

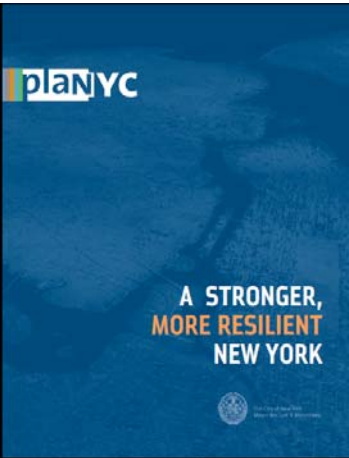
Climate Risk and Resiliency- A Closer Look at the New York City Wastewater Infrastructure

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Analysis at NYC Department of Environmental
Protection*

NEIWPC Workshop
June 2013

Special Initiative for Rebuilding and Resiliency

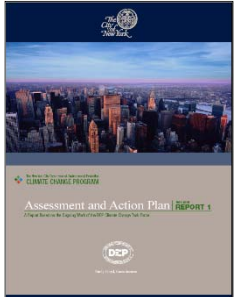
- On June 11, Mayor Bloomberg announced "A Stronger, More Resilient New York"- Road Map for Resiliency
- The report consists of two parts:
 - **Community Rebuilding and Resiliency Plans**
 - **Citywide Infrastructure and the Built Environment**, including
 - Coastal Protection
 - Buildings
 - Insurance
 - Utilities
 - Environmental Protection and Remediation
 - Water and Wastewater
 - Other Critical Networks
- **More than 250 initiatives with a cost of \$20B**



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Climate Change Planning at DEP

2003	Columbia University/NASA GISS commissioned to develop forecast scenarios for watershed region
2004	DEP initiates Climate Change Task Force
2008	Founding of Water Utility Climate Alliance (WUCA) Climate Change Assessment and Action Plan released NYC Mayor's Office kicks off citywide Climate Change Adaptation Task Force
2009	DEP initiates Climate Change Integrated Modeling Project to quantify potential impacts of climate change on drinking water supply and quality
2011	DEP initiates 2 year study of Climate Change and Population Growth Effects on NYC Sewer and Wastewater Systems
2012	DEP expanded the study to include climate impacts on all wastewater infrastructure and identify strategies

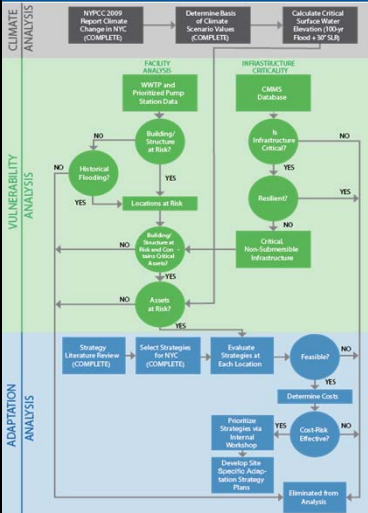


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Climate Analysis Framework

Three Part Framework:

1. Climate Analysis
2. Vulnerability Analysis
3. Adaptation Analysis



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Vulnerability Assessment Methodology

- Identified locations and target assets "at risk" that are below the assigned flood elevation (100-yr ABFE + 30-inches SLR)
- Identified common flood pathways
- Estimated "no action cost"

Site Plan

Aerial

Flood Pathways

Photo Log of Critical Thresholds (e.g., Main Building Basement Windows)

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Storm Surge Guidance

Storm Surge Guidance: 26th Ward WWTP

Storm Surge Guidance: Oakwood Beach WWTP

Provides an "at-a-glance" warning of which WWTP Building Locations may be vulnerable to flooding for a given forecasted storm surge level

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NYCDEP At-Risk Wastewater Facilities

NYCDEP At-Risk Facilities

- Wastewater Treatment Plants (14)
- Pumping Stations (58)
- ABFE Mapped Zones

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Prioritization Approach

Prioritization considered against multiple metrics:

- Beaches Impacted
- Total Potential Damage Cost of At-Risk Assets
- Tributary Area Population Impacted
- Number of Critical Facilities Impacted
- Quantity of Primary At-Risk Assets Associated w/Meeting Permits
- Quantity of Total At-Risk Assets
- Historical Frequency of Flooding
- Historical Loss of Power and Daisy Chain Effect
- Included in DEP's 10 year Capital Plan


Vulnerability Metrics

Operational Metrics



Other Metrics

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Adapt a Design Standard




- DEP will adapt wastewater facility design standard for storm surge and sea level rise
- Based on FEMA 100 yr flood elevations plus 30 inches for Sea Level Rise
- Wide range of adaptation strategies investigated

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Adaptation Strategies- Harden Infrastructure




Strategy	Resiliency Level	Failure Potential*	Explanation of Residual Risk
No-Action	Level 0	100%	
BUILDING LEVEL STRATEGIES			
Emergency Response (Sandbagging)	Level 1,2	11% - 25%	Human element, may overtop
Seal Building or Control Room	Level 3	6% - 10%	May leak in from conduits; difficult to detect all leaks
Construct Barrier	Level 4	1% - 5%	Alternative flood pathways other than over the wall
ASSET LEVEL STRATEGIES			
Floodproof Equipment	Level 4	1% - 5%	May exceed rated pressure
Elevate Equipment	Level 5	< 1%	If elevated to 100-yr flood height, only risk from larger storms and greater climate change
ASSET LEVEL STRATEGIES			
Provide Temporary Power Generation for PS	NA	NA	This measure does not protect the PS, but helps it to regain service following a surge

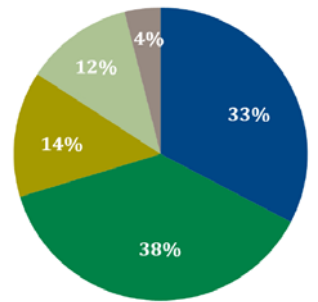
* Failure Potential = Risk of Strategy Failing During a Flood Event

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Harden Infrastructure- WWTPs




- Elevate Equipment
- Floodproof Equipment
- Seal Building
- Construct Barrier
- Sandbag Temporarily



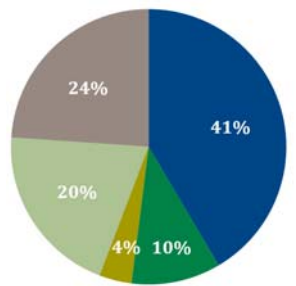
Facility Type	Adaptation Cost	One-Time No Action Cost	Unmitigated Risk Over 50-Years
WWTP (14)	\$189 M	\$901 M	\$298 M

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Harden Infrastructure- Pump Stations



- Elevate Equipment
- Floodproof Equipment
- Seal Building
- Construct Barrier
- Sandbag Temporarily



Facility Type	Adaptation Cost	One-Time No Action Cost	Unmitigated Risk Over 50-Years
PS	\$134.6 M	\$220 M	\$57 M

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Green Infrastructure for Resiliency

NYC GREEN INFRASTRUCTURE
A SUSTAINABLE STRATEGY FOR CLEAN WATERWAYS

planyc

Blue Roofs

Staten Island Bluebelt

Porous Pavements

Green streets

Bioswales

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Restoring New York Harbor

Potential future 1-in-100 yr flood zones for Jamaica Bay using rapid ice melt model-based SLR projections

Brooklyn Queens

Manhattan Beach Hudson River ATLANTIC OCEAN

Map Authors: K. Grady, A. Merzko, L. Patrick, W. Solecki, November 2009
For more information, contact: info@nycplanlab.net

Legend:

- 2026s 1-in-100 Year Flood Zone (w/ 5' Sea Level Rise)
- 2026s 1-in-100 Year Flood Zone (w/ 27" Sea Level Rise)
- 2026s 1-in-100 Year Flood Zone (w/ 53" Sea Level Rise)
- Major Roads and Highways
- FEMA Current 1-in-100 Year Flood Zone
- No Base Flood Elevations Calculated

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Climate Resilience Summary

➤ Adaptation can come in many forms:

- adjustments in **operations and management**
- **capital investments** in infrastructure
- policies that **promote flexibility**
- recalibrating **design standards**
- leveraging **co-benefits** and pursuing **no-regrets** strategies

Source: New York City Panel on Climate Change

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Thank You!

http://www.nyc.gov/dep

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