Climate Change Planning for NYC Stormwater Management

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About NYC DEP

DEP is the largest combined water and wastewater utility in the United States, with 6,000 employees and an annual budget of more than $1 billion.

WATER SUPPLY

- Deliver almost 1 BGD of water to nine million New Yorkers every day and maintain 7,000 miles of water mains
- Protect approximately 2,000 square miles of watershed, including 19 reservoirs and three controlled lakes

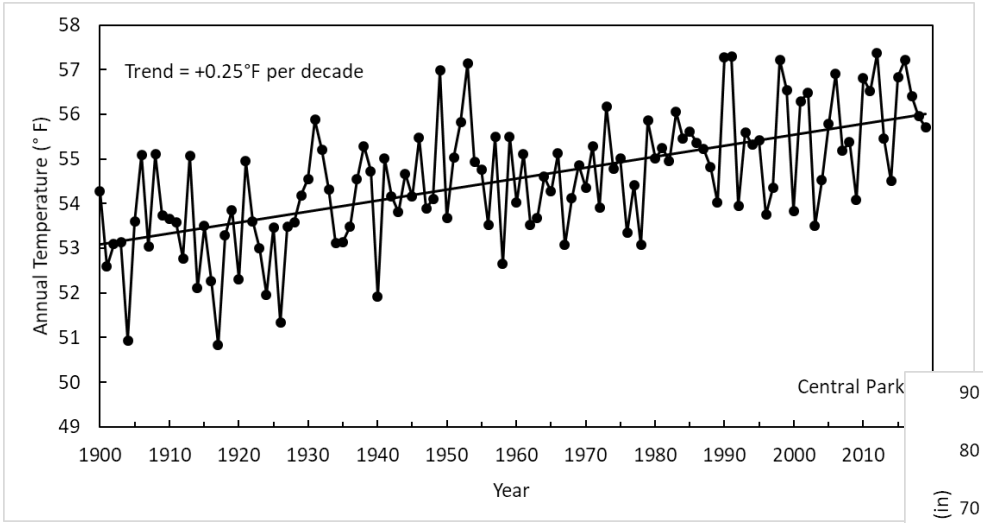
WASTEWATER TREATMENT

- Treat almost 1.3 BGD of wastewater each day
- Operate and maintain 14 plants, 96 pumping stations, and over 7,500 miles of sewers

AIR, NOISE, AND HAZARDOUS WASTE

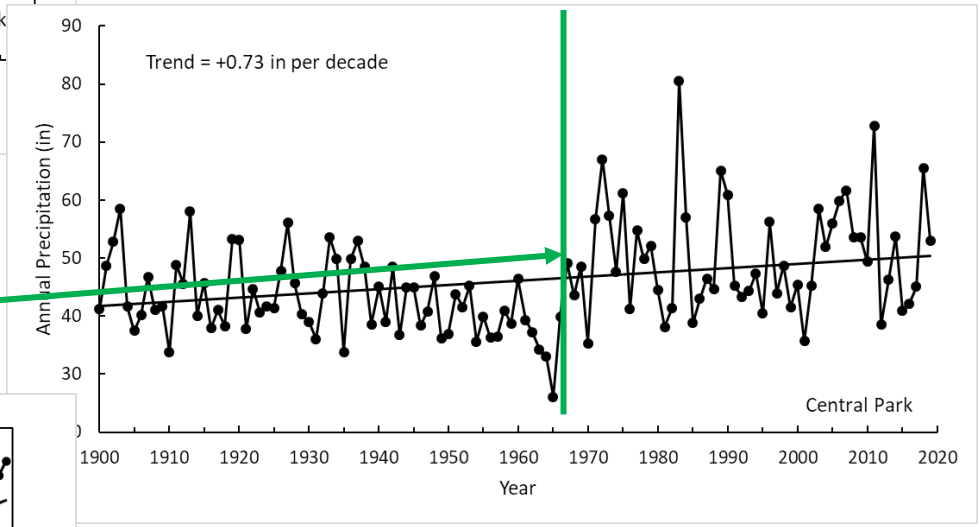
- Enforce the NYC Air Pollution Control Code to reduce local emissions, enforce the NYC Noise Code, and regulate hazardous waste

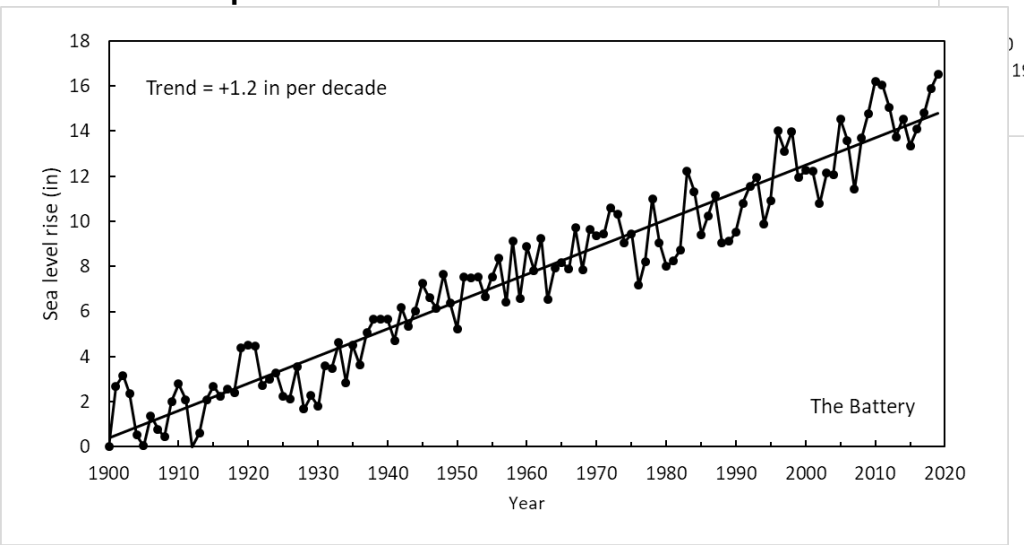
NYC temp, precip, & sea level are increasing



Mean annual **temperature** has increased at a rate of 0.25°F per decade.

Mean annual **precipitation** has increased 0.73 inches per decade. Year-to-year variability has become more pronounced since the 1970s.





Sea level rise has averaged 1.2 inches per decade, nearly twice the observed global rate.

Climate projections show an upward trend

Heat:

Average temperatures are expected to increase by
4.1 to 5.7 degrees by 2050
Number of days in NYC above 90^{o} could triple by 2050

Precipitation:

Average precipitation is expected to increase by 4 to 11 percent by 2050

Sea Level Rise:

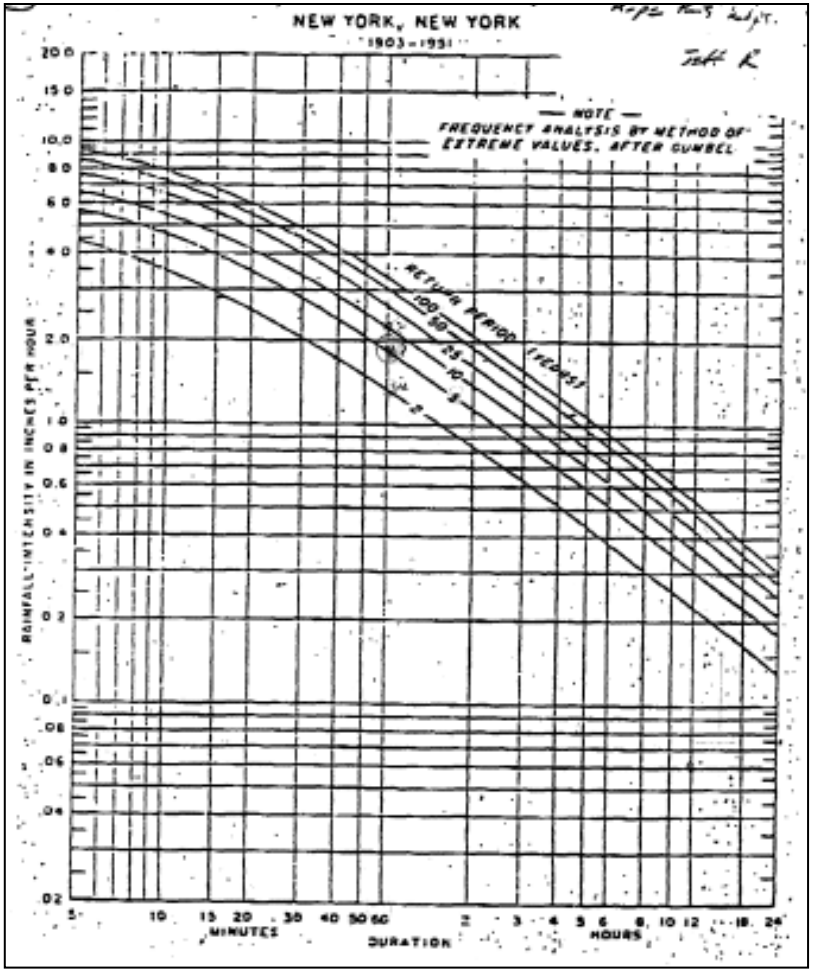
Seas are expected to rise between 11 to 24 inches by 2050
High end projection: 72 inches by 2100

Sewer design is based on historical observations

- Precipitation Intensity-Duration-Frequency (IDF) curves used in engineering and planning applications:
  - Sewer design/construction
  - Sizing of onsite detention systems

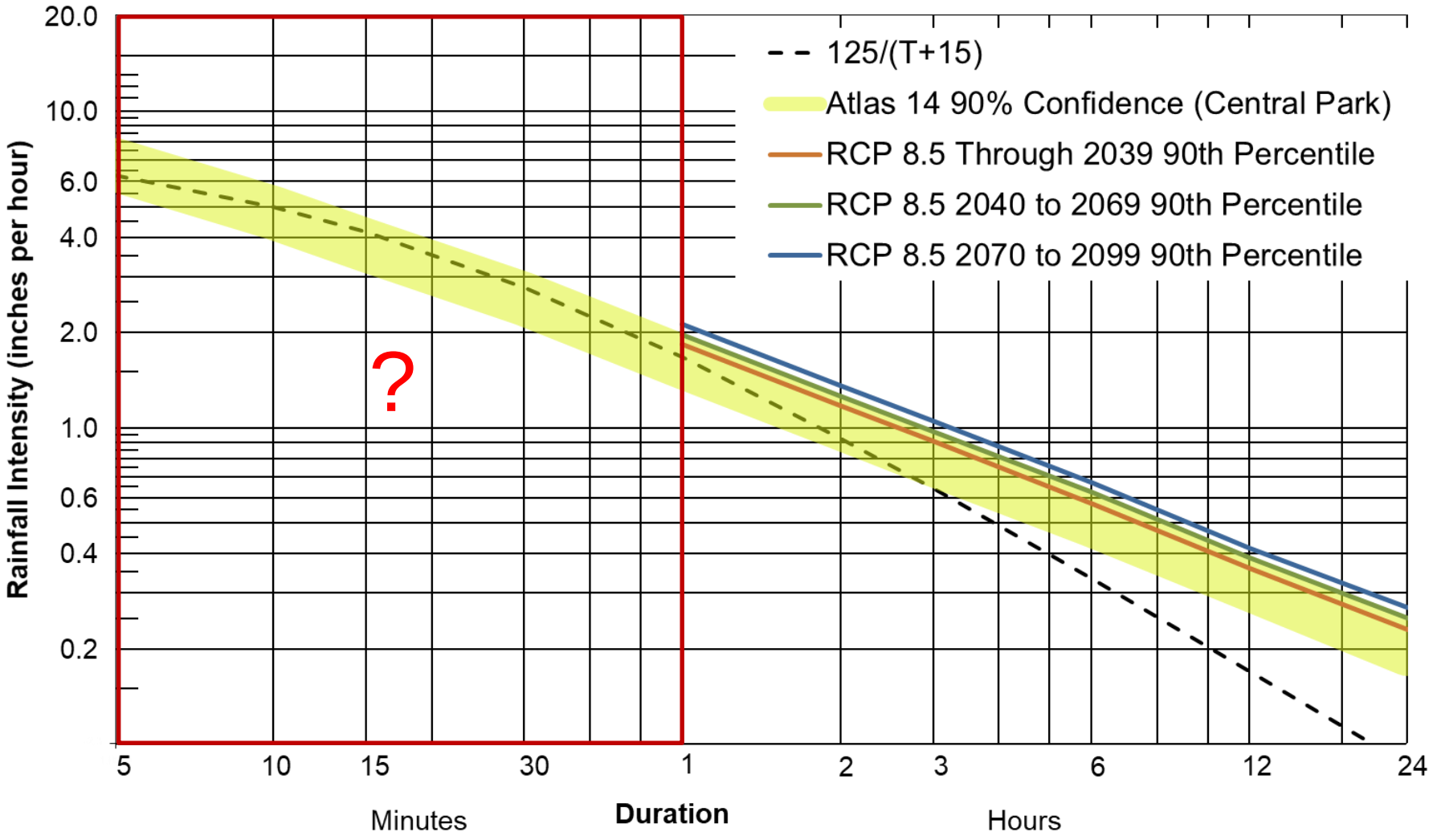
- A single curve is applied citywide; historically based on observed rainfall data from 1903 to 1951.

- Application focused on short duration, high frequency events (5-10 year return periods).



Updating precip data using climate models

Historical observations (Atlas 14) and sewer design curve (125/T+15) compared with downscaled, high-emissions climate scenario (Representative Concentration Pathway 8.5)



Incorporating climate data into design

Who will use the guidelines?

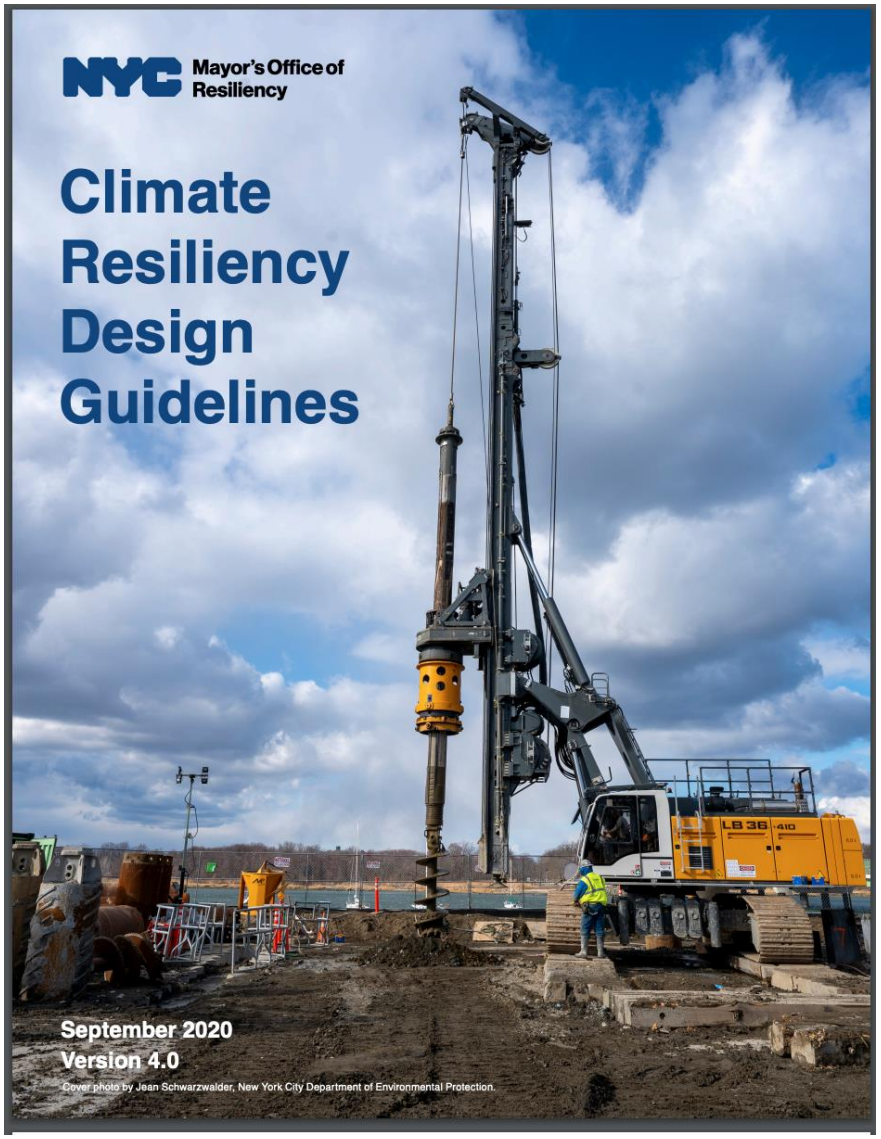
- City agencies
- Engineers, architects, and planners

What kinds of projects?

- Buildings and infrastructure
- New capital construction and major rehabilitation

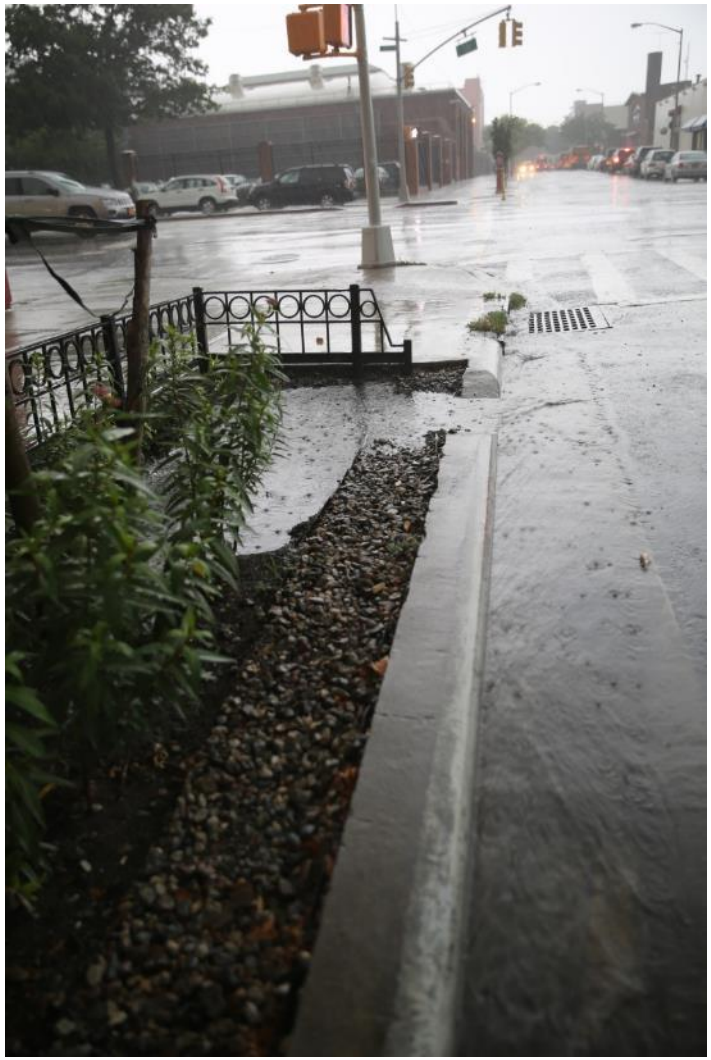
What kinds of assets are not included?

- Coastal protection projects
- Private developments



Incorporating precipitation data into design

Precipitation design adjustment for on-site stormwater systems



"Choose the right combination of interventions after considering the project type, site location, operational requirements, cost, benefits, and useful life of the intervention."

- Utilize strategies that infiltrate, evaporate, or reuse rainwater
- Install stormwater infiltration, detention, and storage
- Protect areas below grade from flooding
- Develop plan to keep catch basin grates clear

NYC is maximizing infiltration where feasible

City Sidewalks

City Streets

Grant Program for Private Property Owners

Public Property Retrofits

Green infrastructure can alleviate flooding

September 2015: Cloudburst event in Copenhagen, Denmark

Public spaces can also be used for flooding

Rotterdam's "Water Square"

Applying climate projections to design

1-hour duration rainfall depths			
End of useful life	5-year design storm (in)	50-year design storm (in)	100-year design storm (in)
Baseline	1.61	2.57	2.87
Through to 2039	1.83	3.02	3.41
2040-2069	1.97	3.33	3.93
2070-2099	2.12	3.74	4.34

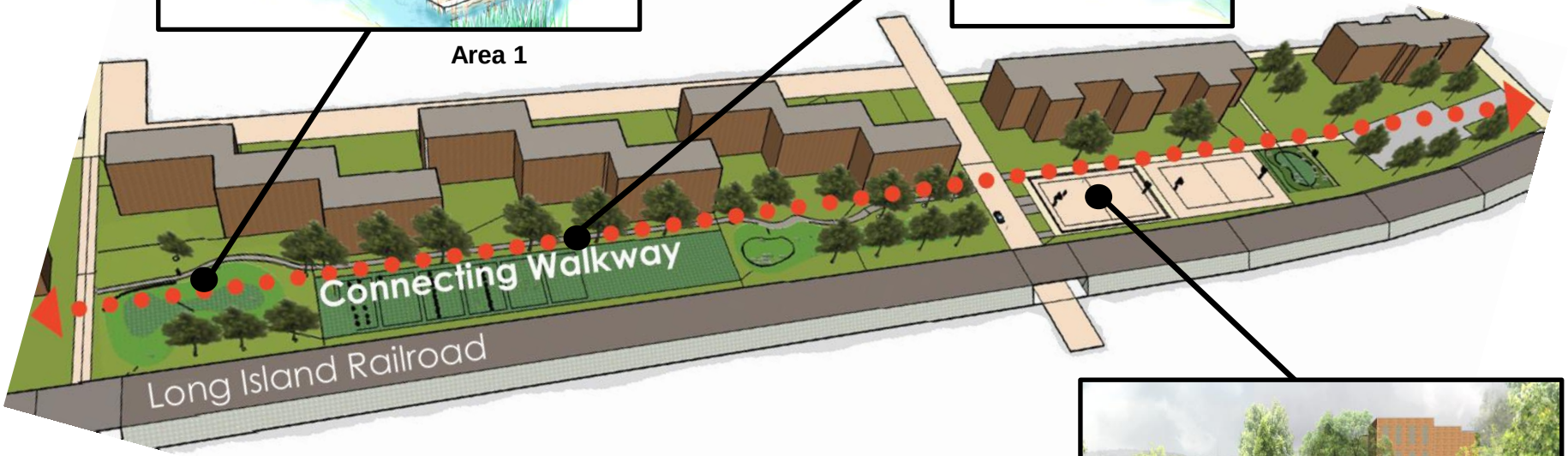
10-year
2.30

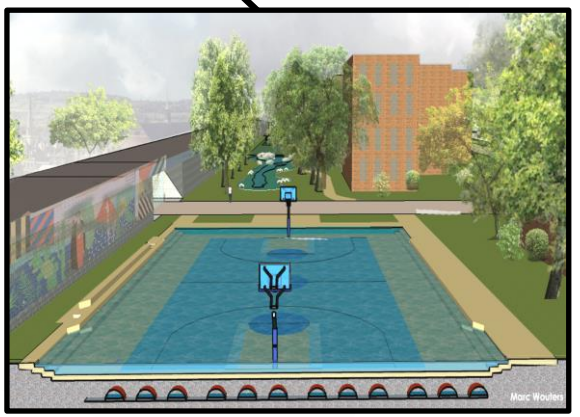
24-hour duration rainfall depths			
End of useful life	5-year design storm (in)	50-year design storm (in)	100-year design storm (in)
Baseline	4.70	7.83	8.79
Through to 2039	5.41	9.21	10.55
2040-2069	5.88	10.13	12.31
2070-2099	6.35	11.28	13.40

Stormwater systems designed for 10-year storm

Area 1

Walkway





Area 3

New designs blend form and function

For more information visit these websites

- NYC Panel on Climate Change:
  https://www1.nyc.gov/site/orr/challenges/nyc-panel-on-climate-change.page

- NYC Climate Resiliency Design Guidelines:
  https://www1.nyc.gov/assets/orr/pdf/NYC_Climate_Resiliency_Design_Guidelines_v4-0.pdf

- NYC DEP Climate Resiliency Programs:
  https://www1.nyc.gov/site/dep/environment/climate-resiliency.page