Park landscape restoration, part of the East Side Coastal Resiliency Project

Green Infrastructure

Green Roof

Cloudburst Projects

How It Works

- Streets, parks, courts, and open spaces act as controlled flood zones, combining green infrastructure (lawns, rain gardens) and gray infrastructure

NYC Application

- First pilot in Queens stores ~300,000 gallons of stormwater $390M planned for multiple neighborhoods(Queens, Bronx, Brooklyn)

Why This Solution Matters

- Reduces flooding and combined sewer overflows
- Increases climate resilience at a local scale
- Prioritizes environmental justice communities

Image courtesy of New York City Department of Environmental Protection

Final Recommendations

- Expand grey & green stormwater systems citywide
- Modernize sewer design standards for future rainfall
- Prioritize vulnerable communities (especially basement units)
- Strengthen emergency alerts & preparedness measures
- Combine engineering, policy, and community planning

Photo by Luke Stackpoole on Unsplash

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Thank You

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