Low Impact Development Guidance Manual and LID Working Group Activities

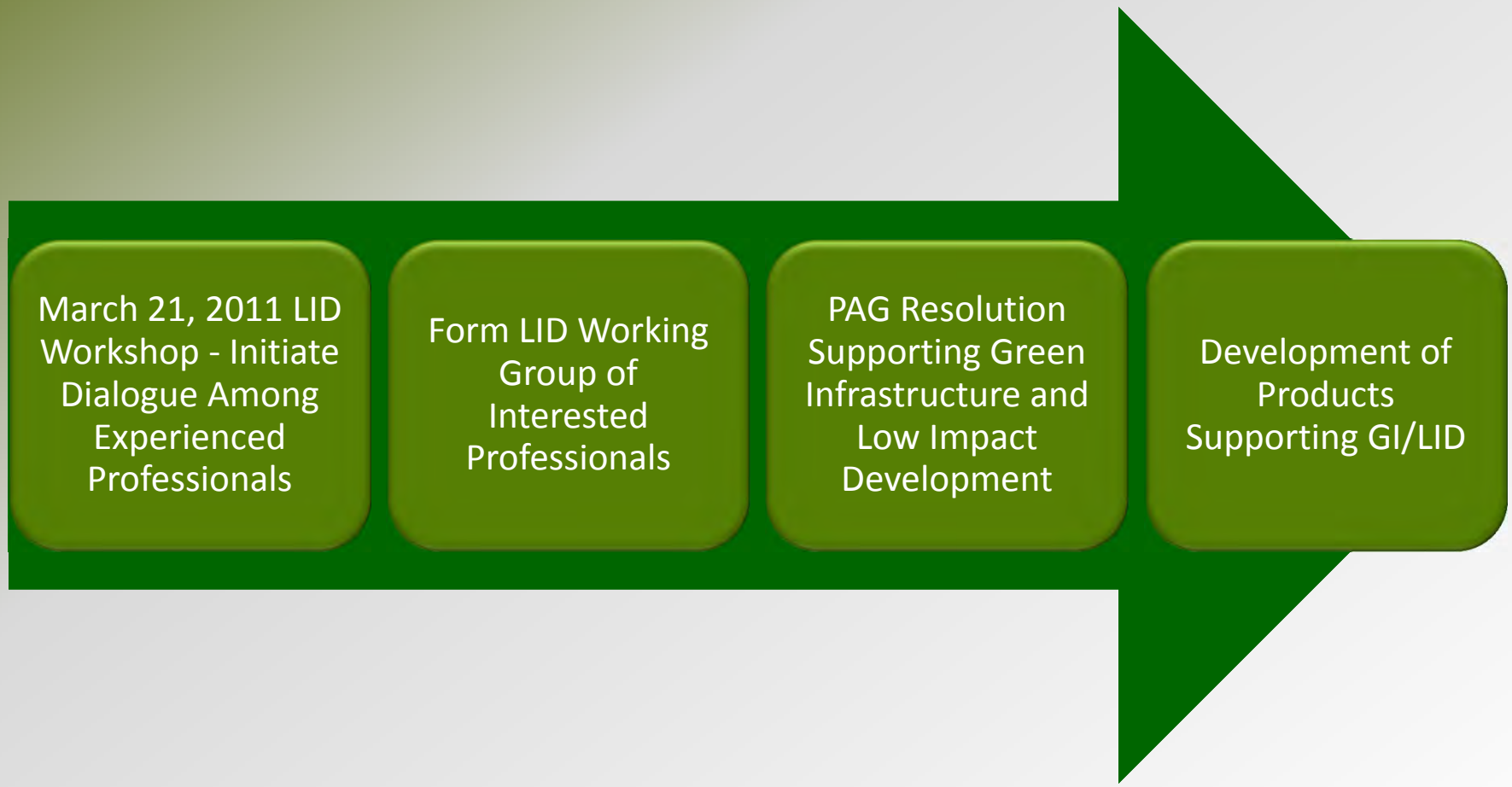
MS4 Statewide Stormwater Summit
June 18, 2013

Evan Canfield, Ph.D, P.E.
Pima County Regional Flood Control

Outline

- Origin of the LID Working Group
- Products that Provide Guidance on GI/LID Practices
- Case Studies Catalog
- Where do we go from here?

Origin of the LID Working Group



PAG Regional Council GI/LID Resolution

Resolution Supporting Low-Impact Development and Green Infrastructure

Whereas, Low Impact Development (LID) and Green Infrastructure (GI) are land development or re-development approaches that seek to manage stormwater as close to its source as possible and to engineer stormwater infrastructure that mimics the natural hydrologic function incorporating measures such as using permeable materials, creating alternative designs for sites, buildings and roads, vegetation and multi-use rainwater catchment systems; and

Whereas, LID/GI enhances the function and resilience of our watershed by preserving and recreating natural landscape features, building habitat, enhancing riparian corridor connectivity, reducing flood hazards and erosion, and capturing rainwater to offset outdoor use of potable water; and

Whereas, LID/GI provides value-added ecosystem services such as mitigating Urban Heat Island effects by decreasing hardscape and increasing shade, as well as greening urban areas, improving safety of heat-sensitive populations, reducing energy demands, improving air quality, increasing carbon sequestration, enriching urban soils and creating aesthetic amenities in our built environment; and

Whereas, LID/GI increases the health and safety of neighborhoods when applied with living street design, next to multi-modal transportation amenities (e.g., walking, cycling) and in combination with transportation structures designed to slow residential traffic; and

Whereas, LID/GI is a core element in sustainability planning nationwide and is identified by the federal Environmental Protection Agency (EPA) as an urban stormwater quality "best management practice" (BMP) that will be increasingly required in Municipal Separate Storm Sewer System Arizona Pollutant Discharge Elimination System permits; and

Whereas, several regional water studies have identified rainwater and stormwater as a valued component of our overall desert water resource portfolio ; and

Whereas, the City of Tucson and the Town of Oro Valley have adopted ordinances requiring commercial construction to use rainwater harvesting to meet a portion of their irrigation needs, and, the City of Tucson, Pima County and Town of Oro Valley have prepared LID/GI implementation guidance documents; and

Whereas, LID/GI stormwater management strategies have widespread citizen support as indicated by the success of volunteer based efforts, as well as widespread private and public support as indicated by concerted efforts to create evaluative BMP seminars and workshops, compile case studies, develop research agendas with EPA, plan and host the 2012 Arid LID conference, and pioneer LID principles in arid landscapes; and

Whereas, the PAG 2040 Regional Transportation Plan supports the implementation of appropriate LID/GI concepts and the regional award of Bicycle Friendly Community is complementary toward these goals; and

Whereas, affordable and scalable LID/GI projects facilitate the participation of, and benefit to, the region's underserved populations thereby enhancing the objectives of environmental justice; and

Whereas, emerging industries are stimulating job and economic growth by selling materials such as rock, engineered soil, cisterns and plants; hiring contractors, consultants, design engineers and landscapers; and attracting visitors to attend conferences and workshops and visit LID/GI installations; and

Whereas, EPA studies indicate that implementing appropriate multi-functional LID/GI practices provide economic savings to local jurisdictions and developers and enhance property values; and

Whereas, EPA case studies identify the successful use of private sector incentives such as lowering permit fees, expediting permits, offering tax rebates, and modifying building codes and development densities as means of encouraging LID/GI; and

Whereas, utilizing LID/GI will play an increasingly important role as our region adapts to rising temperatures and increased weather variability associated with climate change.

Now, therefore, be it resolved that, in recognition of Low Impact Development's (LID) and Green Infrastructure's (GI) multiple environmental, social, and economic benefits, the PAG Regional Council encourages incorporating these principles, methods and incentives into projects when feasible and affordable; in addition, the PAG Regional Council encourages creation of technical guidance and coordinating with regional and intra-jurisdictional land planning efforts, with consideration given to individual buyer preferences and price sensitive markets.

LID Working Group Priorities (08/22/11)

Product	***Total***
LID Site Design BMP Guidance	**7**
Manual providing examples of successful (and unsuccessful) projects (or BMPs?)	**6**
Identification of Barriers to Adoption of LID	**3**
A Set of Performance Metrics/Indicators	**3**
Develop LID Education Materials	**2**
Annual Conference	**1.5**
LID Roadway Design Manual	**1**
A BMP Maintenance Manual	**1**
Contact List	**1**
Processes	
Recognize Accomplishments	**1**
Develop an LID Policy	**1**
On-going Coordination	**2**
Areas of Interest (not mentioned above)	
Influence Policy	**2**
Write Grants/ seek funding	**1**
Do applied Research/Demonstration Projects to support LID	**1**

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- Where do we go from here?

Pima County:
Draft Detention-Retention Manual

Pima County Regional Flood Control District

Analysis and Design for Stormwater Management

Supplement to Title 16, Chapter 16.48

Runoff Detention Systems

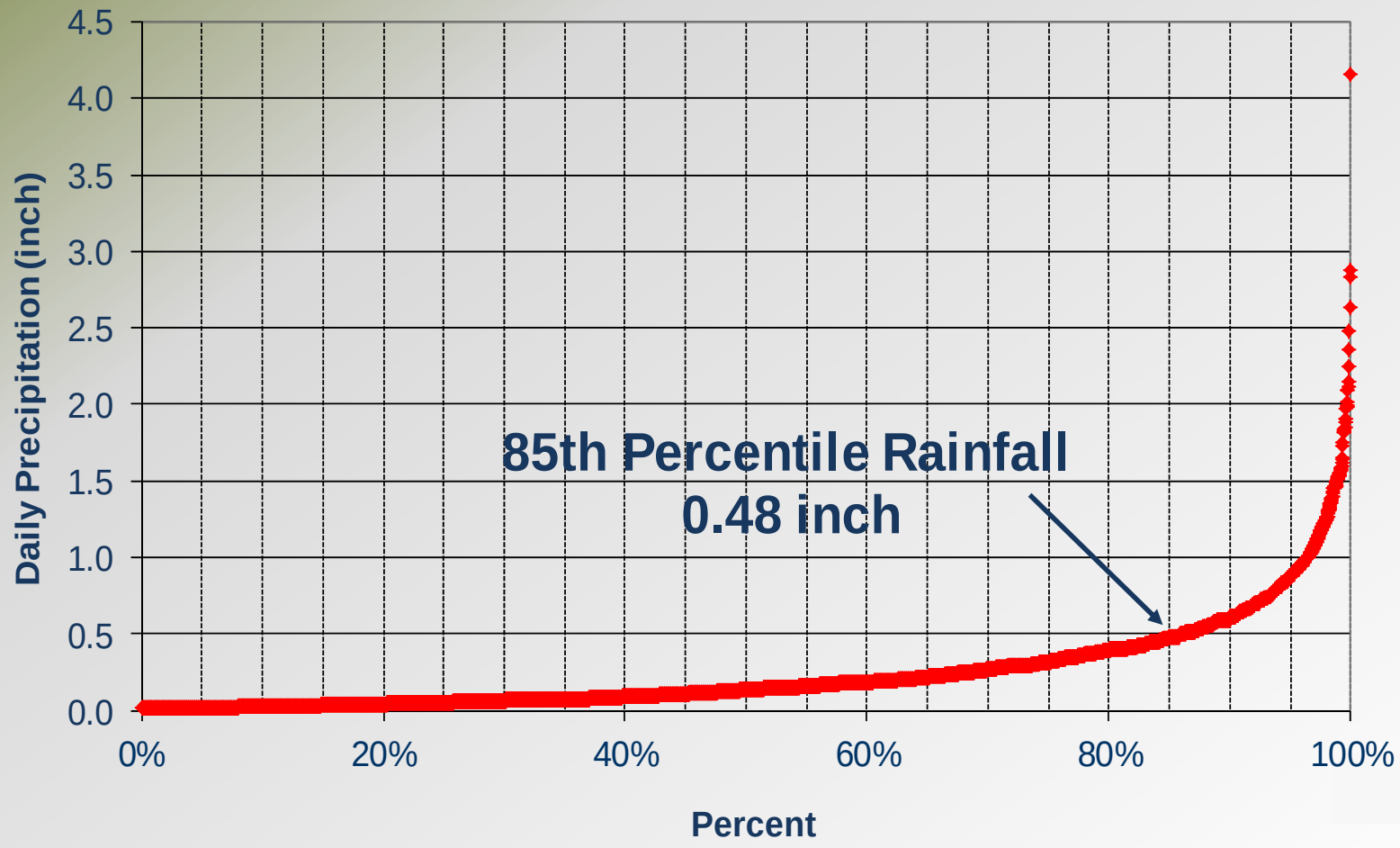
Floodplain and Erosion Hazard Management Ordinance

Pima County Regional Flood Control District
97 E. Congress St., 3rd Floor
Tucson, AZ 85701-1791
(520) 243-1800

Draft January 2013

Pima County:
Draft Detention-Retention Manual

Replace Retention Requirement with a
'First Flush' Retention Requirement
(data U of A Daily rainfall 1895-2000)



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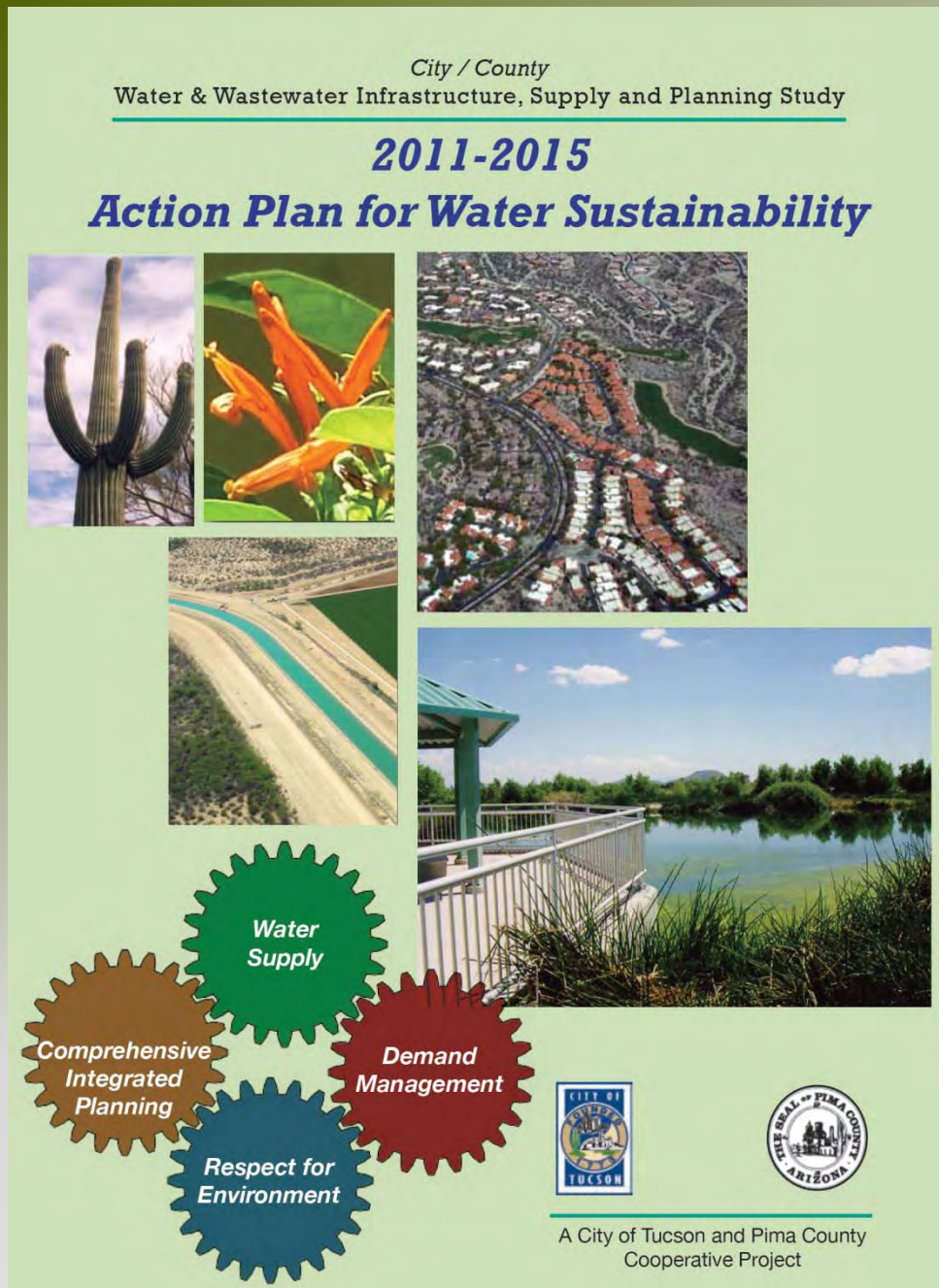


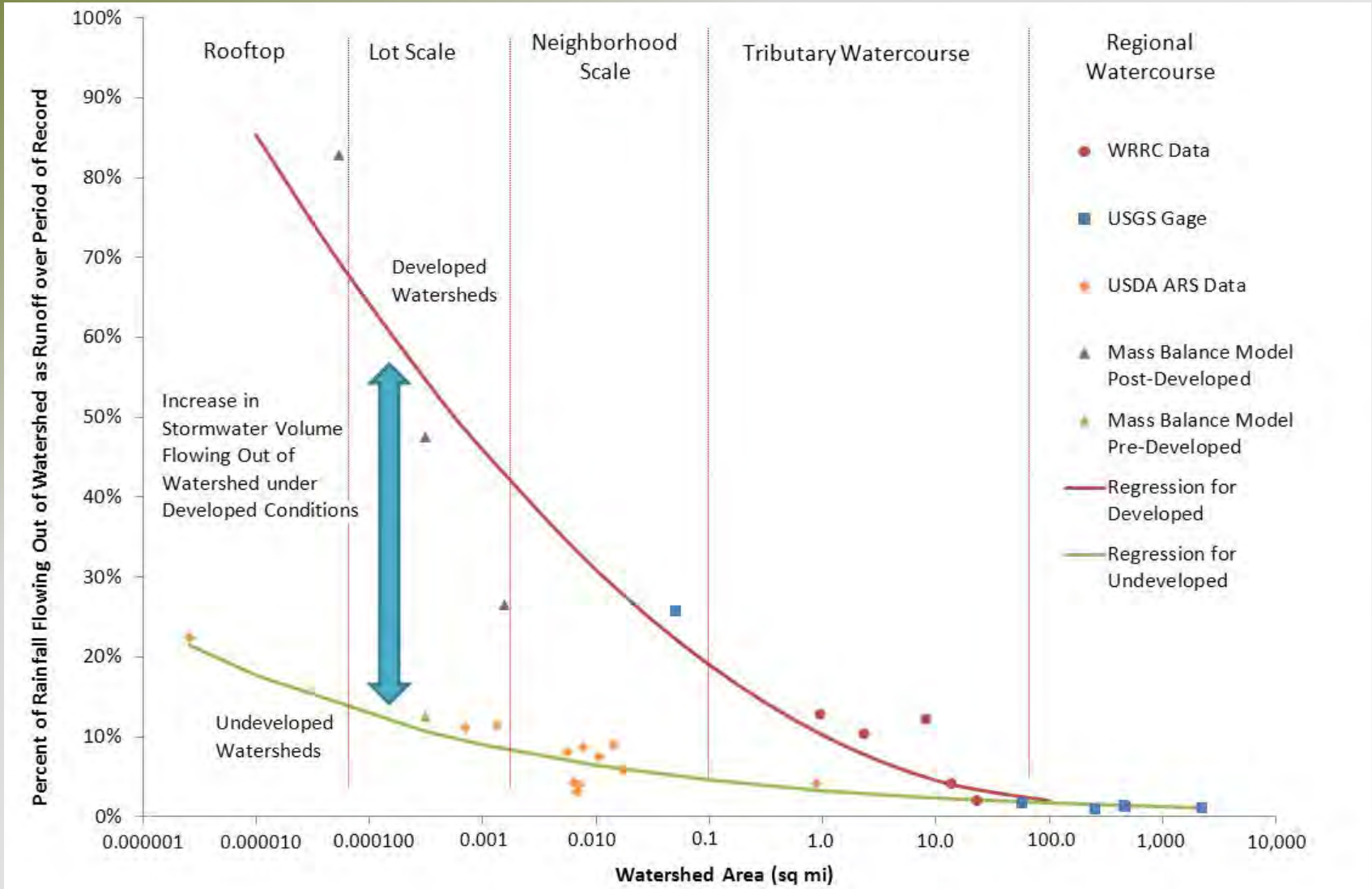
Goal

Demand Management Goal #5:
Increase the use of rainwater and stormwater to reduce demands on potable supplies

Action Plan

Demand Management Action Plan #7:
Develop Design guidelines for neighborhood stormwater harvesting to encourage the creation of habitat and water efficient landscapes.

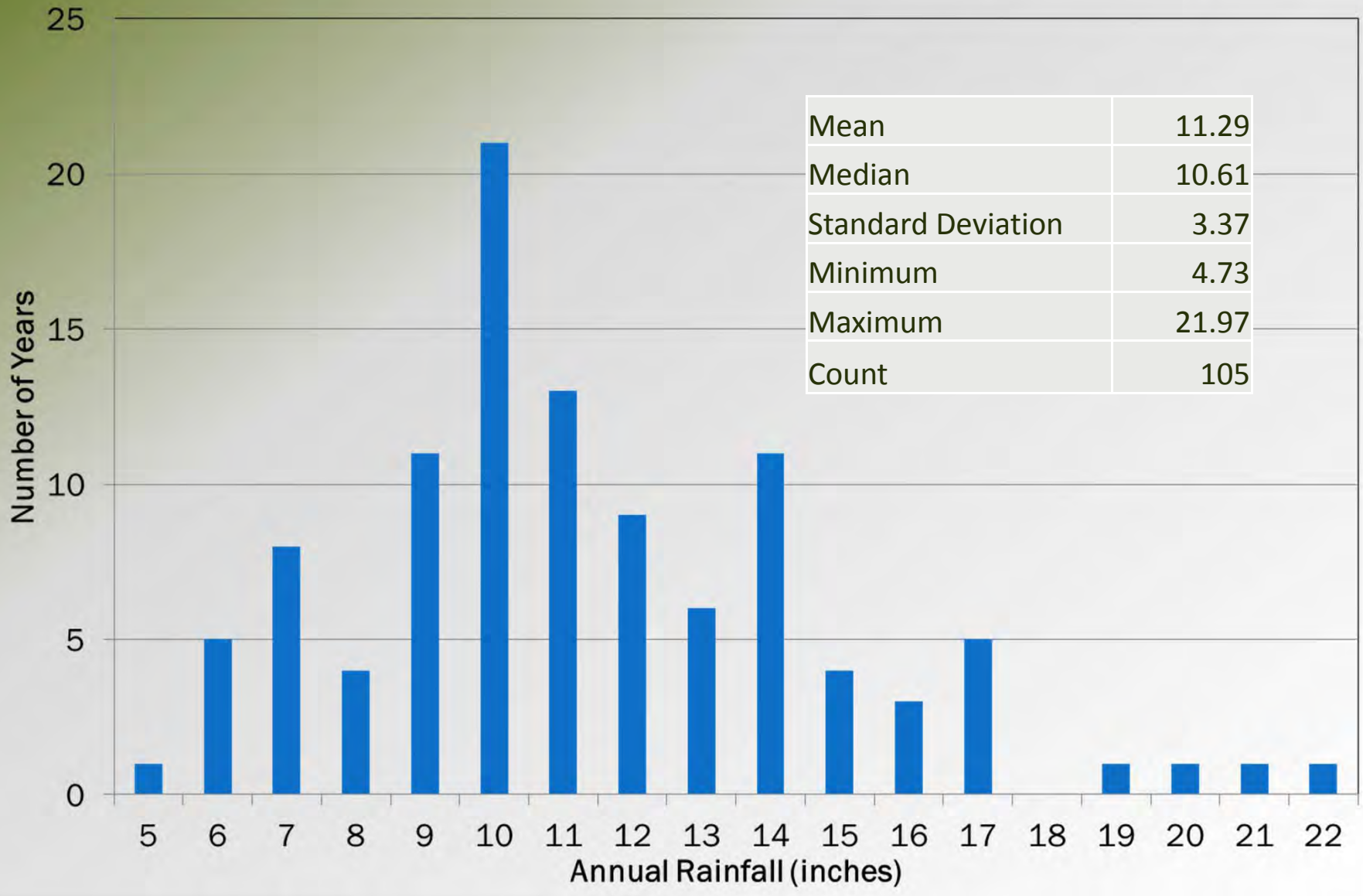
‘Harvestable’ Water (Rainwater/Stormwater) i.e. water yield



Low Impact Development and Green Infrastructure Guidance Manual

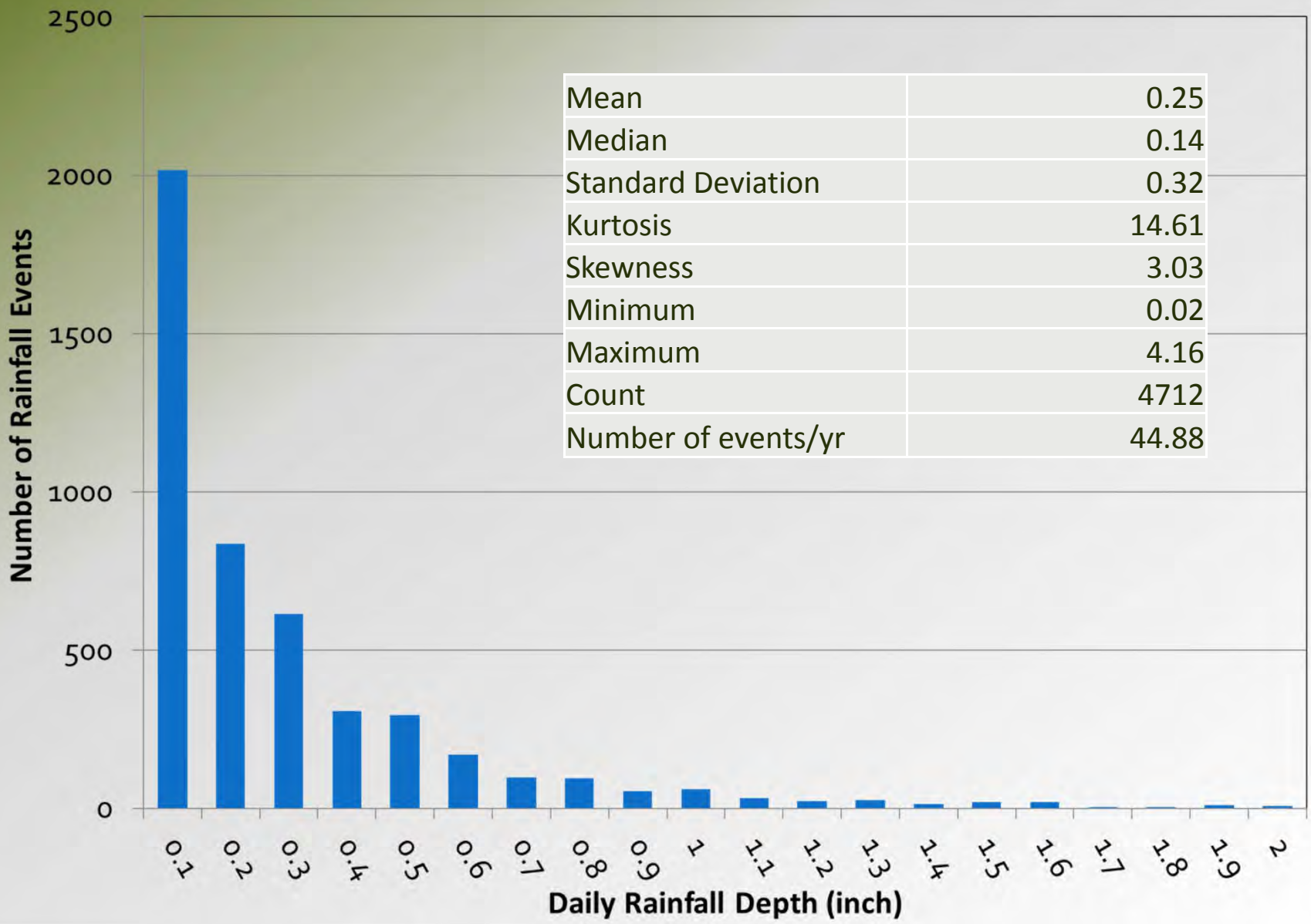
June 2013 (Draft)

Histogram of Annual Rainfall
University of Arizona 1896-2000 (water years)



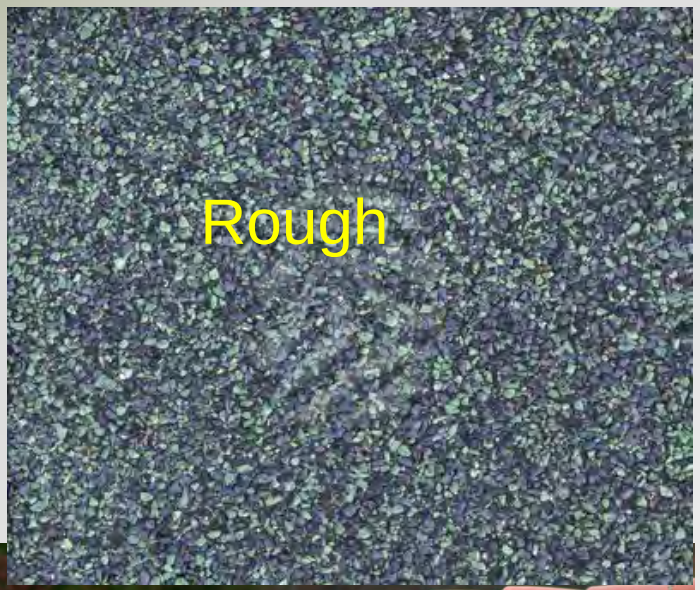
Mean	11.29
Median	10.61
Standard Deviation	3.37
Minimum	4.73
Maximum	21.97
Count	105

Histogram of Daily Rainfall (1895 to 2000, University of Arizona)

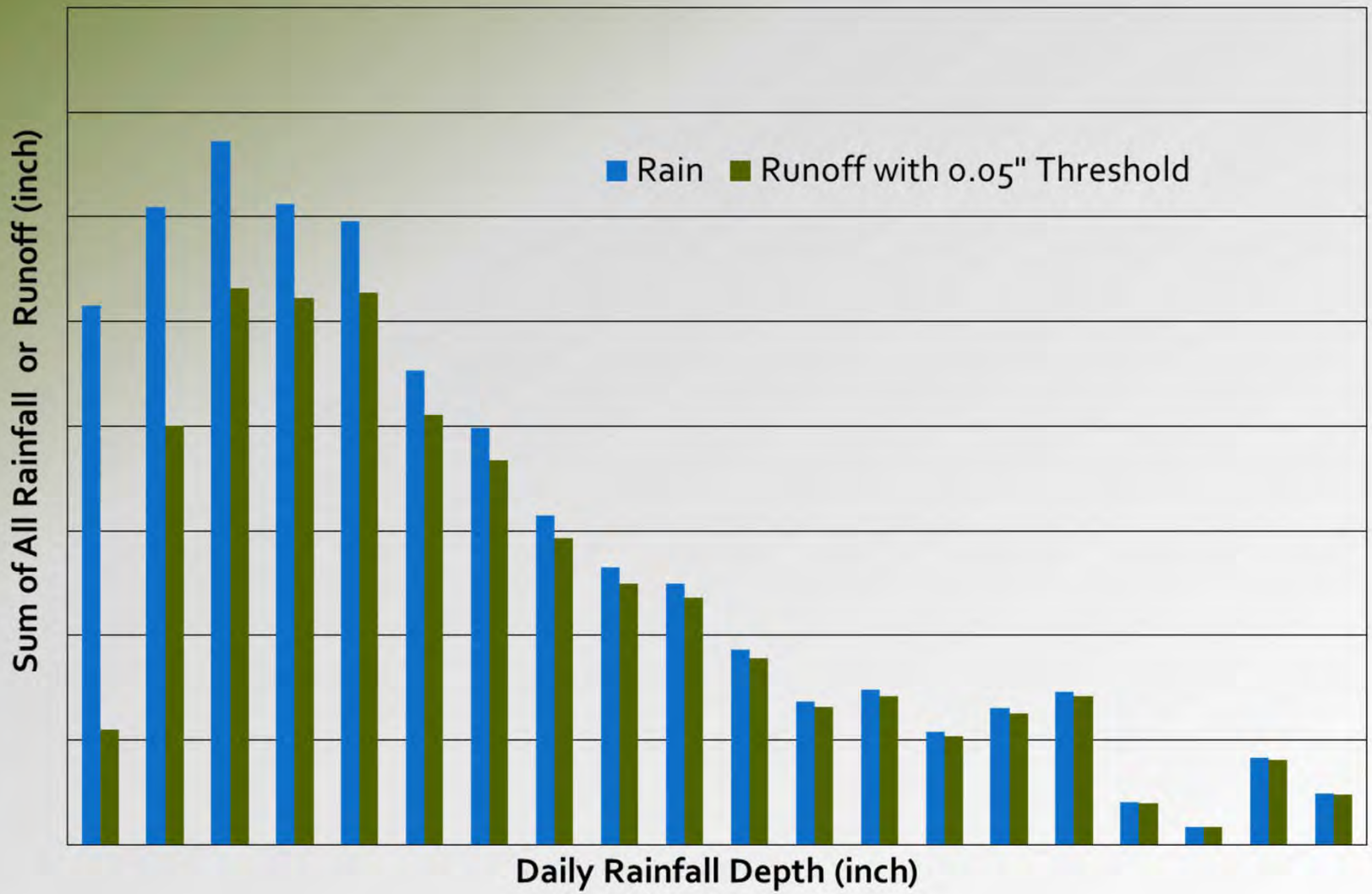


Mean	0.25
Median	0.14
Standard Deviation	0.32
Kurtosis	14.61
Skewness	3.03
Minimum	0.02
Maximum	4.16
Count	4712
Number of events/yr	44.88

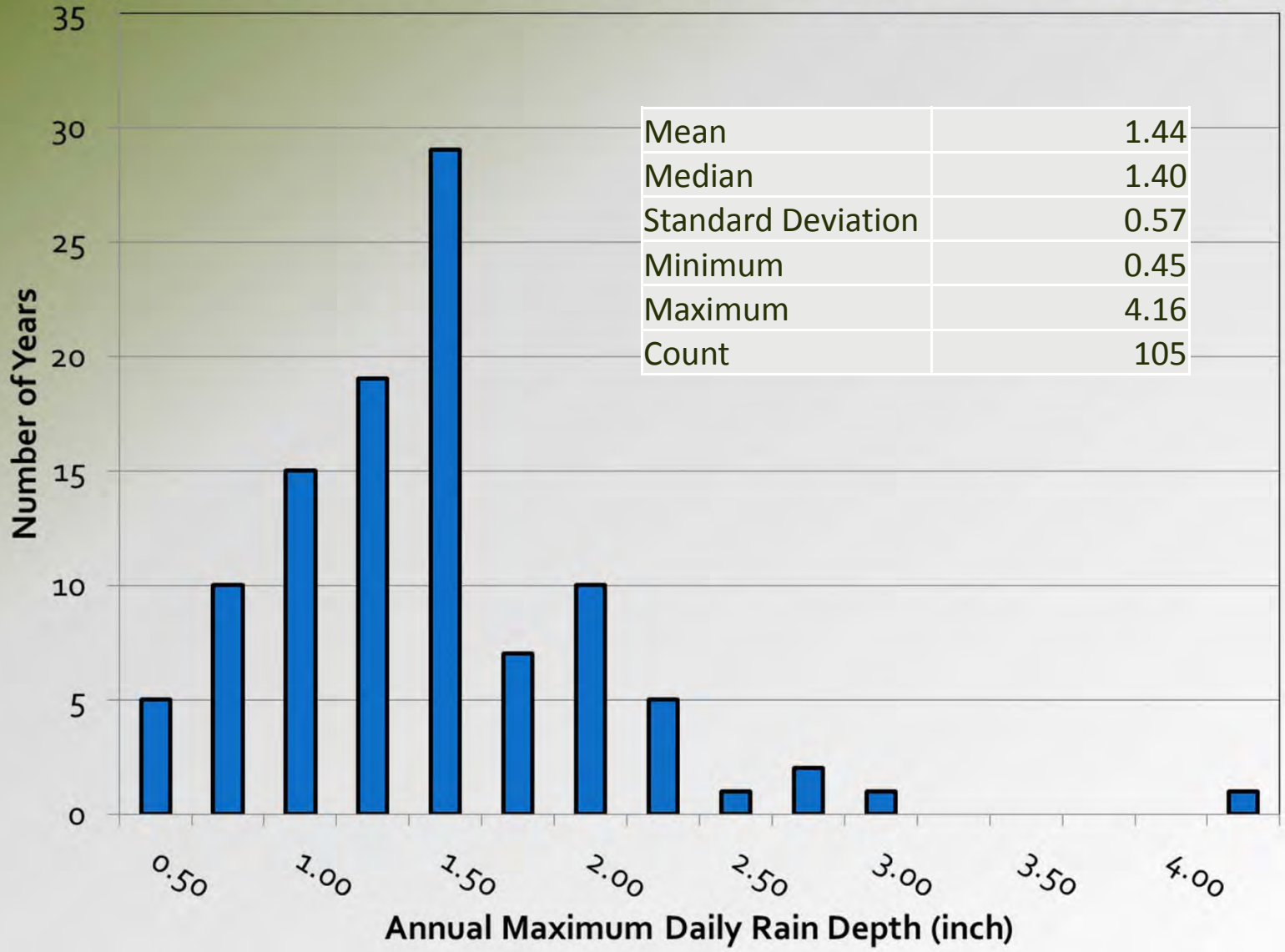
Impervious Doesn't Mean a Roof Sheds 100% of the Rain



Total Volume of Rainfall and Runoff with 0.05” Threshold (1895 to 2000, University of Arizona)



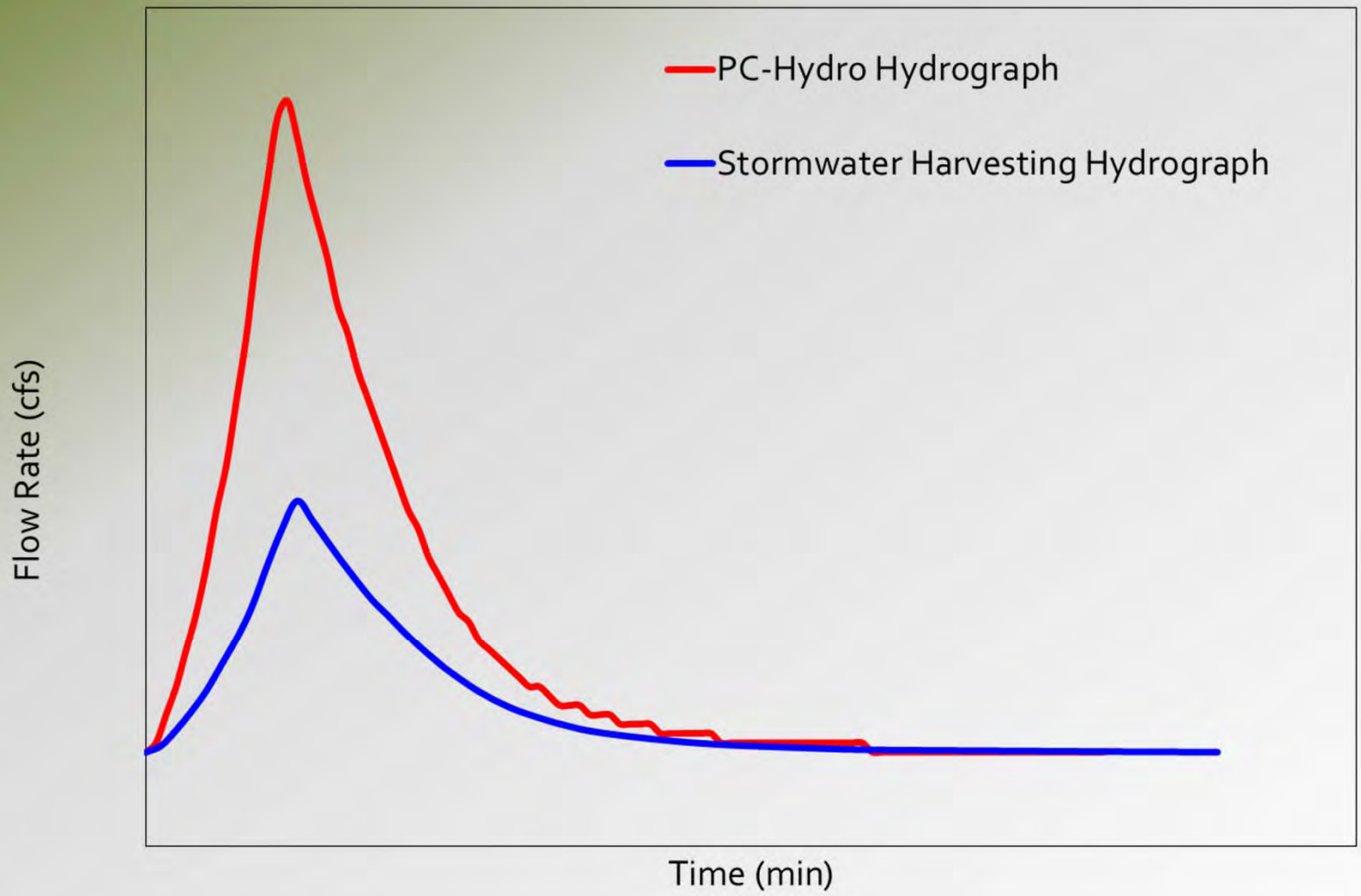
Annual Peak Rainfall
(U of A 1896-2000 Water Years)



Mean	1.44
Median	1.40
Standard Deviation	0.57
Minimum	0.45
Maximum	4.16
Count	105

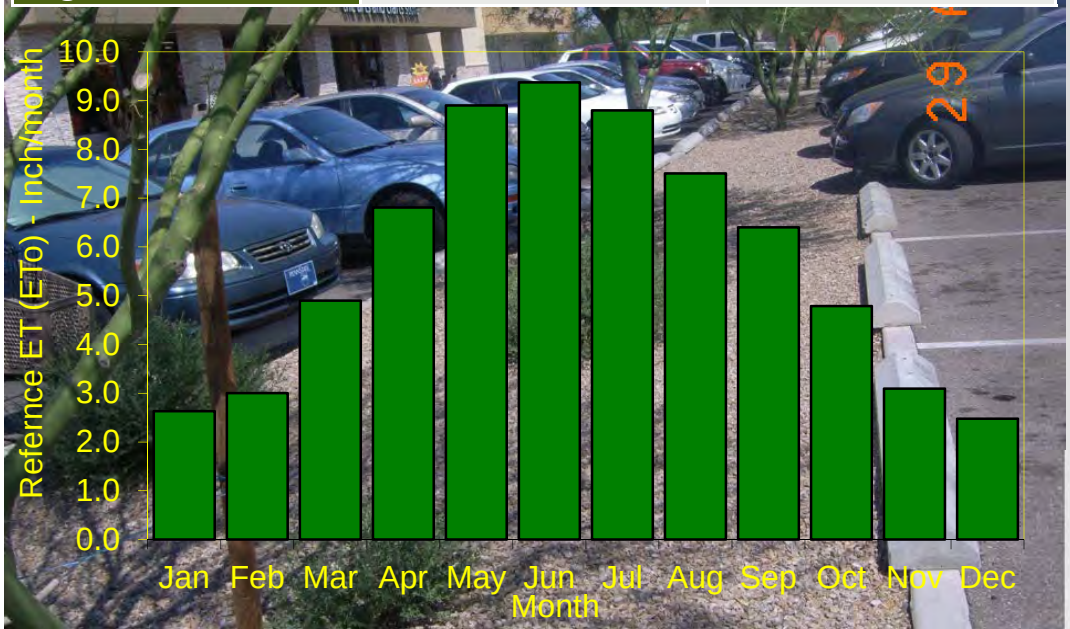
Modeled Effect on Flood Mitigation

(0.8 ac watershed, 80% impervious, harvesting 1.5”)



March Plant Water Use

Plant Type	Plant ET Factors (Waterfall,	
	High	Low
Low Water Use	**0.26**	0.13
Medium Water Use	0.45	0.26
High Water Use	0.64	0.45



$ET_{March} = ET_{O\ March}$ X (Plant Water Use Factor)

$ET_{O\ March}$ = 4.90 inch (AZMET)

4.90 inch (0.26) = **1.27 inch**

Example : Palo Verde Tree

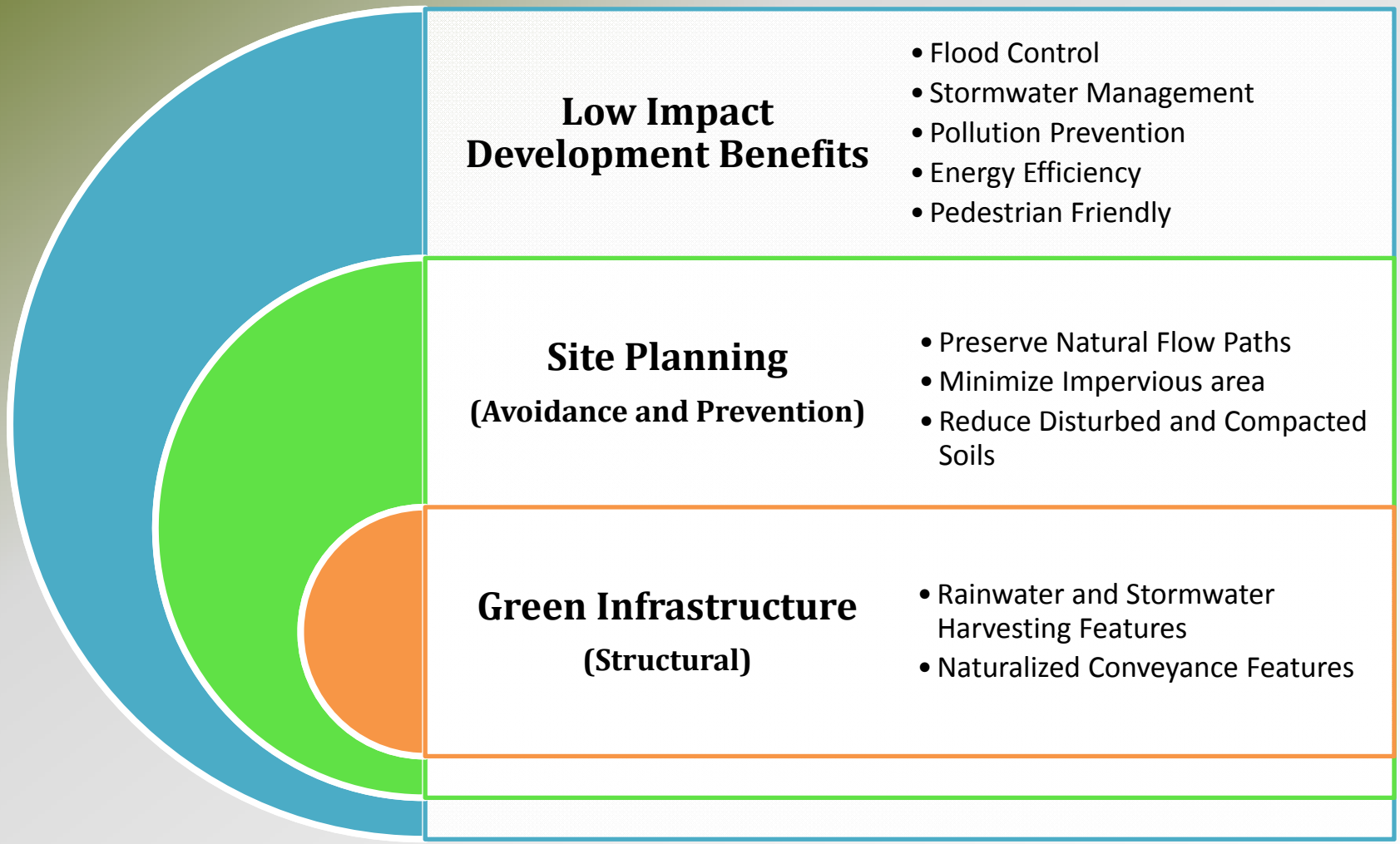
Effective P_{March} = 50%x $Pavg_{March}$

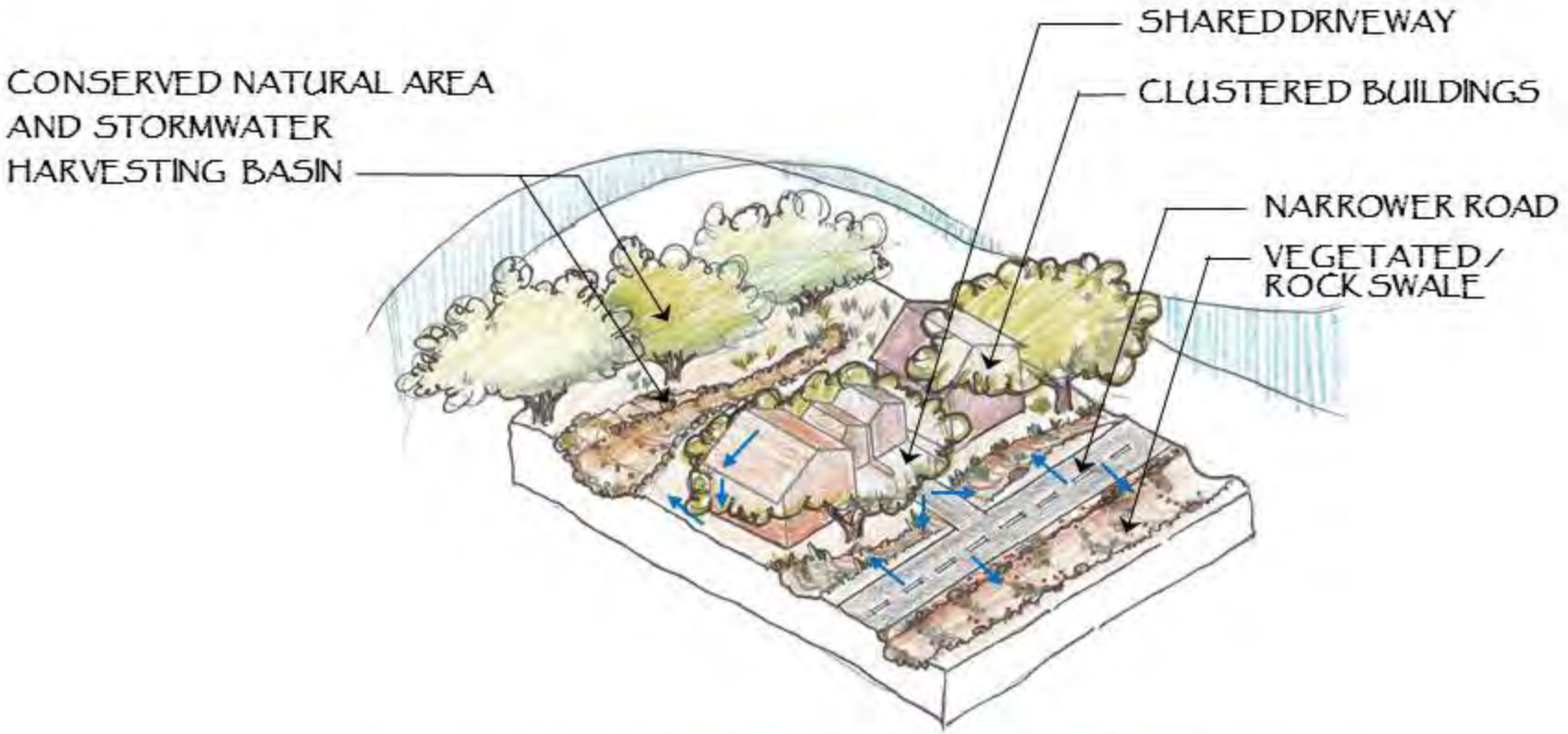
Pavg March = 0.77 inch

$$Catchment\ Ratio = \frac{ET_{March}}{\text{Effective P}_{March}} = \frac{1.27\ inch}{(50\%)0.77\ inch} = 3.30$$

Need: 3.3 x catchment to canopy

LID Planning Practices Should Be Considered Before Structural Practices





DISCONNECTION IMPERVIOUS AREAS AND THE COMPATIBILITY WITH OTHER LID PRACTICES

LID Planning Practices

	Stormwater Runoff		Improves Community Livability			Regulatory
GI/LID Non-Structural Practices / Benefits	Reduces Flooding	Improves Stormwater Quality	Reduces Urban Heat Island & Associated Energy Use	Can Provide Shade for Passive Recreational Use	Provides Wildlife Habitat	Riparian Protection*
Conserving or Restoring Sensitive Natural Areas	●	●	●	●	●	●
Preserving Natural Flow Paths	●	●	●	●	●	●
Preserving Natural Open Space	◒	◒	●	●	●	●
Minimization of Disturbed Areas and Soil Compaction	●	●	◒	◒	◒	◒
Disconnection of Impervious Areas	◒	●	○	○	○	○

● Yes ◒ In Some Cases ○ No

Based on Table from American Rivers, "The Value of Green Infrastructure", 2010.

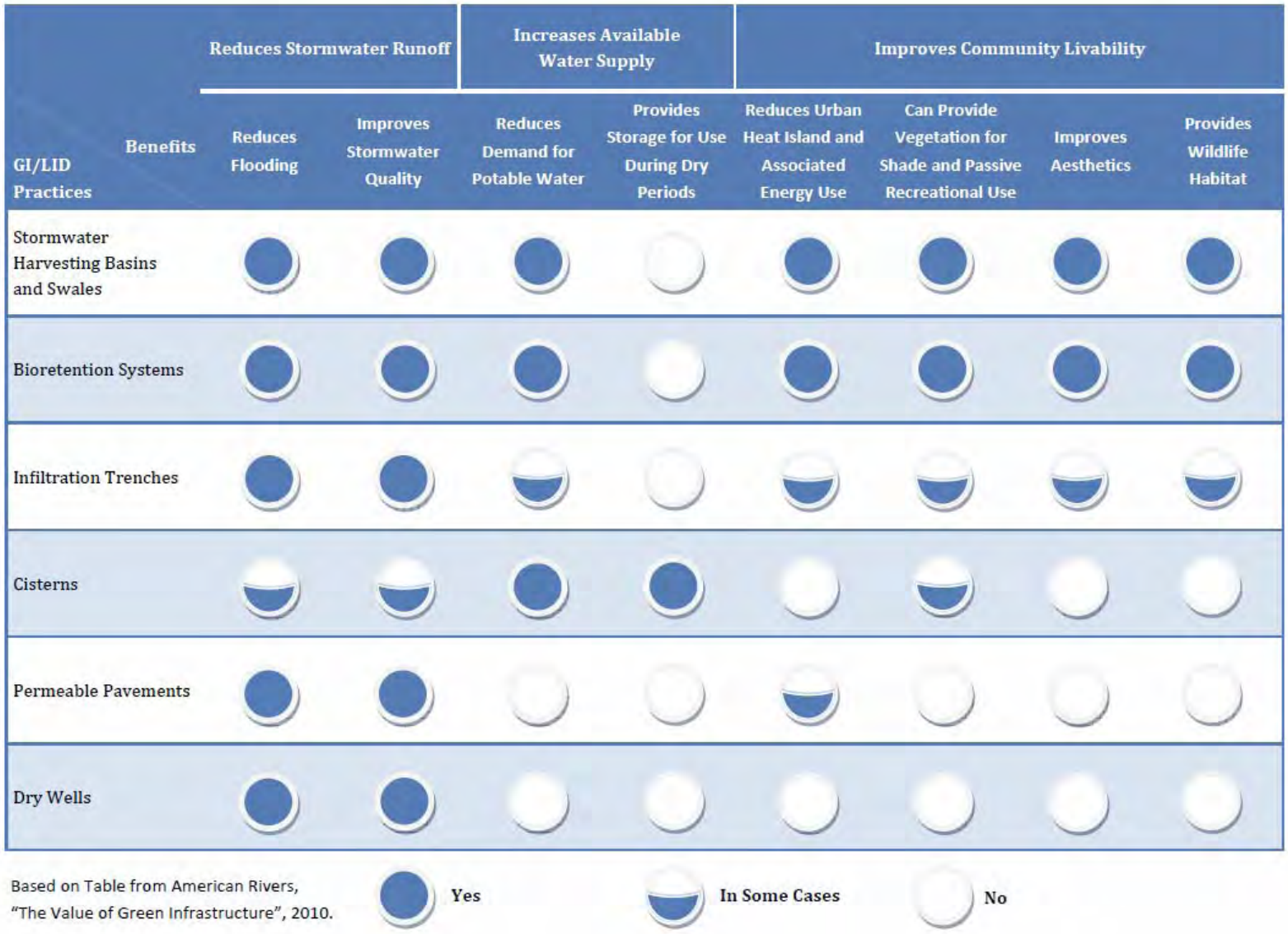
*Ordinance No. 2010 FC5 Title 16 Chapter 16.30

Alternative Site Design

TRADITIONAL: Channelized Drainage

LID: Drainage through Natural Open Space

Structural Practices



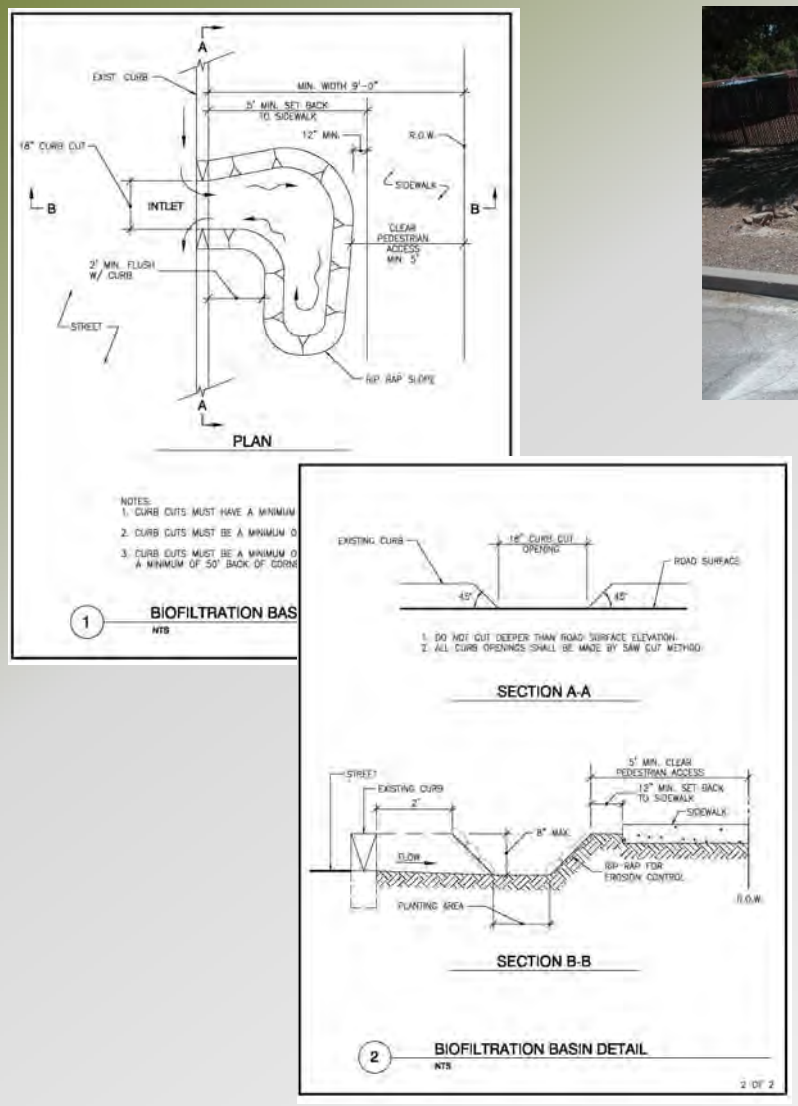
GI/LID Practices \ Benefits	Reduces Stormwater Runoff: Reduces Flooding	Reduces Stormwater Runoff: Improves Stormwater Quality	Increases Available Water Supply: Reduces Demand for Potable Water	Increases Available Water Supply: Provides Storage for Use During Dry Periods	Improves Community Livability: Reduces Urban Heat Island and Associated Energy Use	Improves Community Livability: Can Provide Vegetation for Shade and Passive Recreational Use	Improves Community Livability: Improves Aesthetics	Improves Community Livability: Provides Wildlife Habitat
Stormwater Harvesting Basins and Swales	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Bioretention Systems	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Infiltration Trenches	Yes	Yes	In Some Cases	No	In Some Cases	In Some Cases	In Some Cases	In Some Cases
Cisterns	In Some Cases	In Some Cases	Yes	Yes	No	In Some Cases	No	No
Permeable Pavements	Yes	Yes	No	No	In Some Cases	No	No	No
Dry Wells	Yes	Yes	No	No	No	No	No	No

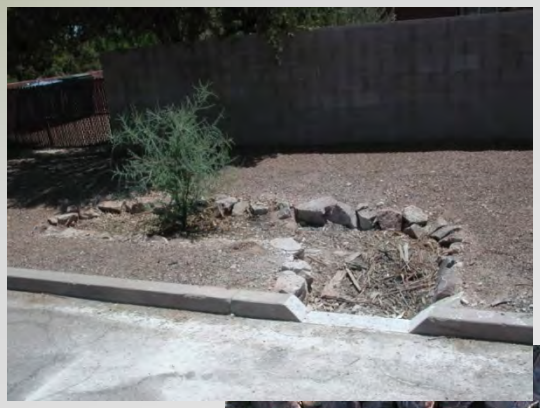
Based on Table from American Rivers, "The Value of Green Infrastructure", 2010.

Yes — In Some Cases — No

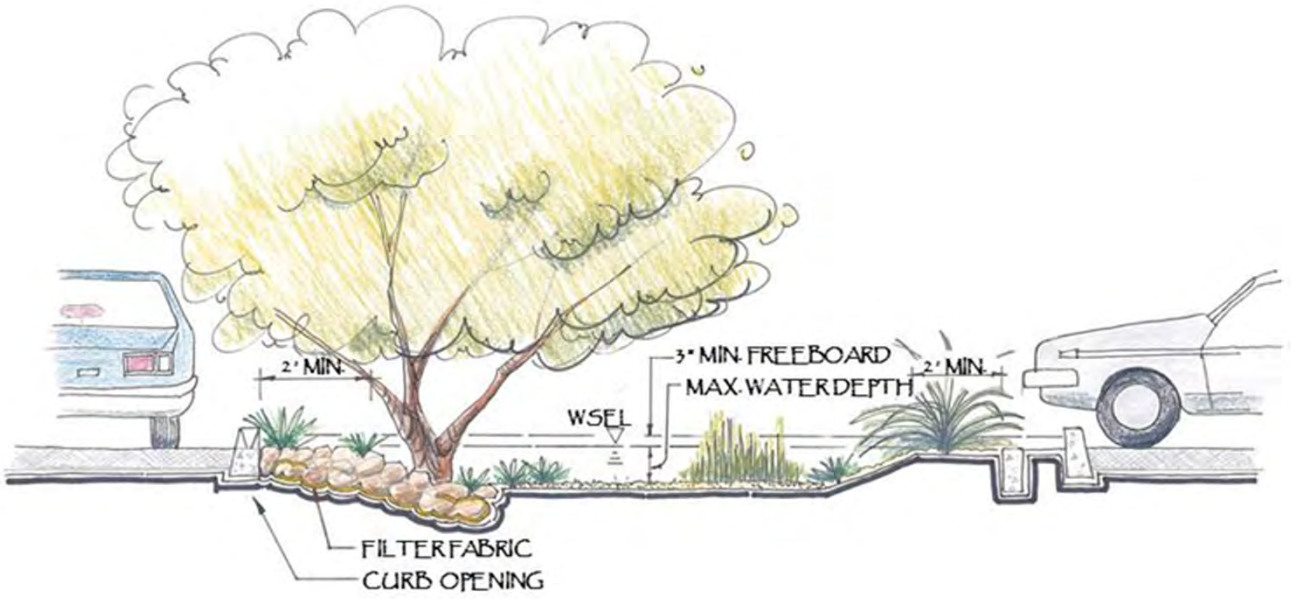
Pervious Pavements

Curb Cut Standards

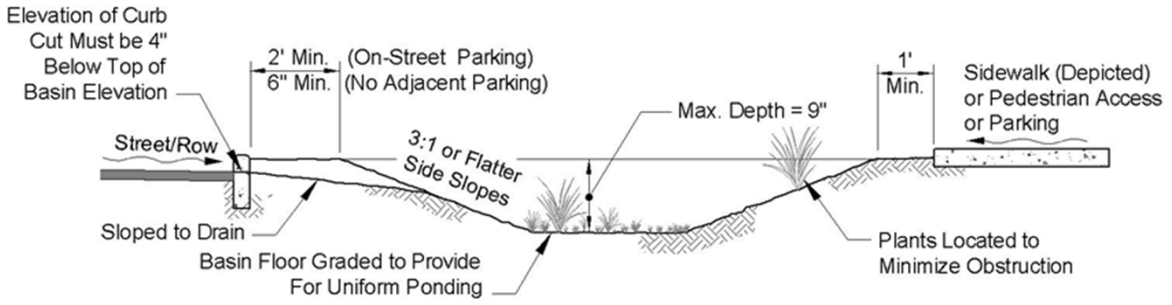




Water Harvesting Basins



WATER HARVESTING BASIN



ELEVATION VIEW

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Success Criteria (simplified)

Key performance indicators	Stakeholder Requested	Planning		Post-Construction	
		N/A	Included	Successful	Not Successful
Regulatory Requirements Met					
Stormwater Runoff					
Stormwater Quality					
Resource Protection					
Sustainability Elements Optimized		included			
Water Conservation					
Natural Area Enhancement					
Urban Heat Island Mitigation					
Education					
Cost Acceptable		included			
Cost Estimate Within Budget					
Projected Maintenance Costs Favorable					
Implementation Successful		included			
Constructability Acceptable					
Stakeholder Expectations Met					
Maintenance Entity Identified					
Project Recognition		included			
Awards Received					
Project Function Successful		included			
Ease of Maintenance					
Value and Function Retained					

Case Study: **20-30 Park (Highland Vista Park):**

Collector street – residential land use
Native vegetation irrigated with harvested stormwater, reduced ponding and associated mosquito problems

Infiltration Trenches


Plan View 2012
20-30
Park
1 inch = 40 feet
0 12.5 25 50 75 100
Feet

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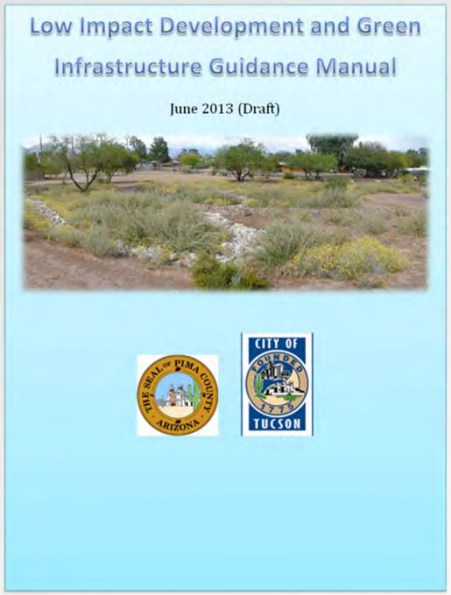
Where do we go from here?

- Finish Guidance Manual - review of the work in progress by the LID Working Group.
- Working draft by end of 2013. Circulated as a web page.
- ‘Final’ version by July 2015.
- Continue to Gather Case Studies.



Questions

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evan.canfield@pima.gov