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Border Green Infrastructure Forum: 20



Resilience and Competitiveness for the Cities of the United States-Mexico Border

The City of Tucson: Experience in Formalizing Regulations Related to Green Infrastructure

Cibeles Convention Center
Cuidad Juarez, Chihuahua, Mexico
September 18-19, 2014

Irene Ogata, Urban Landscape Manager, PLA, ASLA
Office of Integrated Planning
City of Tucson, Arizona, USA

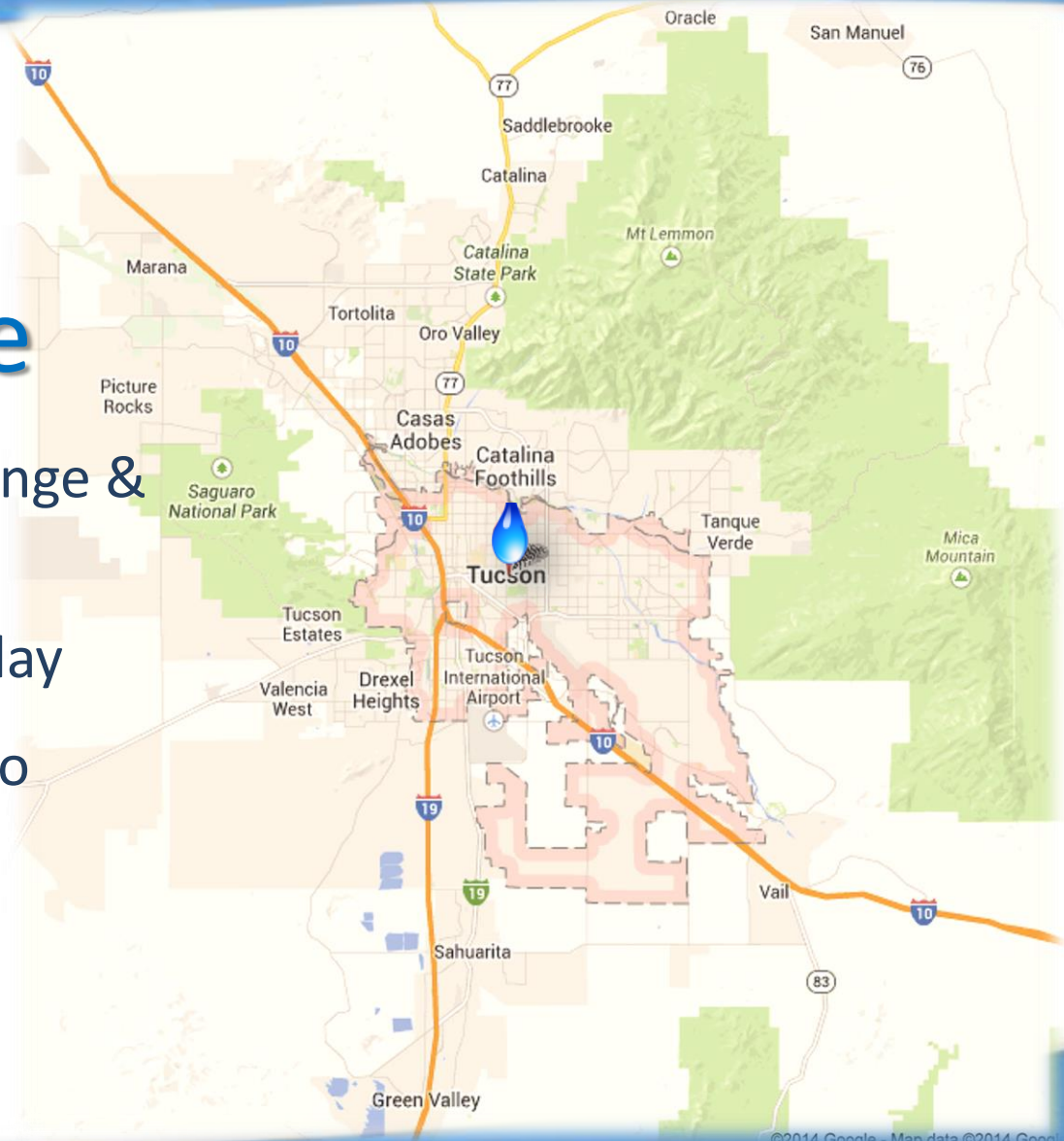
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The Experience

- ❧ The Future: Climate Change & Water Resources
- ❧ Balancing Challenges today
- ❧ Moving from Voluntary to Standards of Practice



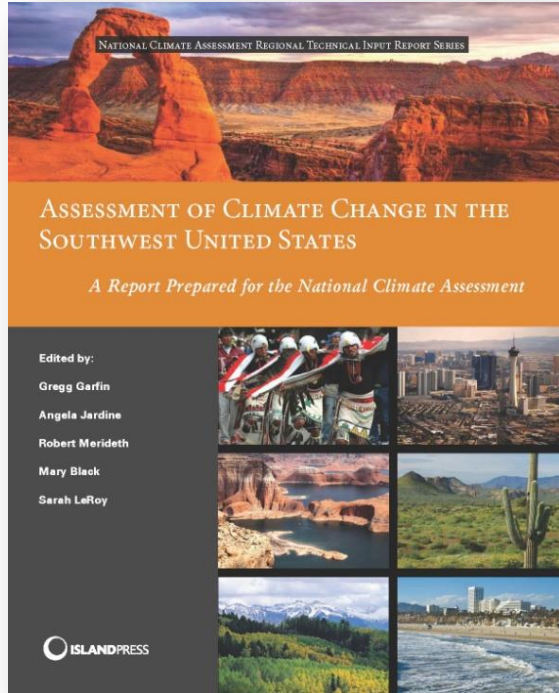
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Balancing Challenges:

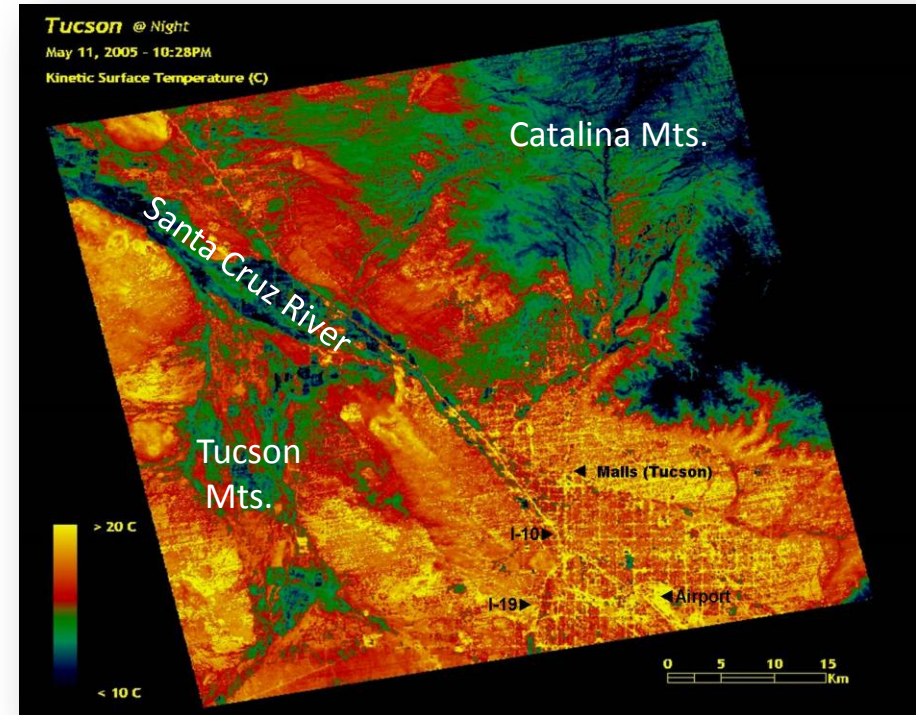
Water Resource & Urban Heat Island



Chapter 15. Human Health

Coordinating Lead Authors: Heidi Brown (Univ. of AZ); Andrew C. Comrie (Univ. of AZ); Deborah M Dreschler (CA Air Resources Board)

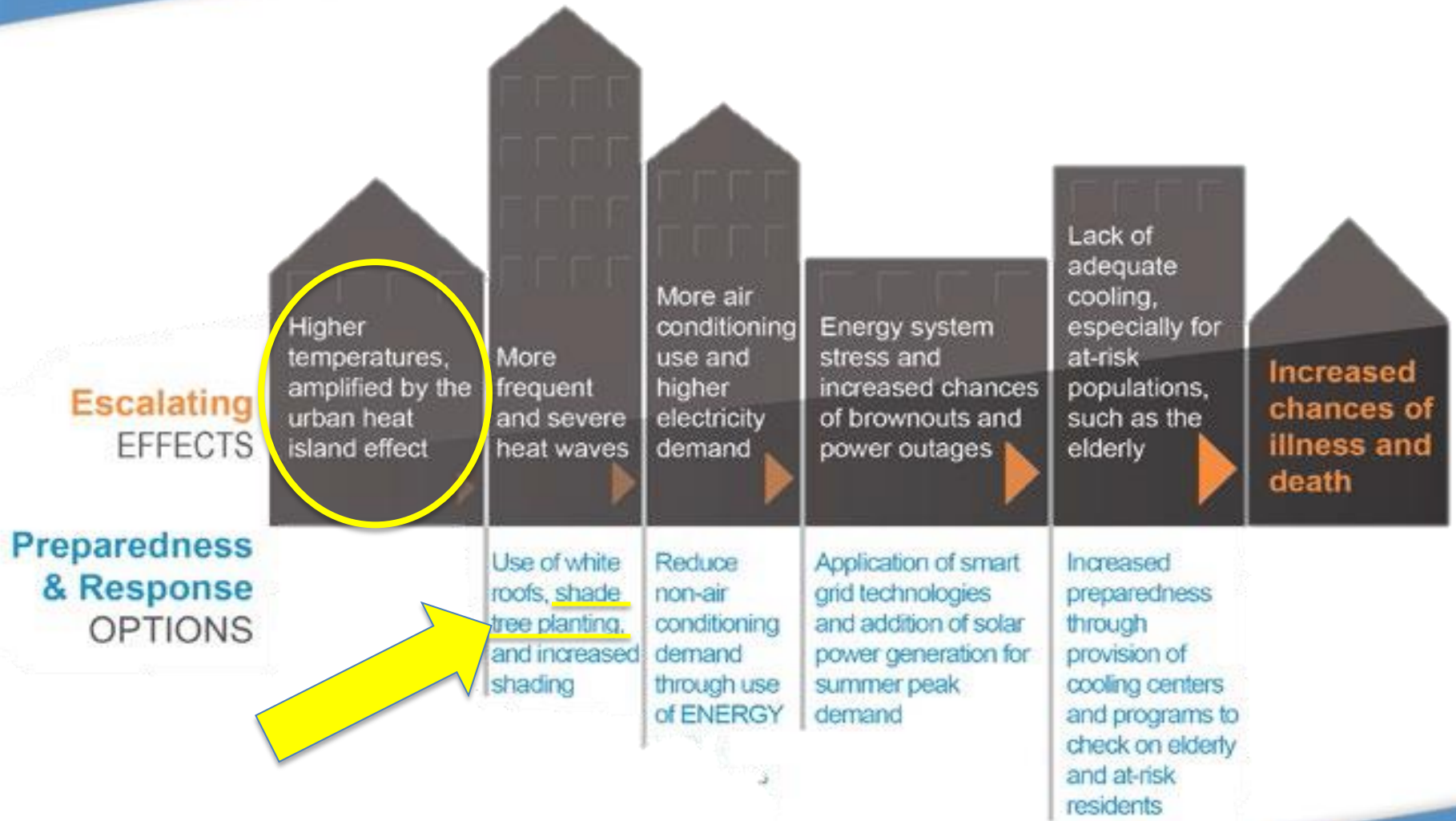
“**Heat stress**, a recurrent health **problem for urban residents**, has been the leading weather-related cause of death in the United States since 1986. . . – and the **highest rates nationally are found in Arizona**.



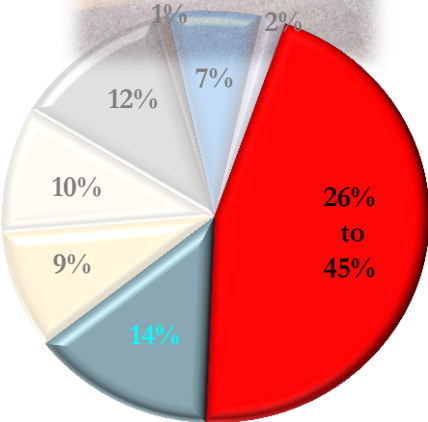
Kinetic Surface Temperature
Tucson Basin, 2005

Dr. Jay Golden, ASU, SMART Center, National Center of Excellence

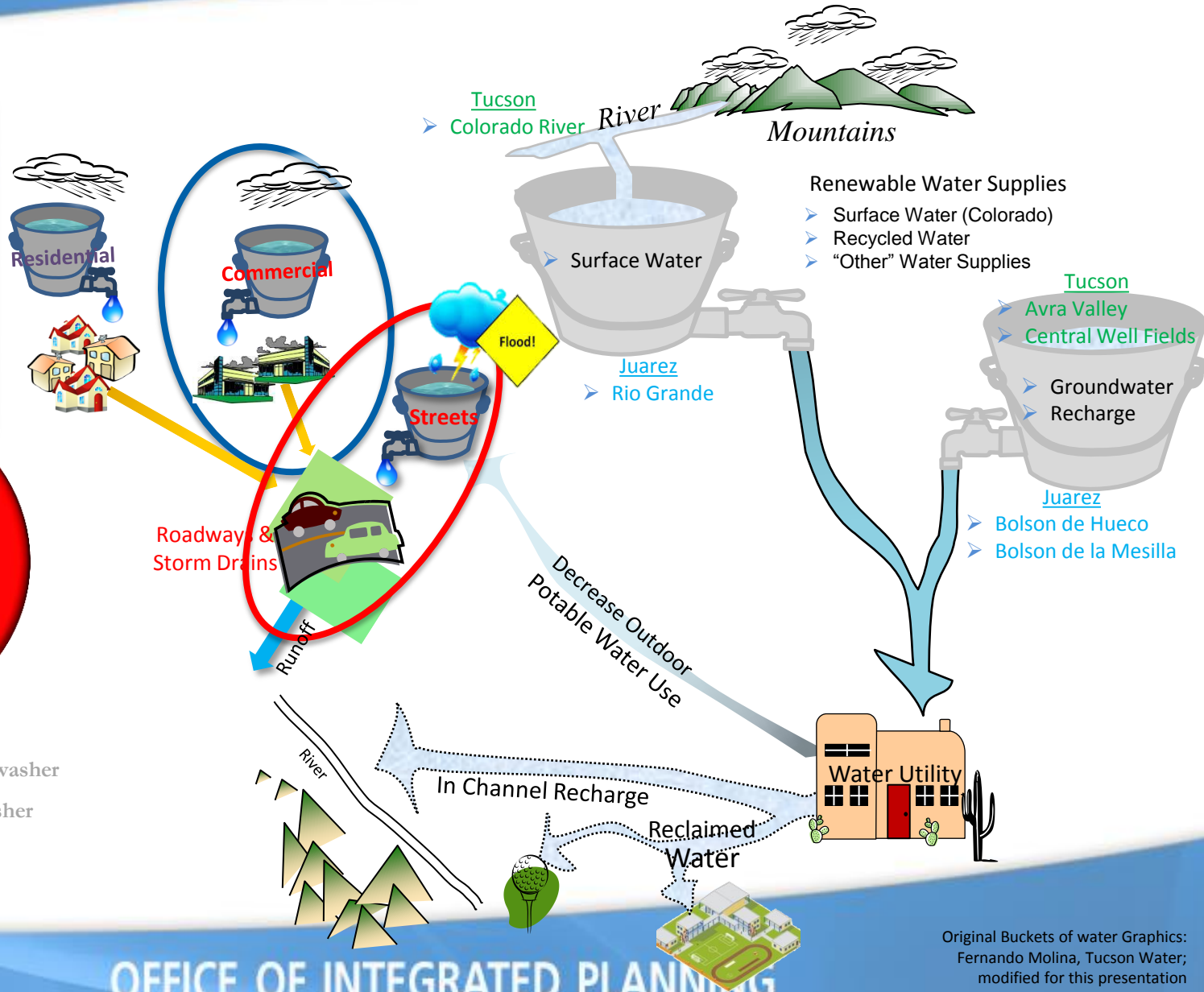
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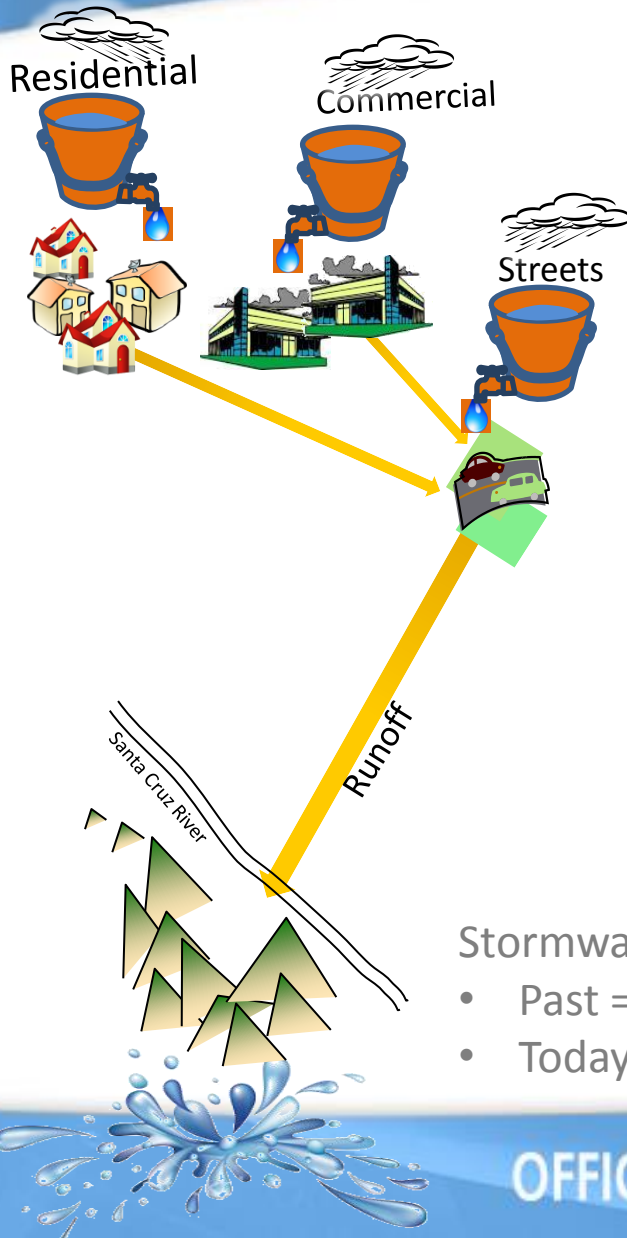
Garfin, G., G.Franco, H. Blanco, A.Comrie, P.Gonzalez, T.Piechota, R.Smyth, and R.Waskom, 2014: Ch. 20: Southwest. *Climate Change Impacts in the United States: The Third National Climate Assessment*, J.M.Melillo, Terese (T.C.) Richmond, and G.W.Yohe, Eds, U.S. Global Change Research Programs .



■ Outdoor	■ Clotheswasher
■ Toilet	■ Dishwasher
■ Shower	■ Leaks
■ Faucet	■ Other



Original Buckets of water Graphics:
Fernando Molina, Tucson Water;
modified for this presentation



Channelized Infrastructure



Green Street Infrastructure



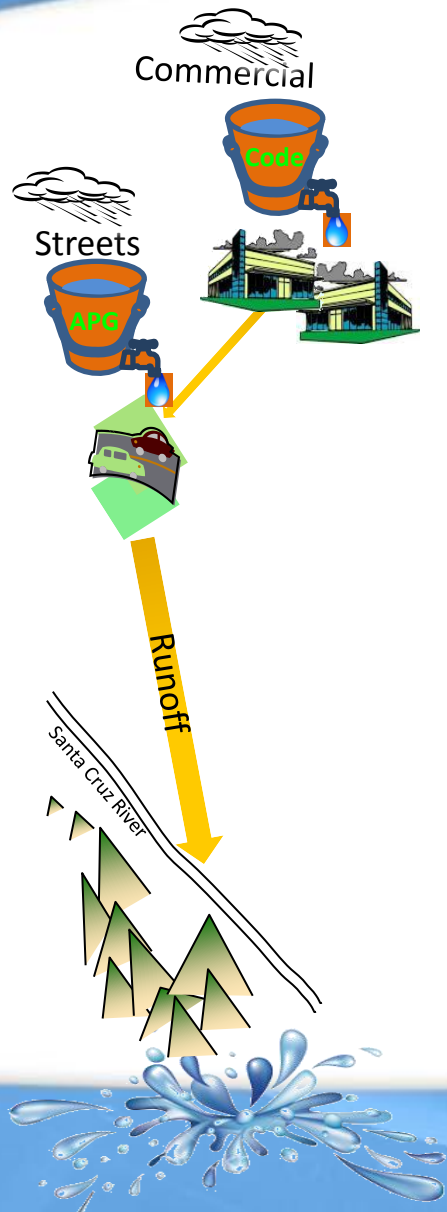
Water Quality



Environmental Benefits

Stormwater Management

- Past = move water away from development
- Today = small events → retain & infiltrate

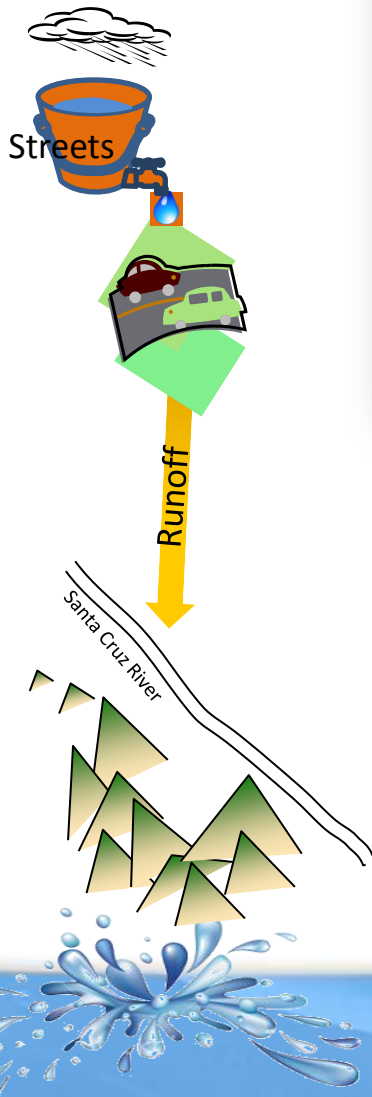


Regulatory Tools

- Ordinances/Codes = Mandatory
 - Commercial Water Harvesting Ordinance (Code)
- Policy = General Guidance; but has weight internally
 - Standard curb cut details
 - Green Streets Active Practice Guidelines (APG)



Developing Standard Practices: Rainwater Harvesting & Green Infrastructures



1998: median captures onsite rainwater

Beginning:

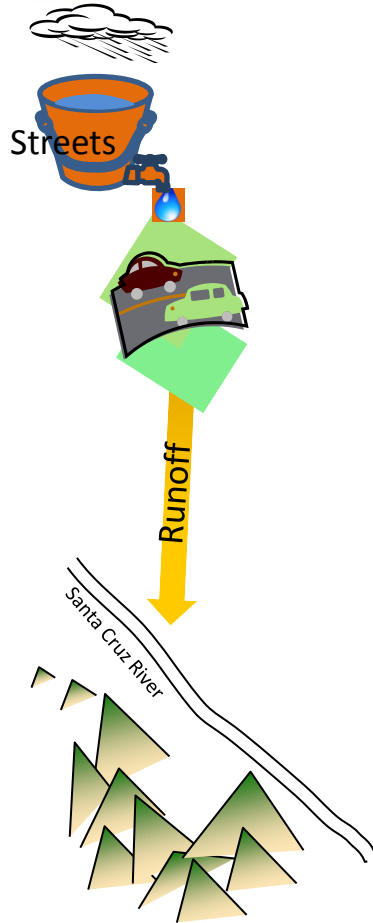
- Applying GI practices
- Sporadic application



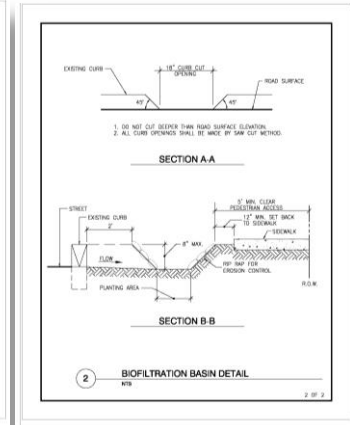
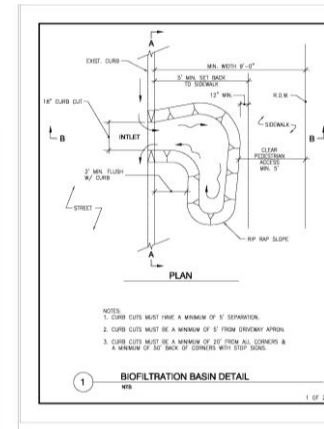
2005: median captures onsite rainwater



Developing Standard Practices: Rainwater Harvesting & Green Infrastructures



Late 1990's, early 2000's:
Transportation landscape architect
attempting to develop curb cut standards



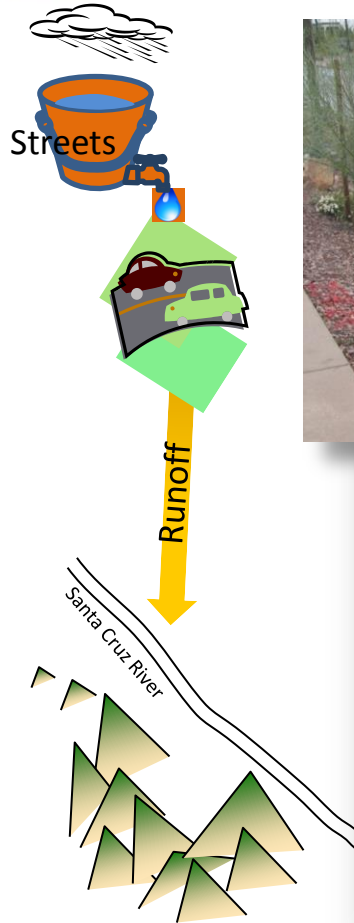
Standard Details on-line

Policy Lesson 1: Engineers talk to Engineers





Developing Standard Practices: Rainwater Harvesting & Green Infrastructures



City Manager's Office
Special Projects:
Scott Ave
Completed 2009



Parks & Recreation:
Camino de Campestre
Completed 2010





RAINWATER HARVESTING ORDINANCE HOW DID WE GET IT DONE



In Less than 2 Years!!!



Developing Standard Practices: Rainwater Harvesting & Green Infrastructures



- December 2007 Mayor & Council study session
- 3 directives to staff , ordinance for:
 - New residential to be plumbed for Gray Water
 - Residential be plumbed for solar-powered hot water heater
 - 100% commercial rainwater harvesting





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Developing Standard Practices: Rainwater Harvesting & Green Infrastructures



Mayor & Council Appointed Advisory Committee

Representatives from 14
organization representing:



Developer/Realty



Professional/Trade



Non-Profit/Other



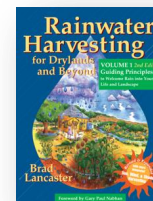
Technical Advisory Committee Staff & Resources



Water Resources
Research Center



P&DSD
OCSD
TW
TDOT
P&R



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Ordinance

Development
Standards



50% water demand met by
rainwater harvesting



Calculate plant water need



Calculate rainfall + size basins



Annual Reporting submitted to
Tucson Water

Code Lesson:

- Community **transparency**/buy-in is critical and
- Commitment to the process

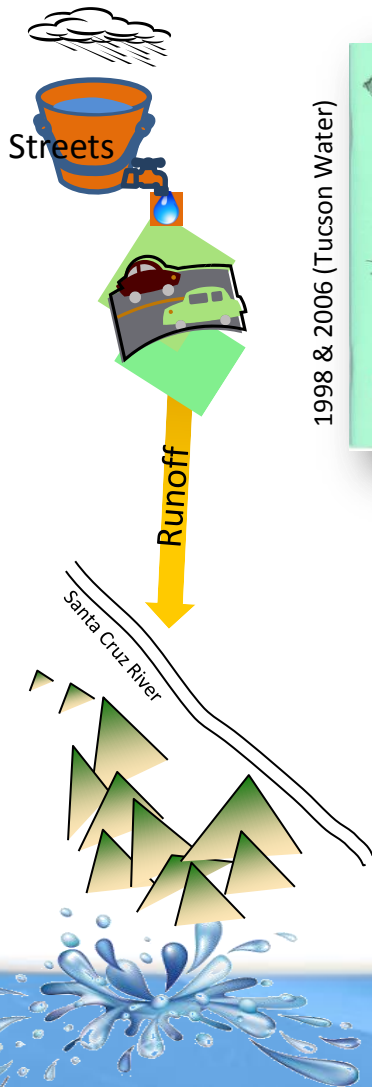


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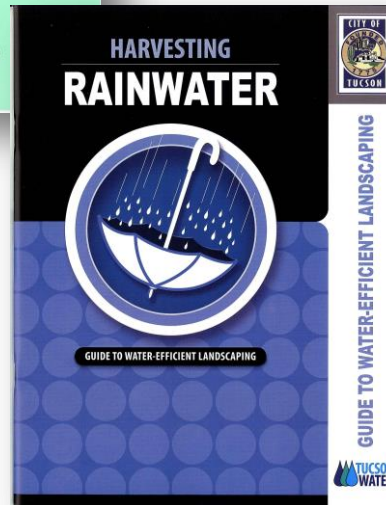
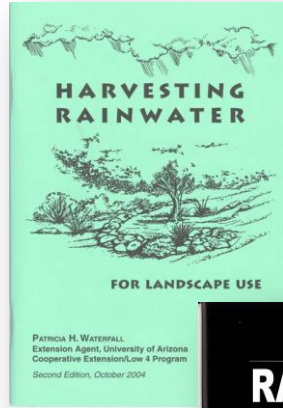
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Internal Policies:

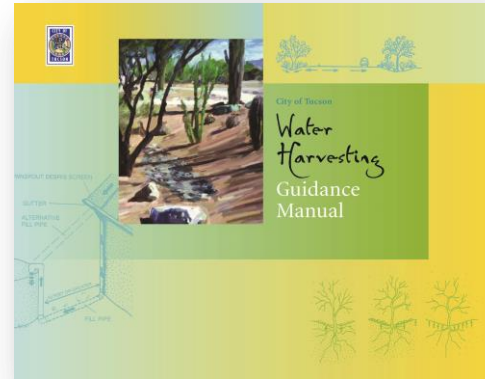
- Start with what's been done



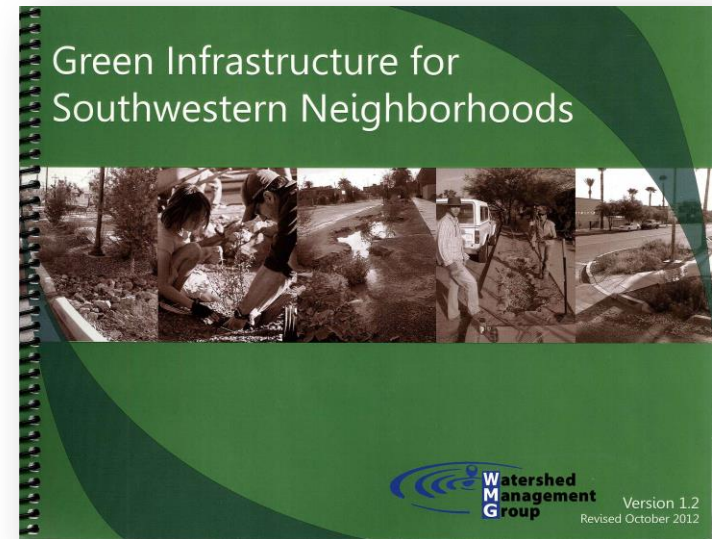
1998 & 2006 (Tucson Water)



Reprint/format 2013



2005 (Dept. of Transportation)



2010 (Watershed Management Group
Working with Dept. of Transportation)

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Working with non-profits:

- Harnessing volunteers
- Educating public
- Gaining experience & credibility

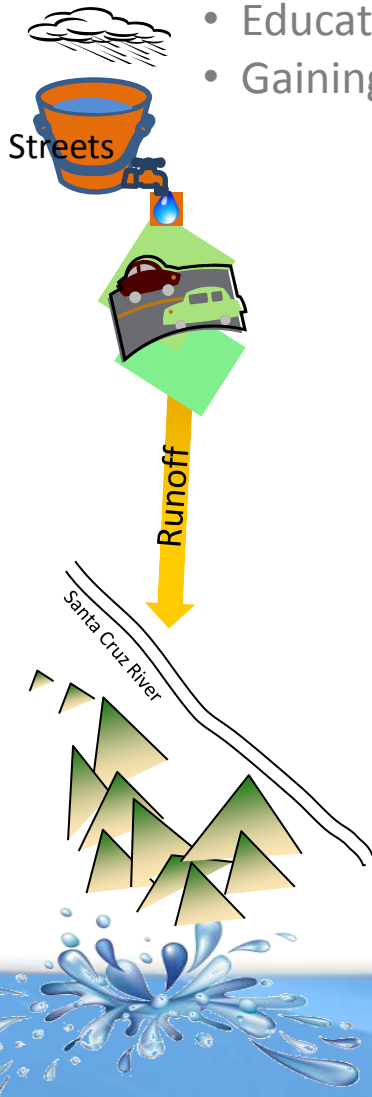


Photo: residential street; Watershed Management Group (WMG)



Photo: residential street; Watershed Management Group (WMG)



Photo: basin & cistern; Watershed Management Group (WMG)

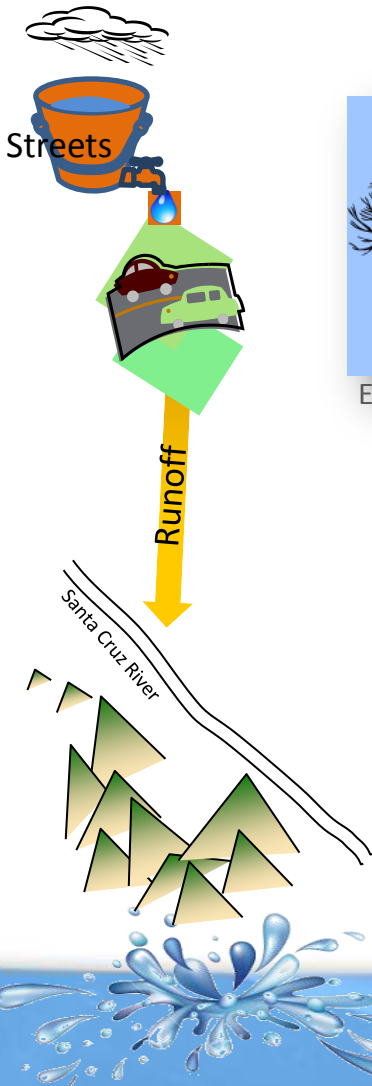




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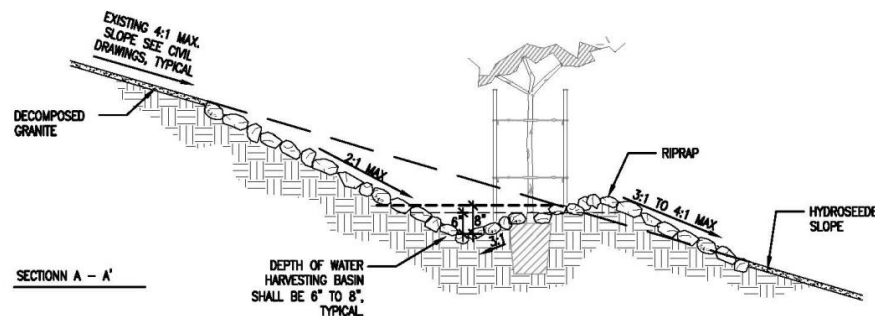
Green Streets Active Practice Guidelines:

- AZ Community Forestry Grant awarded to WMG to develop regulatory guidelines
- Committee: TDOT staff, OIP staff, engineer, landscape architect, Mayor and Ward offices



Early coordination with utilities

- 2013 TDOT Green Streets Active Practice Guidelines (APG)
 - Official Policy – given to consultants working on roadway designs
 - Capture first ½ inch of rainfall
 - Involve landscape architects/GI designers early in process



2

TYPICAL WATER HARVESTING BASIN ON SLOPE (SWALE ON CONTOUR)
SCALE: N.T.S.

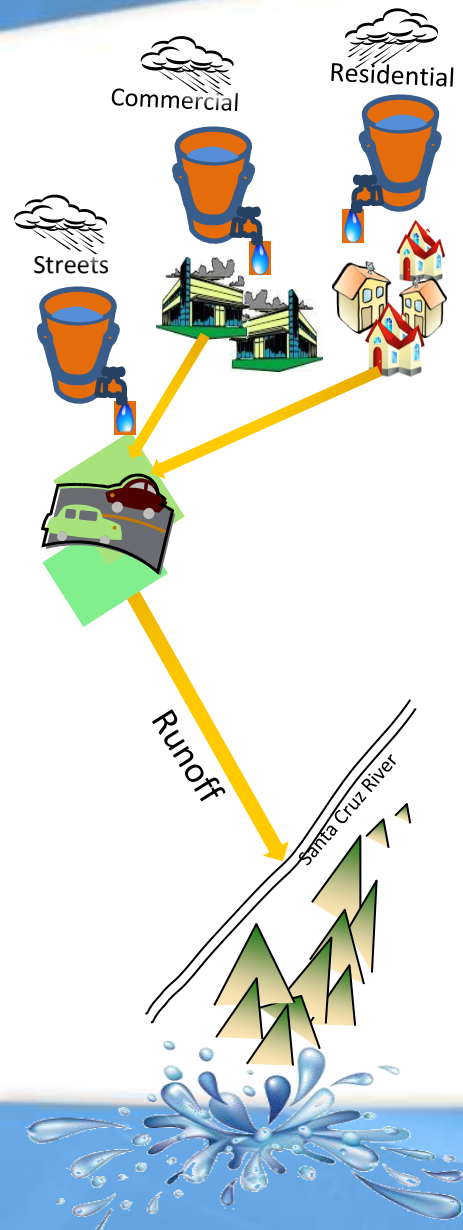
PL-4.1

2014: Design Construction Plans for Silverbell Rd revisited post – APG adoption



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Developing Standard Practices: Rainwater Harvesting & Green Infrastructures



LESSON: Creating regulations today:

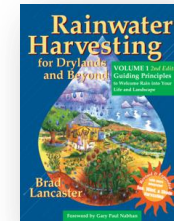
- Paradigm shift
- Collaboration & Communication



Water Resources
Research Center



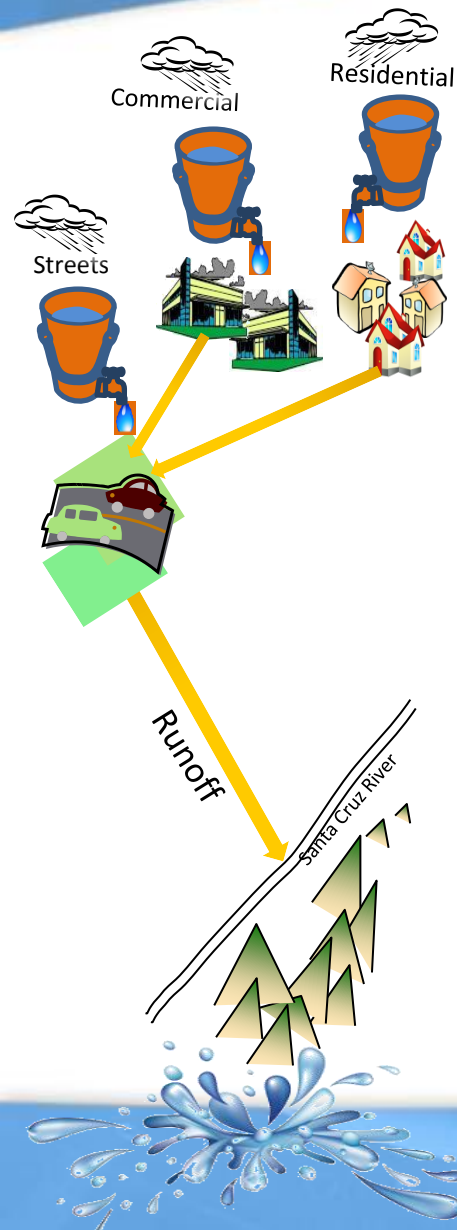
Wheat Scharf
& Assoc.



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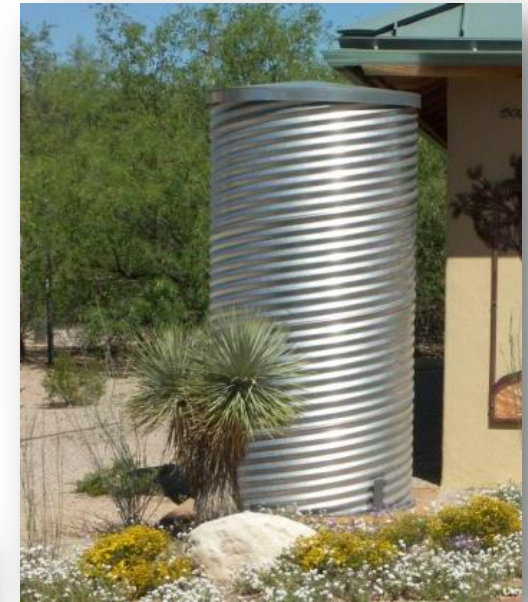
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Commercial Parking Lot



Green Street Infrastructure



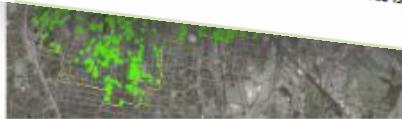
Residential Cistern



Improving Community Resiliency with Green Infrastructure

What is green infrastructure?

Green infrastructure uses vegetation, soils, and natural processes to manage water and create healthier urban environments. The scale of green infrastructure ranges from urban installations such as rain gardens and green roofs up to large tracts of undeveloped natural lands. The interconnected network of green infrastructure can enhance the resiliency of infrastructure and communities by increasing water supplies, reducing flooding, providing climate adaptability, and improving water quality. Approximately one-third of the estimated growth in the 100-year floodplain over the coming decades is attributed to stormwater impacts of upstream development.



Green infrastructure opportunities in downtown Nashville
Photo credit: Nashville Green Infrastructure Master Plan

Enhancing resiliency to flooding and drought in Pima County, AZ

Pima County, home to Tucson, is encouraging the use of green infrastructure to mitigate flooding, improve water quality, and augment the supply of available water.

The City of Tucson has partnered with NGOs to install green infrastructure on residential collector streets, and has adopted an internal policy requiring all public streets to integrate green street concepts into the initial designs.

The green streets infiltrate rainwater to augment local water supplies while simultaneously reducing water pollution. They also help achieve Tucson's water conservation goals, which require rainwater to be used to help reduce potable water demand.

Parking lot designed to infiltrate runoff in Tucson, AZ
Photo credit: Watershed Management Group



For more info see EPA's Green Infrastructure website: <http://water.epa.gov/infrastructure/greeninfrastructure/>

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Questions / Resources

QUESTIONS



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Univ. of Arizona Water Resource Research Center newsletter article:
<https://wrrc.arizona.edu/LID-green-infrastructure>

Rainwater Harvesting Ordinance:
<http://www.tucsonaz.gov/ocsd/sustainability/wter/rainwaterharvesting.php>

Tucson Department of Transportation Green Street Active Practice
Guideline:
[http://cms3.tucsonaz.gov/files/transportation/Green Streets APG
Signed by Director.pdf](http://cms3.tucsonaz.gov/files/transportation/Green%20Streets%20APG%20Signed%20by%20Director.pdf)

City Transportation Landscape Details:
<http://tdot.tucsonaz.gov/tdot/landscape>

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