

Adapting New York City's Water System to Climate Change

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In August 2004, the **NEW YORK CITY DEPARTMENT OF ENVIRONMENTAL PROTECTION (NYCDEP)** established the NYCDEP Climate Change Task Force (Task Force) to develop responses to climate change and climate variability. The Task Force, working in partnership with Columbia University's Center for Climate Systems Research (CCSR) and other institutions, serves to ensure that potential impacts of and adaptations to climate change on the New York City (City) water supply and wastewater systems are factored into the Department's long-term strategic and capital planning. In conjunction with its adaptation activities, the Task Force is investigating the development of a greenhouse gas (GHG) emissions management program. The Task Force is an agency-wide endeavor whose members are NYCDEP employees from all bureaus.

NYCDEP CLIMATE CHANGE TASK FORCE MISSION:

"Ensure that NYCDEP's strategic and capital planning efficiently take into account the potential effects of climate change—sea level rise, higher temperature, increase in extreme events, and changing precipitation patterns—on the City's water supply and wastewater treatment systems".

ADAPTATION ASSESSMENT INCLUDES:

- **Identifying impacts**
- **Applying future climate scenarios:** utilize scenarios to analyze possible impacts for which adaptations are needed
- **Characterizing options:** operations, capital investments, and/or policy
- **Conducting initial screening:** engineering, institutional, regulatory feasibility
- **Linking to capital cycle**
- **Evaluating options:** costs/benefits, ensure no regret adaptations
- **Creating implementation plans:** time scales - short, medium, long-term
- **Monitoring and Reassessing:** use of indicators, continue to refine science

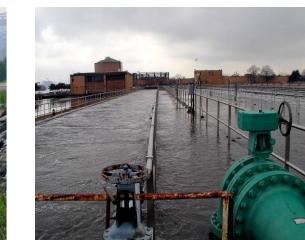
POTENTIAL ADAPTATION EXAMPLES



Bureau of Water Supply (policy and capital investment):
Modify dam infrastructure to allow for water releases to create a short-term void in anticipation of a storm event.
Photo of Croton Falls spillway.

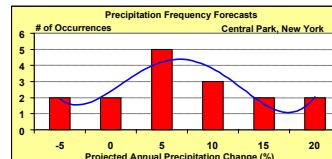
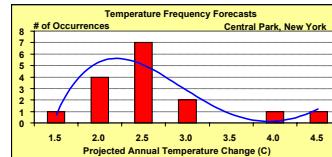


Bureau of Water and Sewer Operations (operations):
Inventory existing tide gates; identify priority locations most vulnerable to sea level rise and storm surges to support long-term maintenance and possible future installation programs.
Photo of NYCDEP tide gate.



Bureau of Wastewater Treatment (capital investment):
Construct Flood Walls in response to sea level rise and associated storm surge levels.
Photo of treatment tanks overflowing at a Bronx WPCP during March 2001 storm; unusually high tidal waters blocked discharge of treated sewage into East River and caused back-up.

Model-Based Probability for Climate Change in 2050s New York City Based upon 8 Global Climate Models*



* Downscaled from the following global climate models: CSIRO, CCCma, GFDL, GISS, HCCP, CCSR, MIPIR, and NCAR NASA/GISS Climate Impacts Group



CLIMATE CHANGE VARIABLES IMPORTANT TO NYCDEP

There is a long-term warming trend in the New York Metropolitan Region, with **annual mean temperature of the region rising at a rate of 0.014 °C/ year** for a total cumulative temperature change of roughly 1.4 °C over the course of the last century.

Surface Air Temperature (min, max, mean)



Over the past century, **annual precipitation in the region has increased by ~2.5 cm.**

Precipitation



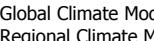
Global sea level is rising at a rate of ~1.7 mm/year, while **sea level rise for the NY Metro Region rate is ~2.6 mm/year** due to local subsidence.

Sea Level Rise



One of the greatest impacts facing the NYCDEP is **stronger and more frequent hurricanes and Nor'easters threatening system infrastructure and quality of the water supply.**

Extreme Events (Storms, Floods, Droughts)



Models & Forecasts

- Global Climate Models (GCMs)
- Regional Climate Models (RCMs)
- Greenhouse Gas Emission Scenarios
- Sea Level Rise
- Storm Surge
- Watershed & Terrestrial Models
- Drought & Flood Indices

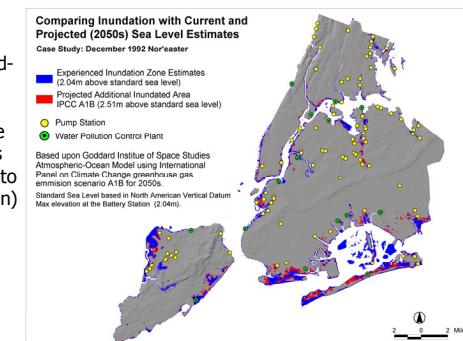
Sea Level Rise Projections -- New York Metropolitan Region, cm			
Time Period	Current Trend*	IPCC GHG Emission Scenario B1	IPCC GHG Emission Scenario A1B
2020s	8.3	17.6	11.2
2050s	16.6	35.7	47.2
2080s	27.7	79.3	97.7

Based upon Goddard Institute of Space Studies' Regional Climate Model. Sea level rise data for decadal means relative to 1990-1999. Due to both thermal expansion and local subsidence.

Source: Columbia Center for Climate Systems Research

Coordinated Science Example

- Interdisciplinary research project on coastal flooding.
- Uses sea level rise forecasts with storm surge & elevation models to analyze impact on NYCDEP coastal facilities.
- Initial runs of the sea level model using a low-level (B1) and mid-level (A1B) GHG emissions scenarios suggests sea level rise increase in the 2050s may range from 16.6 to 47.2 cm (6.1 to 18.8 in) in comparison to the 1990s decadal mean.



MITIGATION

The Task Force's mitigation activity serves to aid in the development of a GHG emissions management program. Efforts focus on producing a GHG mitigation assessment framework and process, and an initial agency-wide GHG inventory conducted in cooperation with the city-wide GHG inventory.

References: NYC Department of Environmental Protection, www.nyc.gov/dep; Columbia Center for Climate Systems Research, [www.ccsr.columbia.edu](http://ccsr.columbia.edu); Stony Brook Storm Surge Group, <http://msrc.sunysb.edu>; and HydroQual Inc., www.hydroqual.com