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Potential **Impacts and Adaptations** Summary

Summary of Potential Climate Change Effects, Impacts, and Adaptations Identified to Date by DEP's Climate Change Program



POTENTIAL IMPACTS



WATER SUPPLY

POTENTIAL CLIMATE CHANGE EFFECT

POTENTIAL IMPACT TO DEP

Warmer weather

- Longer plant growing season increases evapotranspiration, which reduces water supplies
- Shifting bird migration patterns and populations change fecal contamination of reservoirs

More hot summer days

- Increased peak and seasonal demands
- In-City water pressure and delivery problems

Warmer water temperatures in reservoirs

- Biological and chemical effects on potable water quality

Warmer water temperatures downstream of dams

- More pressure for increased reservoir releases to maintain fish life in rivers and streams reduces water supply for NYC

Warmer winters, less snowfall and snowpack

- More runoff in winter, less runoff in spring
- Concern for lower overall water supplies

More intense rainstorms

- More turbidity incidents in unfiltered watersheds
- Increased nutrient loads to reservoirs, increased eutrophication, taste and odor problems, increased levels of disinfection by-product precursors
- Increased loadings of pathogenic bacteria and parasites such as *Cryptosporidium* and *Giardia*

More extreme rainstorms

- Increased pressure to use City reservoirs for flood control could reduce water supply for NYC
- Change in Maximum Probable Flood raises dam safety concerns

More frequent and severe droughts

- More frequent "drought emergencies"

Combination of temperature increases and precipitation changes

- Changed ecology of watersheds raises concerns about ability to maintain filtration avoidance in Catskill and Delaware systems

Movement of salt front in Hudson River due to sea level rise

- Threat to ability to use Chelsea Pump Station as an emergency water supply

Movement of salt front in Delaware River due to sea level rise

- More pressure for increased Delaware releases could reduce water supply for NYC

DRAINAGE AND WASTEWATER MANAGEMENT



POTENTIAL CLIMATE CHANGE EFFECT

POTENTIAL IMPACT TO DEP

Increased temperature of harbor waters

- Water quality impairment due to thermal stratification, reduced dissolved oxygen concentrations, and increased ammonia toxicity

More frequent intense rainfalls

- More street and basement flooding
- Sewer flood
- Capacity exceedances for sewers and treatment facilities
- Need to manage more CSOs to prevent water quality standards non-compliance

Sea level rise

- More coastal flooding
- More street and basement flooding
- Increased inflow of seawater to sewers and WPCPs
- Reduced ability to discharge CSOs and WPCP effluent by gravity
- Rise in groundwater levels could cause basement flooding and sewer infiltration

More frequent coastal storms

- More damage to coastal infrastructure



POTENTIAL ADAPTATIONS



WATER SUPPLY

POTENTIAL IMPACT TO DEP

POTENTIAL ADAPTATION

Decrease quantity of supplies

- Further diversify the water supply system:
 - Bank surface water in aquifers
 - Desalinate Hudson or Harbor waters
 - Expand groundwater system
 - Interconnect systems with other municipalities
- Implement conservation and water use restrictions
- Increase system redundancy (e.g., additional tunnels and new pumps for transferring water between systems)
- In addition to enhancing flood works at select DEP reservoirs and other non-mandated DEP measures for assisting with flood mitigation in and downstream of the watershed, require operators of other (non-NYC) impoundments to mitigate reservoir spills
- Require jurisdictions potentially impacted by flooding to restrict development in flood plains

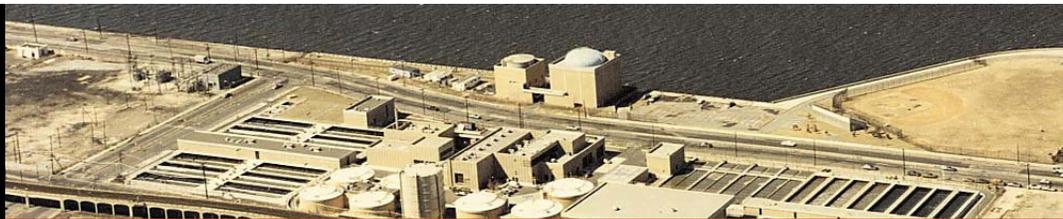
Decreased quality of supplies

- Increase and improve water supply quality protection measures such as the Stream Management Program in the Catskill Watershed and the Waterfowl Management Program
- Acquire additional land and enhance land-use management
- Increase operational flexibility (e.g., rely more heavily on the filtered Croton system during turbidity events and drought)
- Apply alum and sodium hydroxide when necessary to reduce peak levels of turbidity
- Apply structural and non-structural controls to reduce turbidity as necessary
- Balance water supply needs with maintenance

Increased water demand

- Reduce demand through conservation programs:
 - Address illegal opening of fire hydrants
 - Develop programs for City and non-City seasonal use reductions
 - Increase in-City conservation programs

DRAINAGE AND WASTEWATER MANAGEMENT



POTENTIAL IMPACT TO DEP

POTENTIAL ADAPTATION

Street, basement flooding, and sewer flood

- Augment collection system
 - Increase sewer cleaning
 - Build "high level" storm sewers
 - Implement stormwater controls at the source
 - Retain stormwater using rooftop or off-line storage and reuse it for ecologically productive purposes
 - Pump stormwater
 - Increase WPCP wet weather capacity
 - Build larger sewers
- Revise drainage design criteria
- Enhance natural landscape and drainage features for runoff control
- Manage flooding unconventionally (e.g., plan for controlled flooding in designated areas during storms)

Coastal flooding

- Raise elevations of key infrastructure components
- Construct watertight containment for critical equipment and control rooms
- Use submersible pumps
- Have additional backup emergency management equipment in reserve
- Install local protective barriers
- Construct large harbor-wide storm surge barriers
- Develop plans allowing for coastal inundation in defined areas
- Gradually retreat from the most at-risk areas or use these areas differently, such as for parkland that could flood with minimal damage

Wastewater treatment process disruptions

- Discuss with regulators the possibility of water quality variances for severe weather conditions
- Increase blower capacities or use redundant equipment for high temperature events
- Increase backup power capacity
- Clean interceptors and catch basins to reduce grit and sediment loads during wet weather
- Improve main sewage pumps and screening for wet weather
- Relocate vulnerable equipment and construct watertight containment for critical equipment
- Raise freeboard for flooding
- Revise design criteria for flood protection
- Pump effluent

Receiving water quality impairment

- Aerate critical water bodies
- Upgrade WPCP processes to improve effluent quality
- Enlarge or supplement CSO control facilities
- Reduce runoff into the stormwater and combined sewer systems