EPA's Stormwater Program and Improving Resiliency with Green Infrastructure

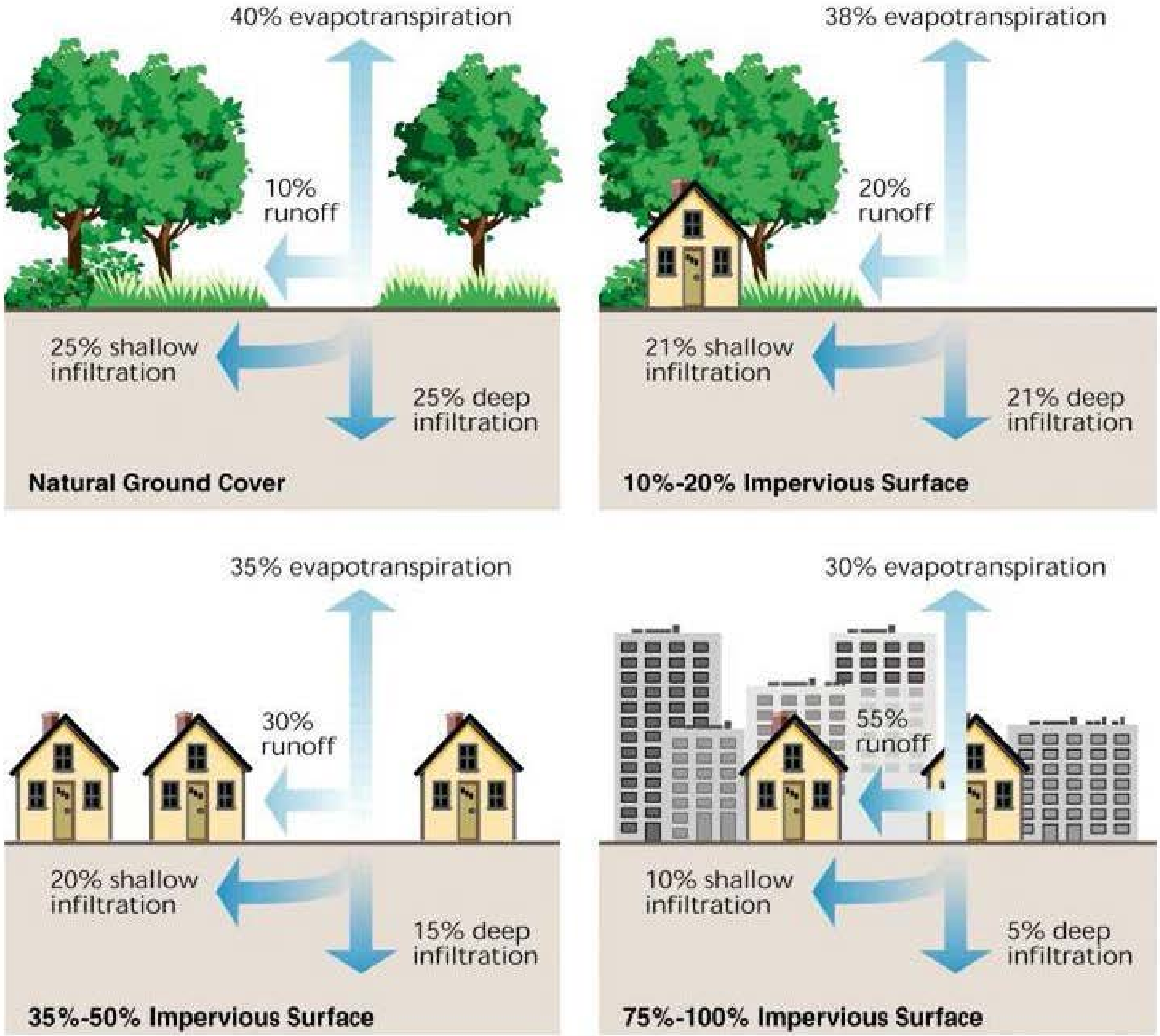
Holly Galavotti, US EPA Office of Water

Infiltration trench in MD parking lot

Stormwater is a Leading and Growing Cause of Water Pollution

- Urban stormwater is a leading source of impairment (2004 WQ Report):
  - 22,559 miles of impaired rivers and streams
  - 701,024 acres of impaired lakes
  - 867 square miles of impaired estuaries
- #1 cause of beach closures and advisory days in 2012.
- Combined sewer systems in more than 700 municipalities in 31 states and the District of Columbia discharge an estimated 850 billion gallons of CSOs each year.
- Only increasing source of water pollution in Chesapeake Bay.

Altering the Hydrologic Cycle



Street flooding after ½” rainfall in Ocean City, NJ, August 2011

Climate Impacts on Water Resources

↑ frequency of **heavy precipitation** events across the U.S.

↑ **streamflow** in the eastern U.S.

↓ duration and extent of **snow cover** in most of North America

↓ annual precipitation in the Central Rockies and Southwest

↓ mountain snow water equivalent in Western North America

↓ runoff and streamflow in the Colorado and Columbia River basins

↓ the proportion of precipitation falling as snow in the West

↑ **periods of drought** in the West

↓ 25-40% by 2050 and potentially 70-90% 2100 of the Sierra snowpack

Prettyboy Reservoir, Maryland during 2002 drought. *Photo courtesy of National Weather Service.*

Bryson B. Bates, Z.W. Kundzewicz, S. Wu, and J.P. Palutikof, Eds., *Climate Change and Water*, Technical Paper of the Intergovernmental Panel on Climate Change, IPCC Secretariat, Geneva, 2008.

David S. Beckman, N. Garrison, R.C. Wilkinson, and R. Horner, *A Clear Blue Future: How Greening California Cities Can Address Water Resources and Climate Challenges in the 21st Century*, Natural Resources Defense Council, August 2009.

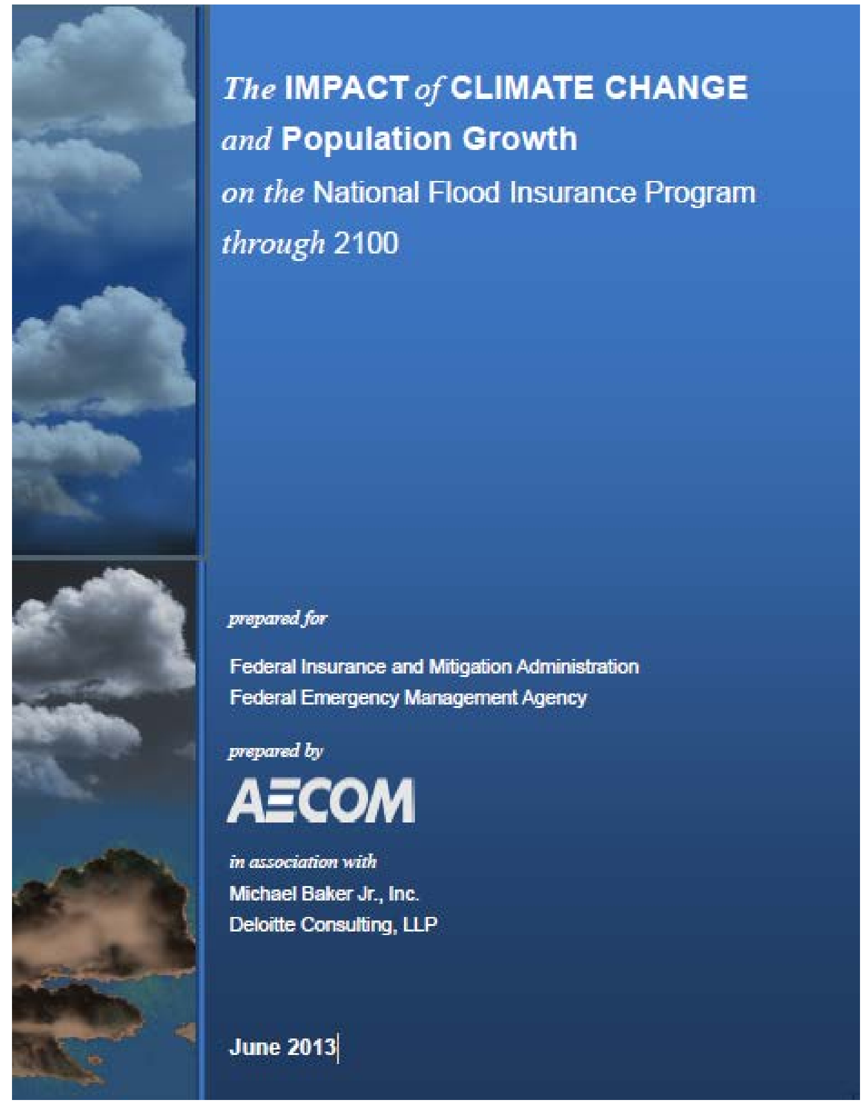
Climate Impacts & Stormwater

- In some areas, "wet weather" stormwater issues will conflate with increased intensity and frequency of precipitation events associated with climate change.
- Expansion of 100-year floodplain over the coming decades

  1/3 due to upstream development

  2/3 due to climate change

FEMA, 2013



Integrating Green Infrastructure: Infiltrate, evapotranspire and harvest and use stormwater

Bioretention Cell in El Monte, CA
Photo Credit: Bill DePoto

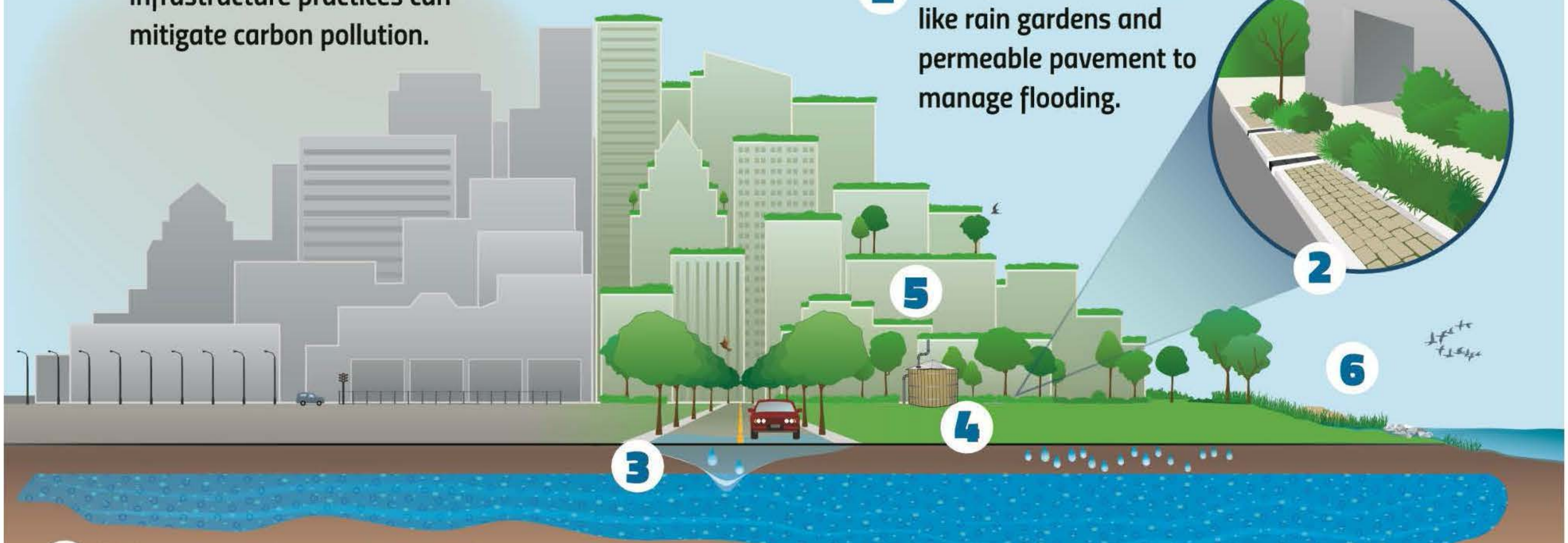
Chicago City Hall

Permeable pavement and bioretention in Albuquerque, NM
Photo courtesy of AridLID.org

Green Infrastructure Builds Resiliency

1 Vegetation-based green infrastructure practices can mitigate carbon pollution.

2 Build green infrastructure like rain gardens and permeable pavement to manage flooding.



3 Reduce dependence on imported water and save money.
Let water soak into the ground to recharge local groundwater supplies.

4 Keep water local. Capture runoff in cisterns and rain barrels to reduce municipal water use.

5 Plant trees and green roofs to mitigate the urban heat island effect.

6 Use living shorelines, buffers, dunes and marsh restoration to reduce the impact of storm surges.

United States Environmental Protection Agency

For more information on green infrastructure, see:
www.epa.gov/greeninfrastructure

Increasing Resiliency with Green Infrastructure

- Flooding
  - Menomonee River revitalized brownfield site now mitigates impacts of localized flooding up to the 100 year storm event.
  - 70 acre stormwater park provides a high-value community recreation asset.

- Groundwater recharge
  - LA study indicated that BMPs could produce benefit of additional groundwater supplies that have a 2005 value of $7.2 billion (Devinny et. al. (2005))

Menomonee River Green Infrastructure Project, Milwaukee, WI.
Photo Courtesy of MMSD.

Green Infrastructure: Water Reuse

Water harvesting practices can capture runoff for on-site use and decrease potable water demand.

Infiltration practices can be used to recharge groundwater supply and restore flow to streams, rivers, lakes, and reservoirs.

Syracuse War Memorial Arena
First system in the country designed to use harvested rainwater (15,000 gallon cistern system) for a hockey rink and is one of only a handful around the world

Rainwater Harvesting

Rainwater cisterns used to capture rainwater at the Texas Medical Center School of Nursing. Photo courtesy of Suzanna Perea.

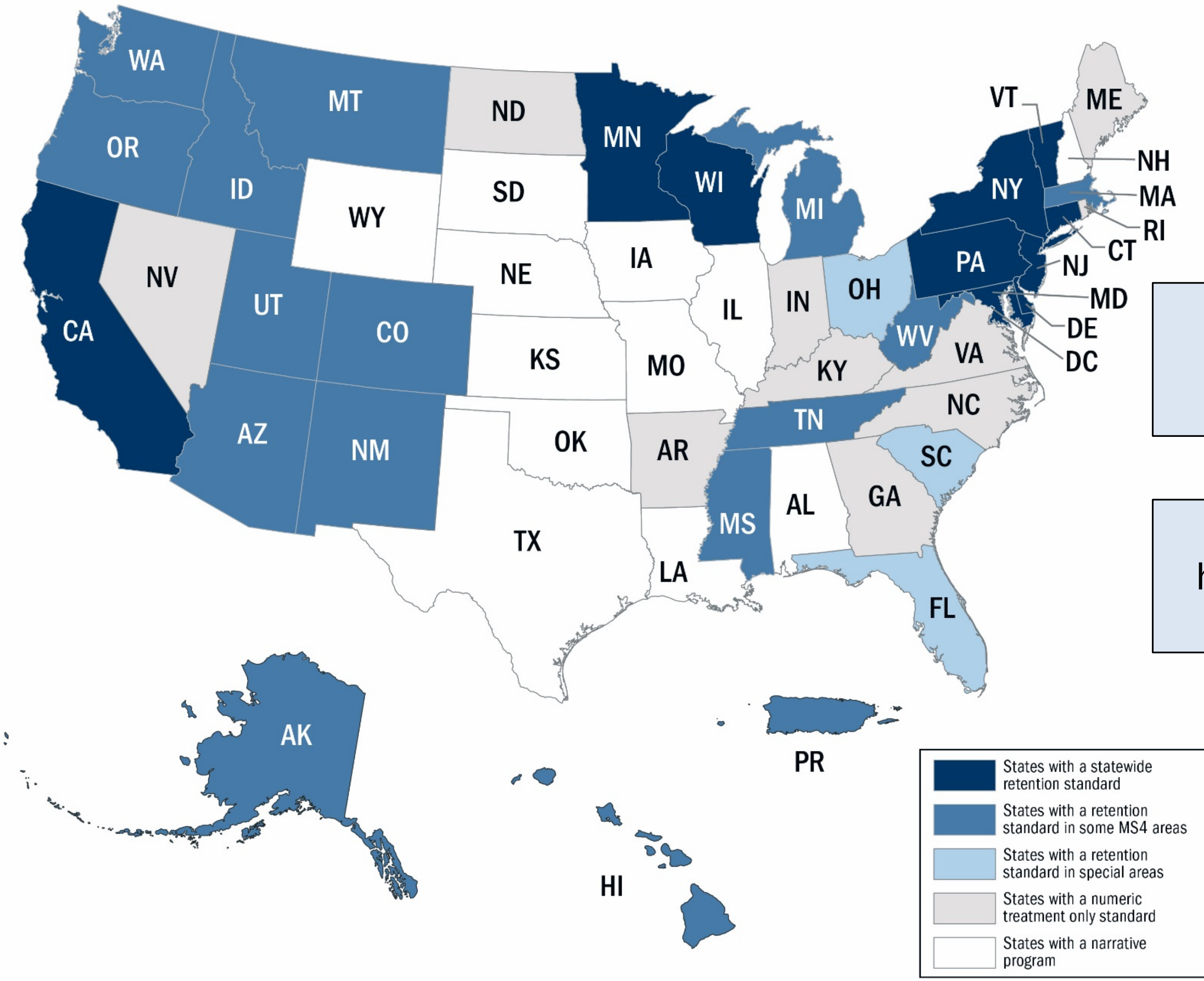
Municipal Separate Storm Sewer System (MS4) Program

Green street retrofit in Lansing, MI.
Photo credit Dan Christian, Tetra Tech.

Minimum Control Measures:

- Public Participation/ Involvement
- Public Education and Outreach
- Illicit Discharge Detection and Elimination
- Construction Site Stormwater Runoff Control
- Post Construction Stormwater Management in New Development and Redevelopment
  - *28 states have some type of retention standard that promote green infrastructure*
- Pollution Prevention/Good Housekeeping

Retention/Volumetric & Treatment Post Construction Standards Across the Country



28 states, DC & PR have some type of retention standard

10 states have a treatment only standard

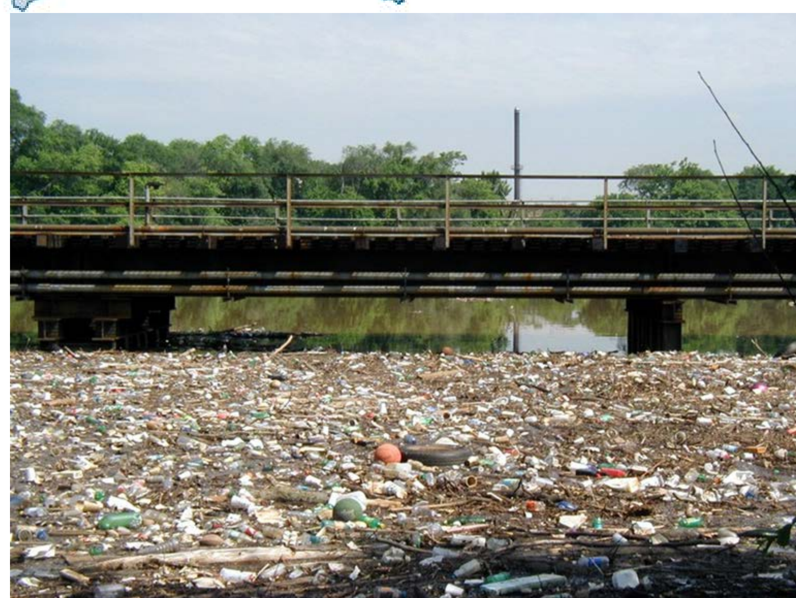
12 states have a narrative program

Retention/Volumetric Post Construction Standards for Discharges from New Development in MS4 permits

MS4 Permit	Standard
WV small MS4 (2009)	Keep and manage on site 1” rainfall from 24-hour storm , preceded by 48 hours of no rain
MT small MS4 (2009)	Infiltrate, evapotranspire, or capture for reuse runoff from first 0.5” of rain
Anchorage, AK Phase I MS4 (2009)	Keep and manage the first 0.52 inches rainfall from a 24 hour event preceded by 48 hours of no measureable precipitation.
Middle Rio Grande Watershed MS4 (2014)	Capture 90th percentile rainfall event
UT small MS4 (2016)	Retain on-site the 90th percentile storm event
MA small MS4 (2016)	Retain 1 inch multiplied by the impervious area and/or meet treatment standard
PR small MS4 (2016)	Retain 1 inch, if practicable
MS small MS4 (2016)	Develop site designs and require measures that infiltrate, evapotranspirate, harvest and/or use first inch of rainfall
CO small MS4 (2016)	Infiltrate WQ control volume (80th percentile storm event) – one of seven standards

Combined Sewer Overflow Program

- Combined sewer systems in more than 700 municipalities in 31 states and the District of Columbia discharge an estimated 850 billion gallons of CSOs each year.
- 1994 CSO Control Policy requires plans to be developed to significantly reduce overflows
- Investment needs estimated to be several hundred billion dollars.



Trash on the Anacostia River.

Lancaster, PA Case Study

Collection & Treatment Savings:

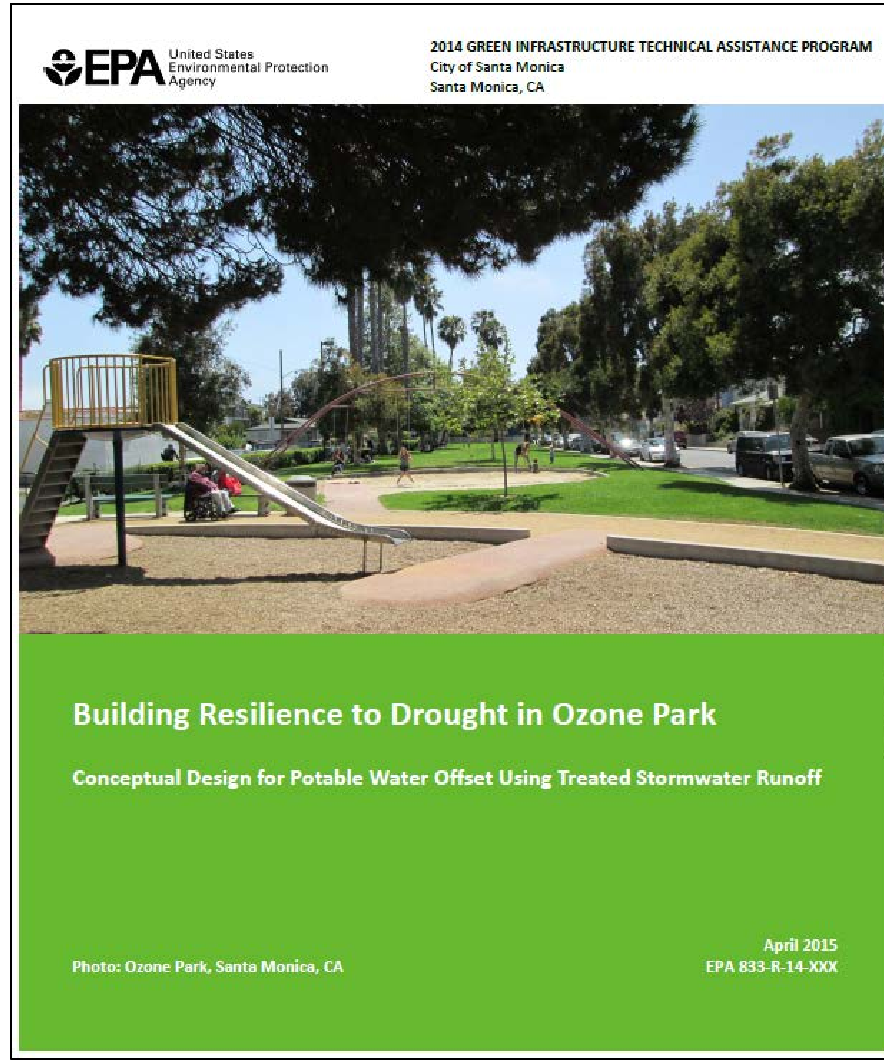
- Using green infrastructure within CSS area is estimated to reduce stormwater inflow into sewer system by 700 MG and CSOs by more than 500 MG.
- Resulting estimated pumping and treatment savings of more than $660,000 annually.

Estimated Value of Avoided Costs for Wastewater Treatment & Storage at 25-Year Implementation*	
Reduced Pumping and Treatment Costs (per year)	$661,000
Reduced Gray Infrastructure Capital Costs	$120,000,000

*Benefits of green infrastructure stormwater reduction outside the CSS area were not included in this analysis

Green Infrastructure Technical Assistance

- More than $2 million provided to 39 communities
- Tools, Strategies and Lessons from EPA Green Infrastructure Technical Assistance Projects (2015)
- 3 resiliency projects:
  - Norfolk, VA – address coastal flooding and sea level rise
  - Iowa City, IA – riverfront park options to manage flooding
  - Santa Monica, CA – rainwater harvesting for public park irrigation: using a cistern and a 0.5-acre foot underground infiltration gallery. The system has the potential to provide up to 100% of the approximately 450,000 gallon annual irrigation demand at Ozone Park.


EPA United States Environmental Protection Agency

2014 GREEN INFRASTRUCTURE TECHNICAL ASSISTANCE PROGRAM
City of Santa Monica
Santa Monica, CA

Building Resilience to Drought in Ozone Park

Conceptual Design for Potable Water Offset Using Treated Stormwater Runoff

Photo: Ozone Park, Santa Monica, CA

April 2015
EPA 833-R-14-XXX

Green Infrastructure Technical Assistance

4 resiliency charrettes:

- Albuquerque, NM– focus on water management in arid environment
- Grand Rapids, MI – focus on stormwater management
- New Orleans, LA- focus on localized flooding
- Los Angeles, CA – focus on stormwater for water supply
  - Using Green Instructure along Transportation Corridors to treat and infiltrate stormwater into the aquifers for eventual use as drinking water
  - Charrette built upon the city’s development of a design tool, Greenways to Rivers Arterial Stormwater System (GRASS)

US EPA Green Infrastructure

www.epa.gov/greeninfrastructure