


“Of all the potential threats posed by climatic variability and change, those associated with water resources are arguably the most consequential for both society and the environment.”

*Water – the Nation’s Fundamental Climate Issue:  
A White Paper on the U.S. Geological Survey Role and Capabilities*  
USGS Circular # 1347, 2010

# Being Prepared: Water Infrastructure & Climate Change

NJ Climate Change Workshop  
Rutgers University  New Brunswick  
29 November 2011



Jessica Rittler Sanchez, PhD  
Delaware River Basin Commission  
& NJ Clean Water Council

# Being Prepared:

## Water Infrastructure & Climate Change

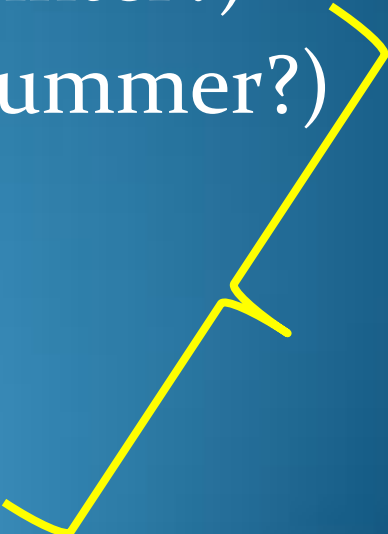
### I. Climate-related threats to water & infrastructure: supply, waste & storm

- 2009 NJCWC Public Hearing
- NJ and DRBC concerns

### II. Management Options

# Water Infrastructure & Climate Change

What we can expect:

1. Greater variability/extremes in precipitation amounts & timing
    - a) More wet days/ storms (winter?)
    - b) More dry/drought days (summer?)
  2. Higher temperatures
  3. Sea level rise
  4. **Synergistic effects**
- 

# More frequent storms/wet days

- more stormwater/  
more flooding in  
vulnerable locations

3 record-breaking floods in 22 mos:  
Sept 2004  
April 2005  
June 2006



- water quality  
impairment (TSS,  
nutrients, etc.)
- infrastructure impacts
- service disruption



# Lambertville Sewage Treatment Plant: April 2005

Aerial photo used with permission of  
[www.elevated-images.com](http://www.elevated-images.com)



Lambertville, N.J.

April 2005

New Hope, Pa.

# Water Infrastructure & Climate Change

## Source impairment, infrastructure disruption

Hurricane Irene - August 2011



The breach of the canal wall south of Lambertville.

This photograph was taken on August 28th, by Tim Kasony.

FIRM

**FIRM**  
FLOOD INSURANCE RATE MAP  
**MERCER COUNTY,**  
**NEW JERSEY**  
(ALL JURISDICTIONS)

PANEL 206 OF 276

MAF FLOODEN

**REVISED PRELIMINARY**  
**JULY 16, 2010**

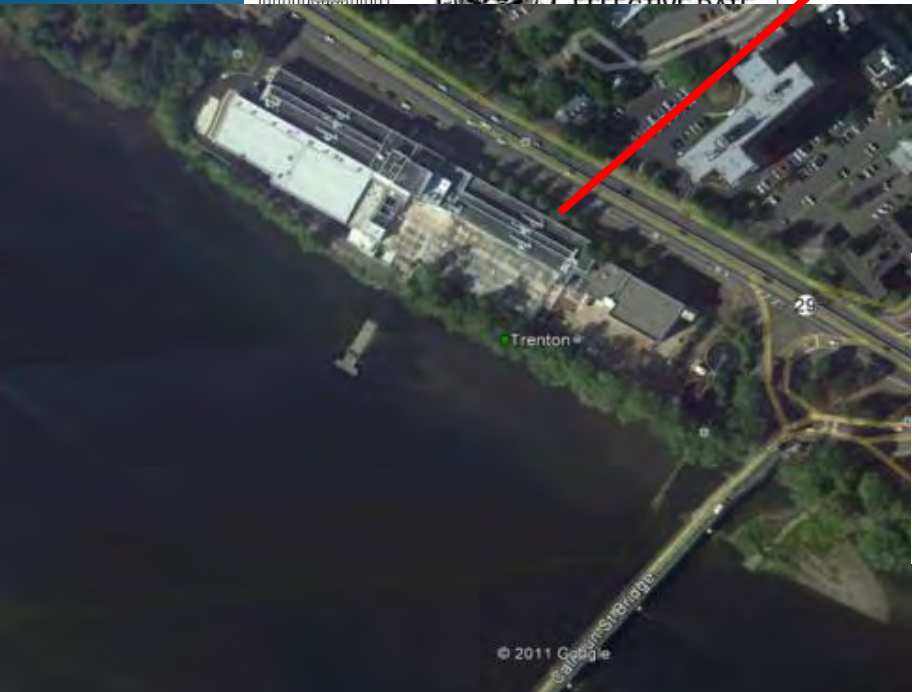
Notice to User: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.



MAP NUMBER  
34021C0206F

EFFECTIVE DATE

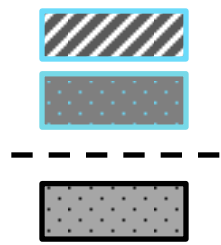
# Trenton Water Works



6'52.5"

415000 FT

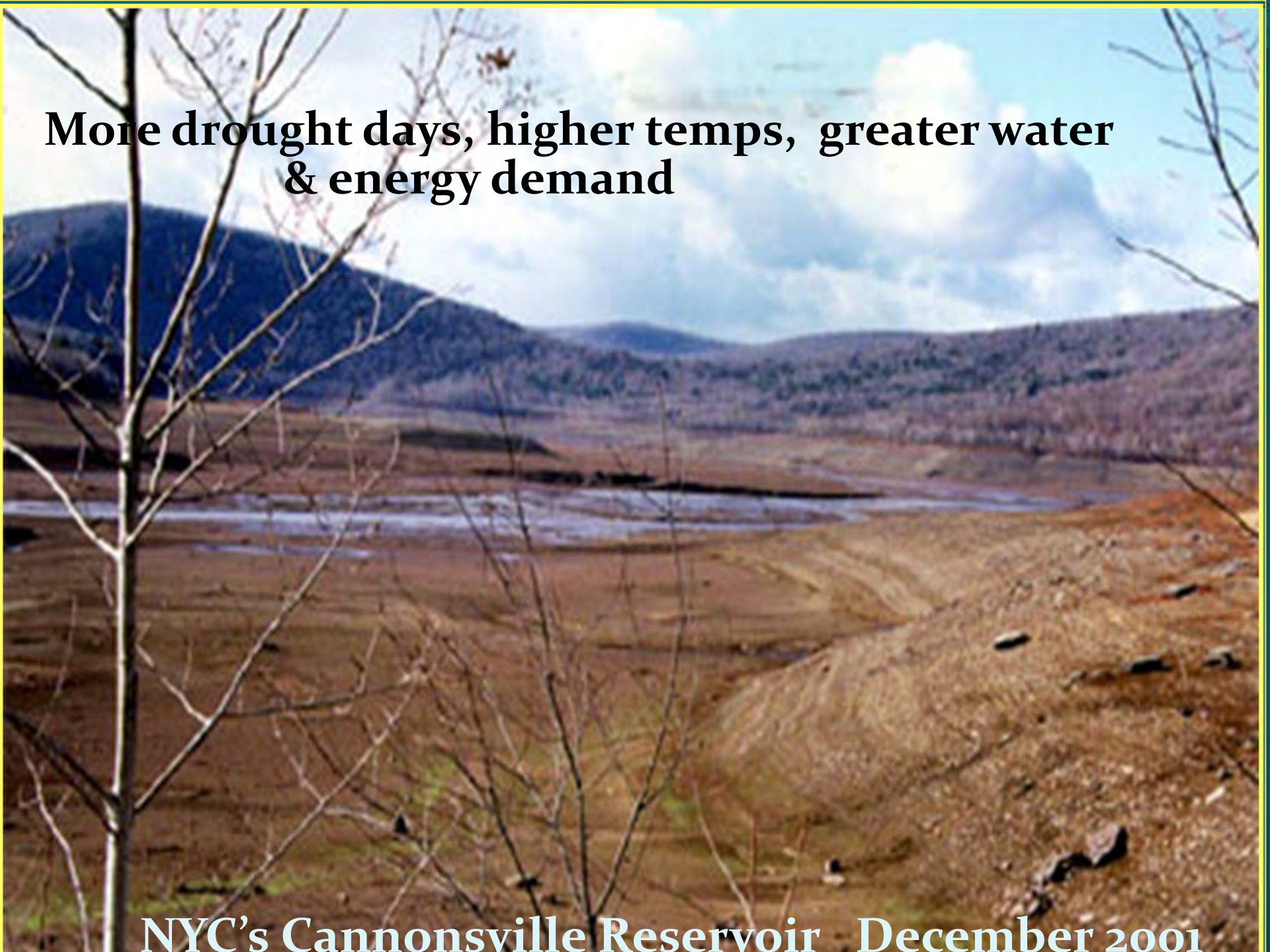
Floodway  
 100 yr Floodplain  
 NJ Flood hazard area  
 500 yr Floodplain





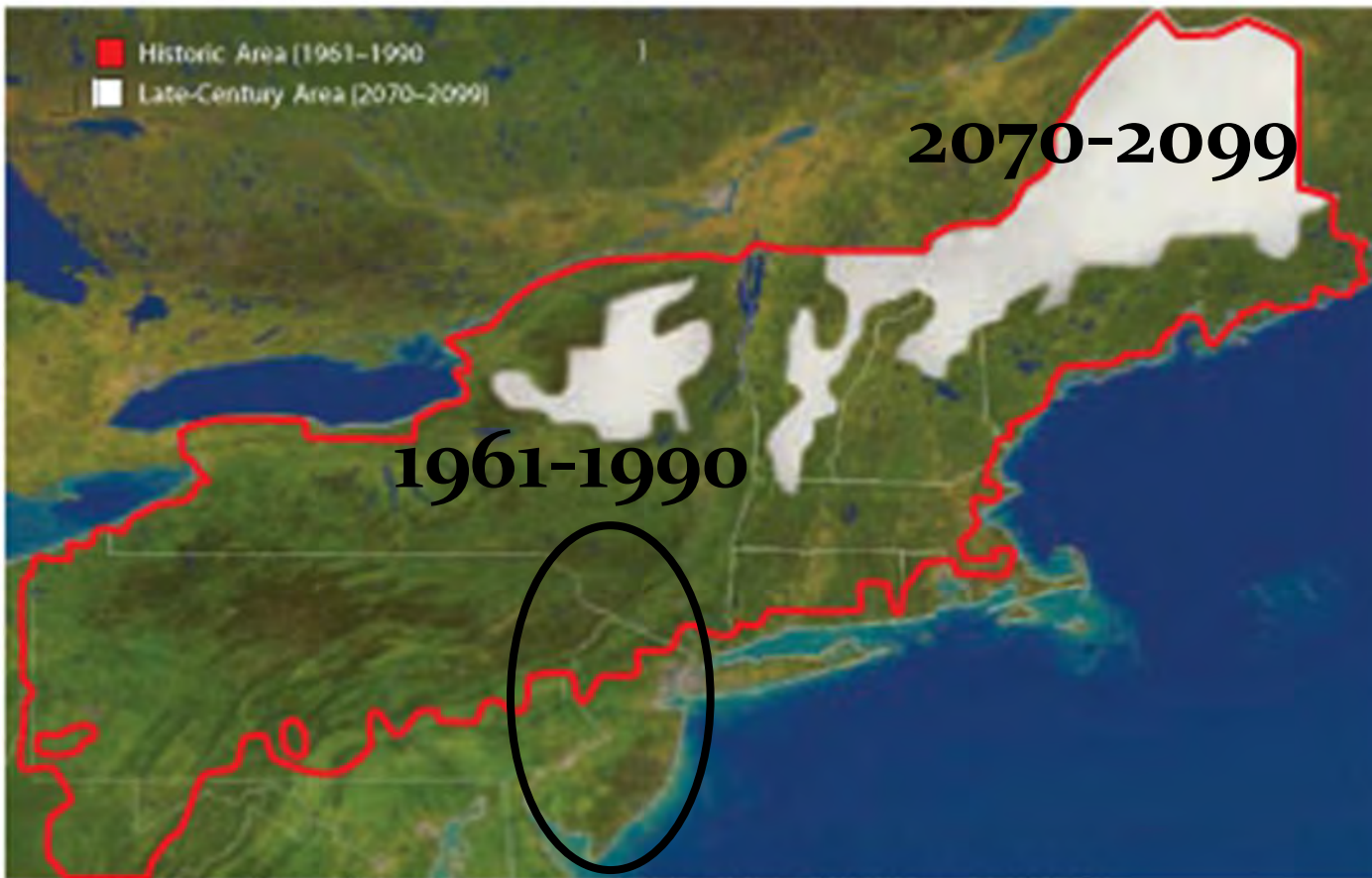
**More drought days, higher temps, greater water  
& energy demand**

**NYC's Cannonsville Reservoir December 2001**



# Seasonal Delivery Changes

## The Changing Face of Winter - High Emissions Scenario



Implications for reservoir operations, instream flows, aquatic habitat, assimilative capacity, water quality.

# Water Infrastructure & Climate Change

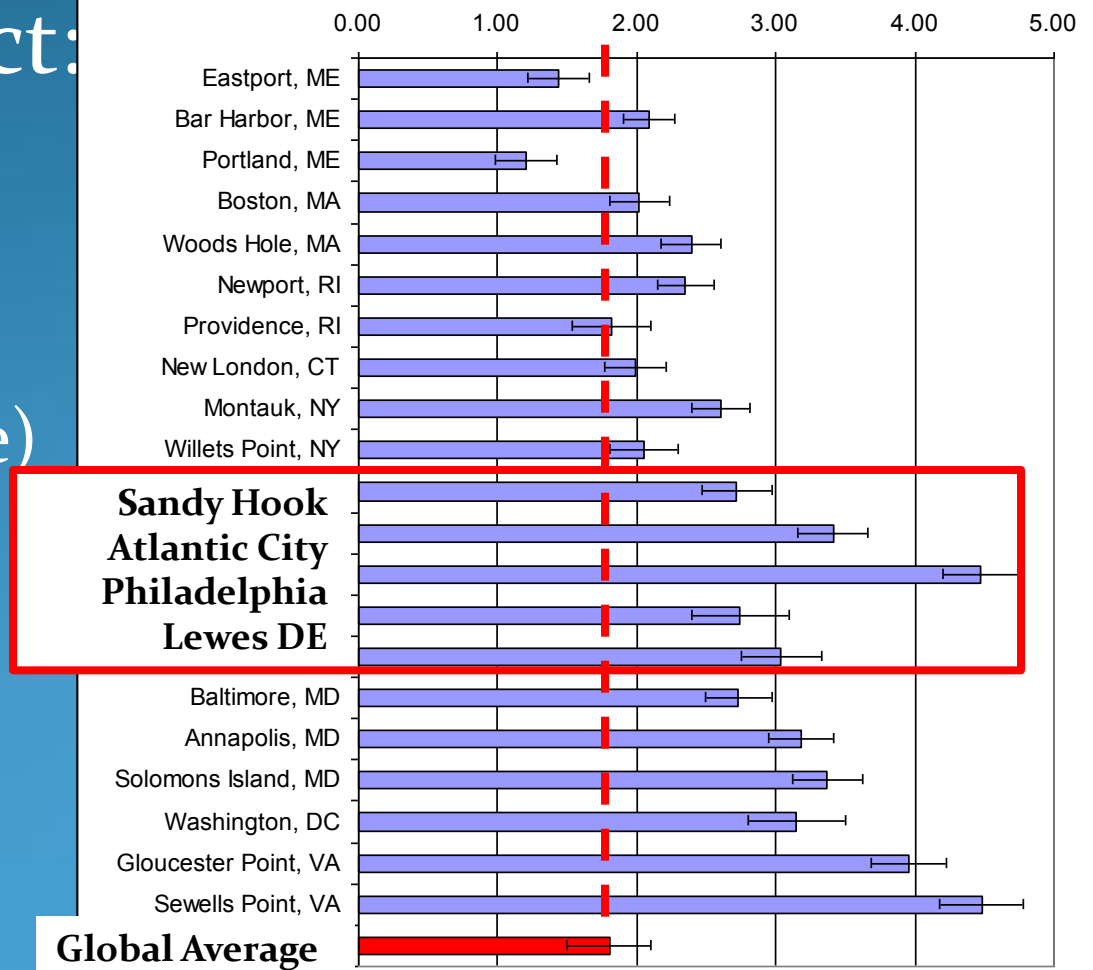
Source – Ray Najjar

What we can expect:

## 3. Sea Level Rise

- Inundation:  
(height & tidal range)
- Storm surge
- Salinity

**Northeast US Sea level trends, 1950-1999  
(mm/yr)**



## What's vulnerable?

- All coastal & waterfront infrastructure
- Fresh water intakes on tidal rivers
- Unconfined aquifer wells (storm surge)
- Confined aquifer wells (saltwater intrusion)
- Systems in need of repair

# Water Intakes at Risk

2008 PennDesign Studio:

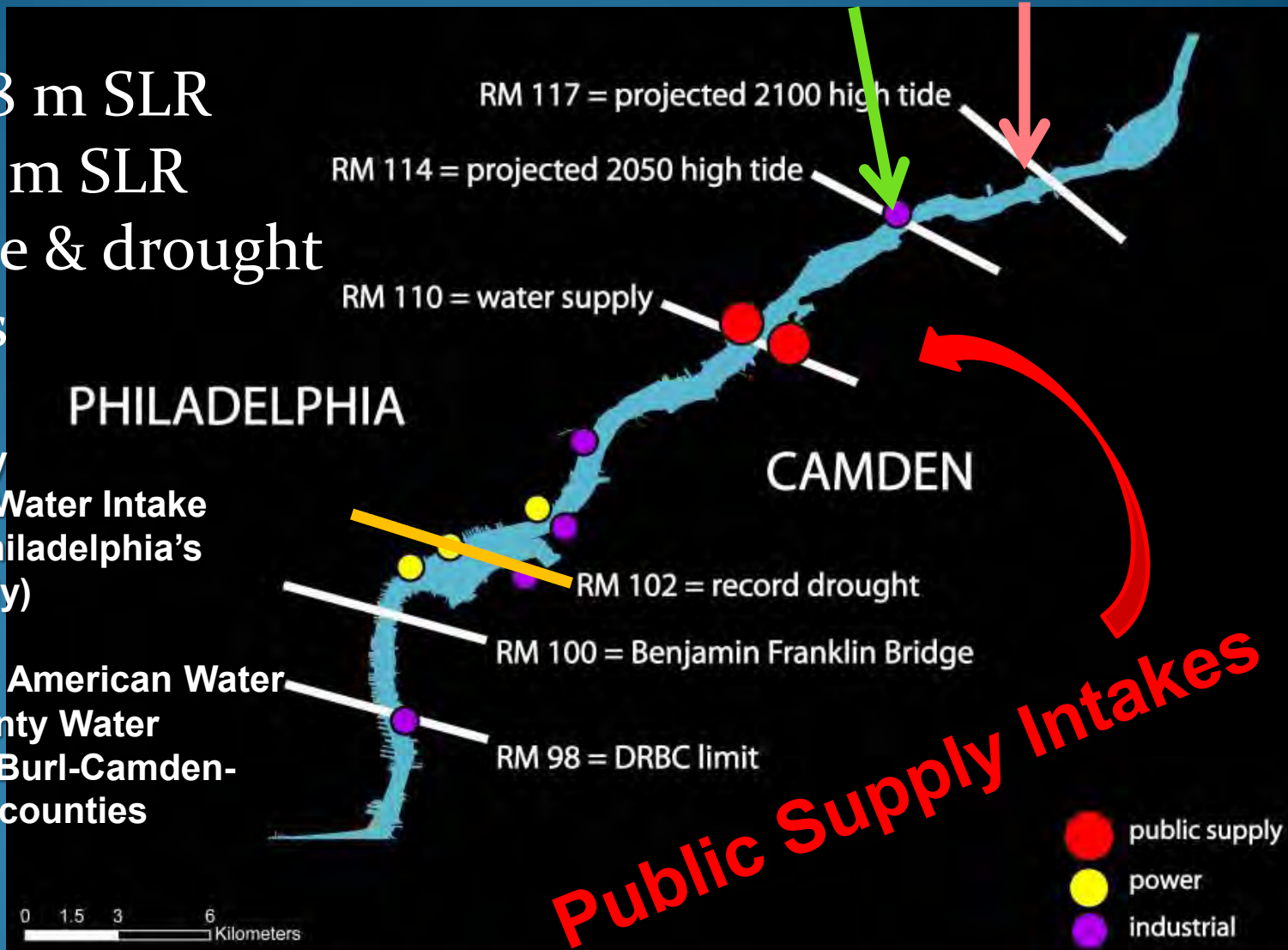
*Projected locations of the salt line 2050 & 2100*

2050 +0.48 m SLR

2100 +1.06 m SLR

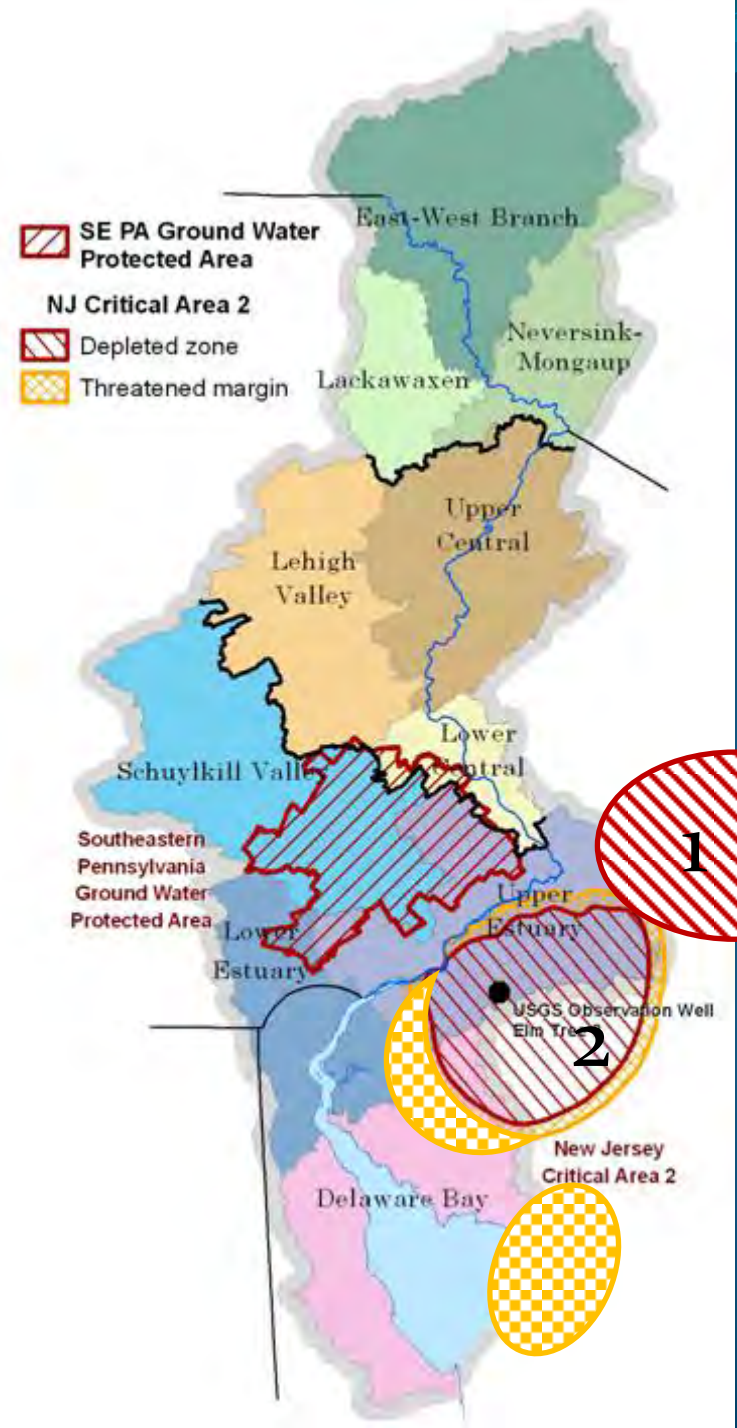
at high tide & drought conditions

- Public Supply
  - Torresdale Water Intake (~60% of Philadelphia's water supply)
  - New Jersey American Water Co. Tri-County Water Treatment: Burl-Camden-Gloucester counties



# Existing problem: Critical Areas - Ground Water Supply

- 2 NJ Critical Areas plus additional areas of concern
- Emphasis on conjunctive use: surface water alternative is crucial
- Coastal wells vulnerable to saltwater intrusion & overwash

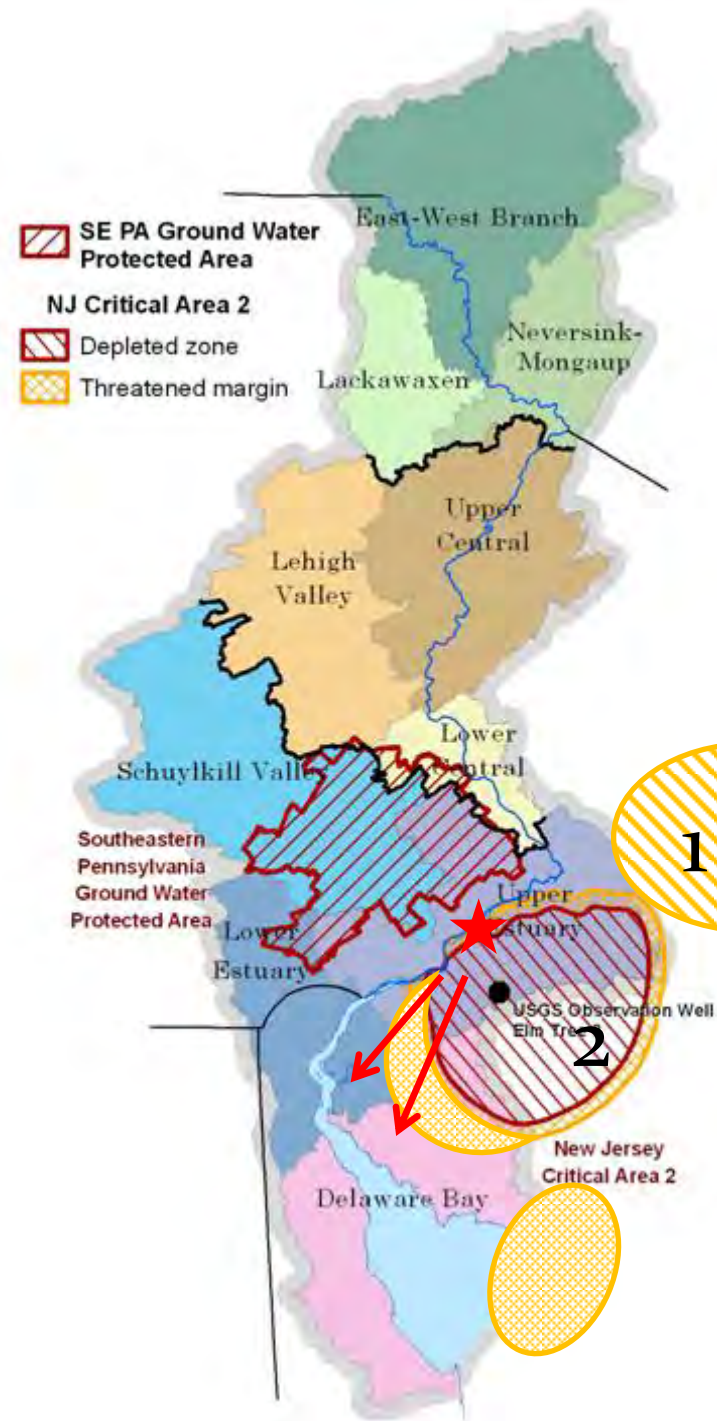


# Existing problem: Critical Areas - Ground Water Supply

Planned alternative supply:  
Delaware River water

Intake vulnerable to:

- SLR
- decreased flow from major tributaries
- (increased consumptive use)



# 2009 NJ Clean Water Council Public Hearing: Water Policy & Climate Change

The over-arching message :

“New Jersey should **integrate** consideration of the effects of changing climatic conditions into its planning, assessment and regulatory programs to:

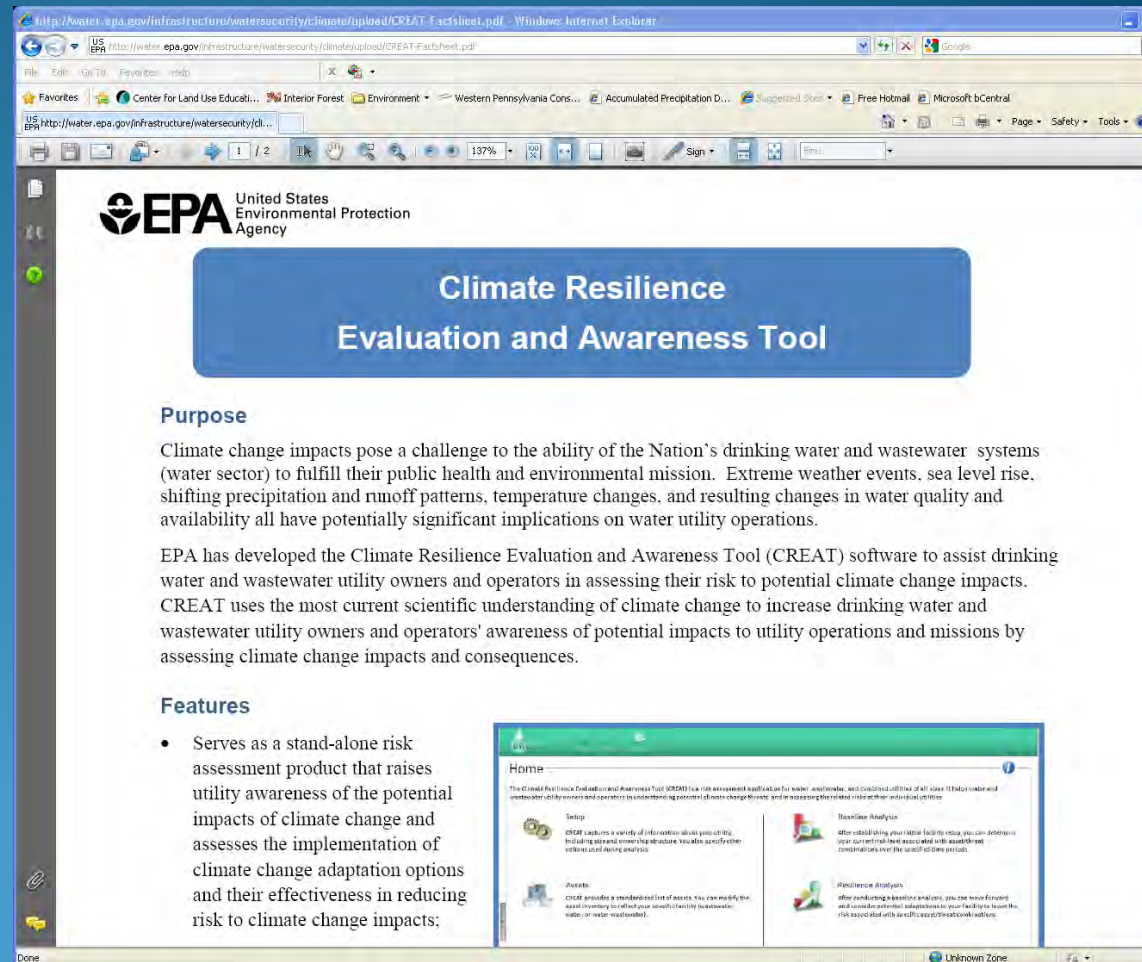
- increase program flexibility,
- avoid foreseeable negative impacts, and
- maximize programmatic and fiscal efficiency.”

<http://www.nj.gov/dep/cleanwatercouncil/>



# EPA: CREAT for Utilities Climate Resilience Evaluation & Awareness Tool

- Assets
- Threats
- Adaptive Measures
- Baseline Analysis
- Resilience Analysis
- Implementation Planning
- Results & Reports



The screenshot shows a web browser window displaying the EPA website. The URL is <http://water.epa.gov/infrastructure/watersecurity/climate/upload/CREAT-Factsheet.pdf>. The page features the EPA logo and the text "United States Environmental Protection Agency". A prominent blue button reads "Climate Resilience Evaluation and Awareness Tool". Below this, the "Purpose" section states: "Climate change impacts pose a challenge to the ability of the Nation's drinking water and wastewater systems (water sector) to fulfill their public health and environmental mission. Extreme weather events, sea level rise, shifting precipitation and runoff patterns, temperature changes, and resulting changes in water quality and availability all have potentially significant implications on water utility operations." The "Features" section includes a bullet point: "Serves as a stand-alone risk assessment product that raises utility awareness of the potential impacts of climate change and assesses the implementation of climate change adaptation options and their effectiveness in reducing risk to climate change impacts;". A small inset image shows the CREAT software interface with a "Home" page and several menu items: "Setup", "Baseline Analysis", "Assess", and "Resilience Analysis".

CREAT is available for download at  
<http://water.epa.gov/infrastructure/watersecurity/climate/creat.cfm>

# Water Infrastructure & Climate Change

## 21st Century water management



Aerial view of a typical wastewater treatment plant

### Old paradigm

- Highly specialized
- Centralized
- Segregated
- Linear
- Extractive



### New paradigm

- Multifunctional
- Decentralized
- Integrated
- Systemic
- Restorative
- Adaptive

# Water Infrastructure & Climate Change

“Adaptation to climate change is now inevitable . . .  
The only question is will it be by plan or by chaos?”

Roger Jones, CSIRO, Australia; Co-author of IPCC



## 4. Synergistic & systemic effects

