

**Water Reuse:
Retrofitting Last Century Systems for the Future**

37th Annual Meeting

Mar. 7, 2013

AWRA-WI, Brookfield, WI

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- **Old Technique Rediscovered**
- **Intersection – Stormwater & Water Use**
- **Need for a Tool**
- **Reuse Tool**
- **Conclusions**



Old Technique Rediscovered



Common Practice

- Arid Climates
- Less Wealthy Countries

Photo courtesy of:



AMERICAN RAINWATER CATCHMENT
SYSTEMS ASSOCIATION

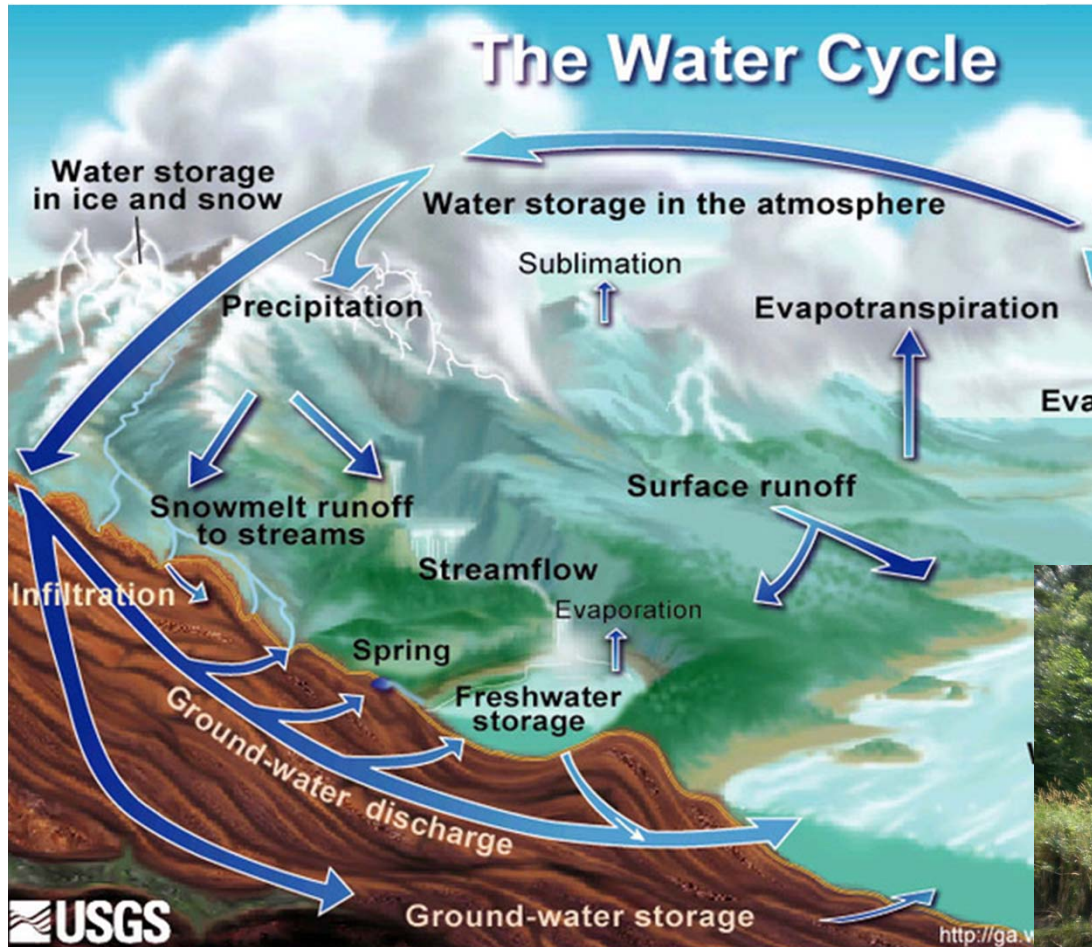


Why forgotten in the US?

- Potable Water Systems Prevalent - & are Convenient
- Is using highly purified water for ALL uses a good



Intersection - Stormwater & Water Use



- Convergence of:**
- 1. Evolving Stormwater Standards**
 - 2. Sustainable Water Use**



Intersection - Stormwater & Water Use



New Stormwater Standards

- **Emphasis on Volume Control**
- **Mimic Natural Hydrology**
- **Infiltration**
- **Difficult sites-?**
 - **Clay Soils**
 - **Shallow Bedrock**
 - **Contamination**

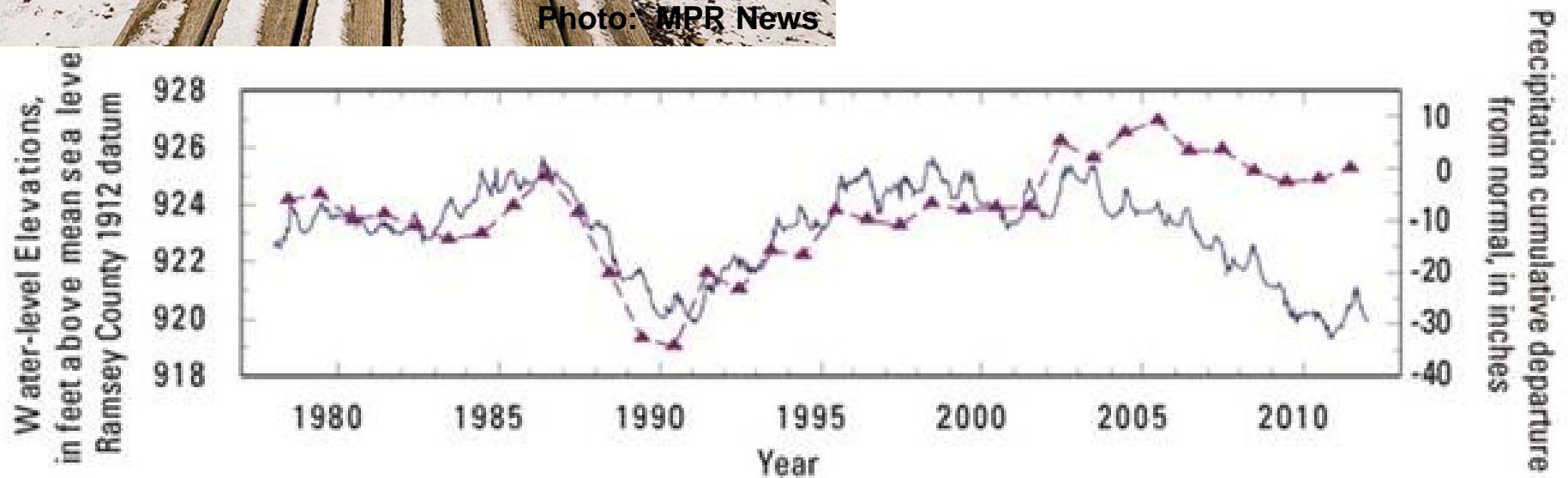
Intersection - Stormwater & Water Use



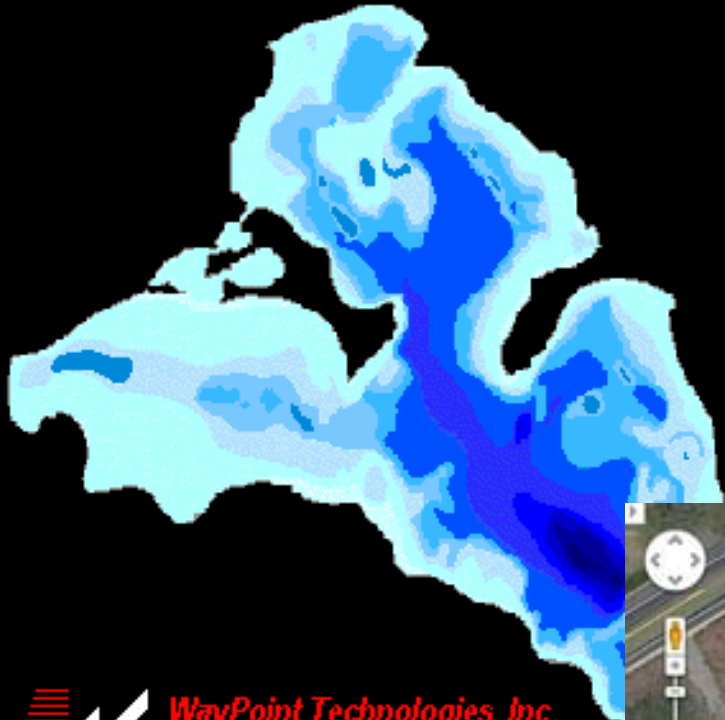
Photo: MPR News

Unsustainable Water Use

- Growing Examples of Shortages
- Increased Energy Costs



Intersection - Stormwater & Water Use



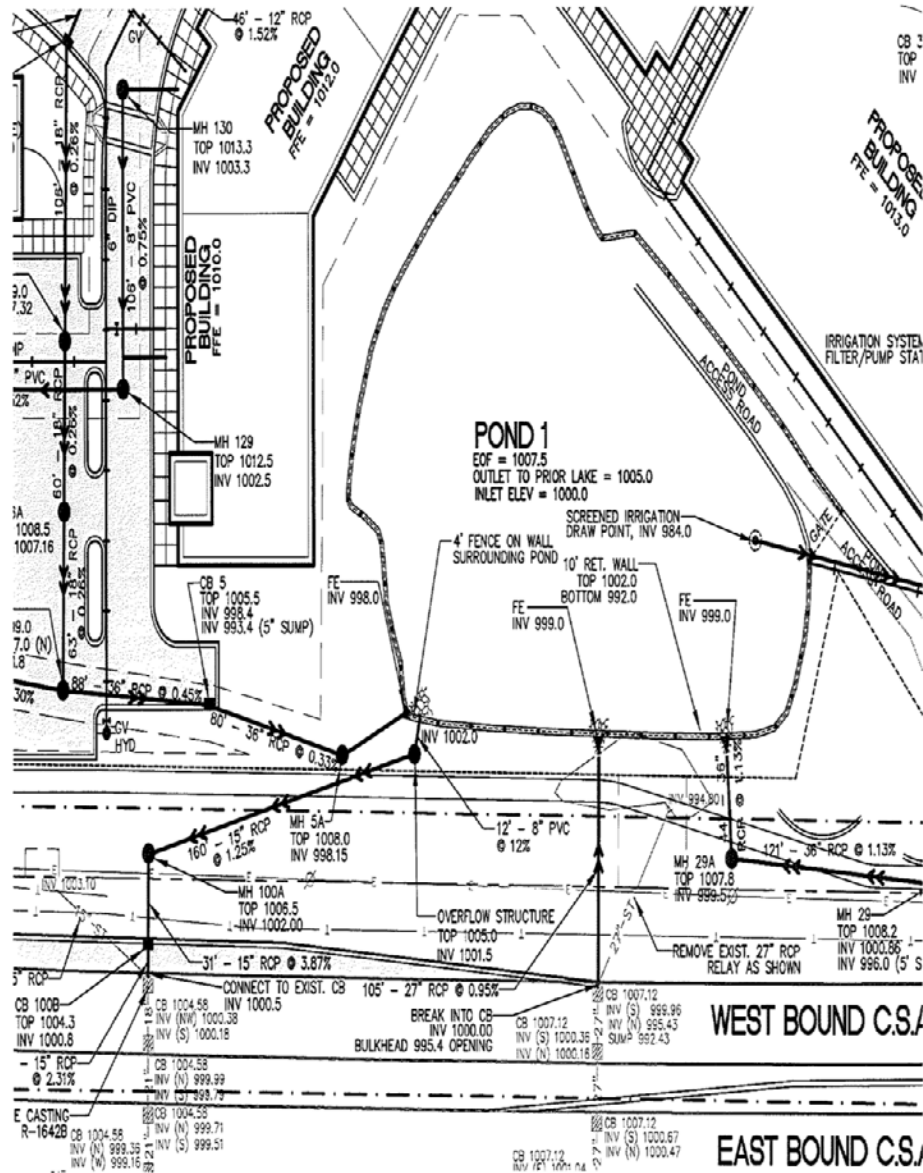
 **WayPoint Technologies, Inc.**
www.lakemap.com

Unsustainable Water Use



Photo: MPR News

Need for a Tool



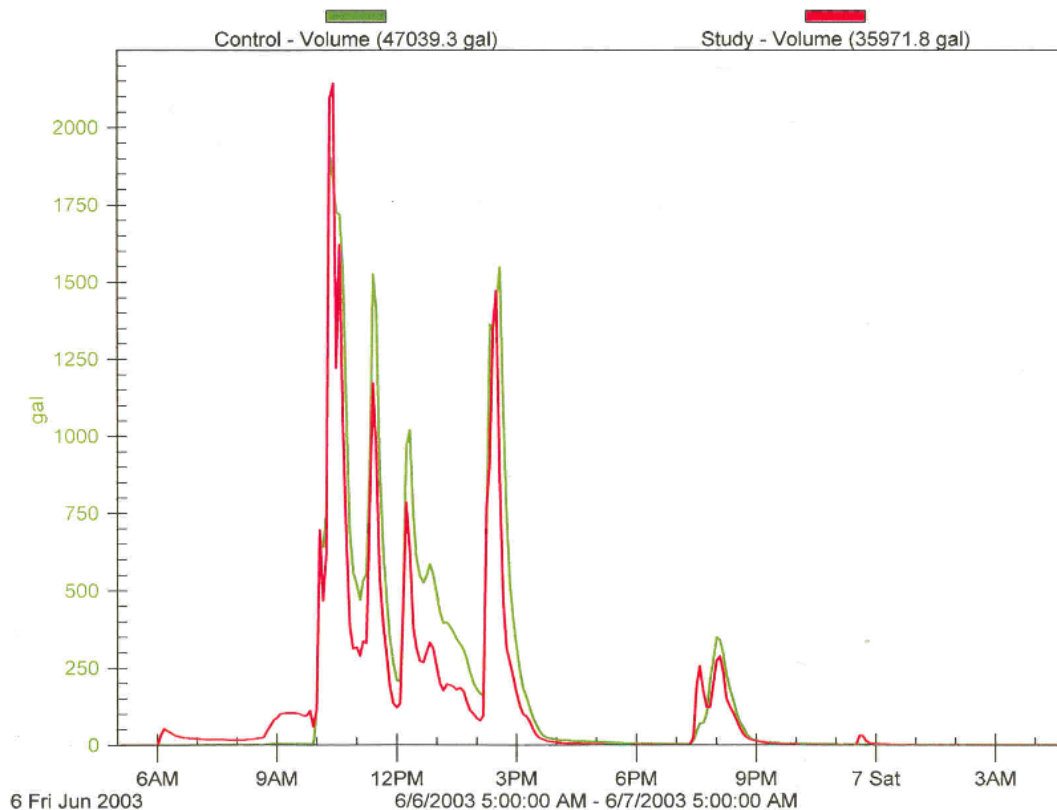
New Volume-Based Standards:

How to Quantify Benefits?

Timing of Precipitation – Account for Meteorological Variability

Pre-Construction Runoff Volumes

June 6, 2003 - 0.57" Rainfall



New Water Tool for Reuse/Harvesting:

Quantify Benefits and Timing

Relatively Simple

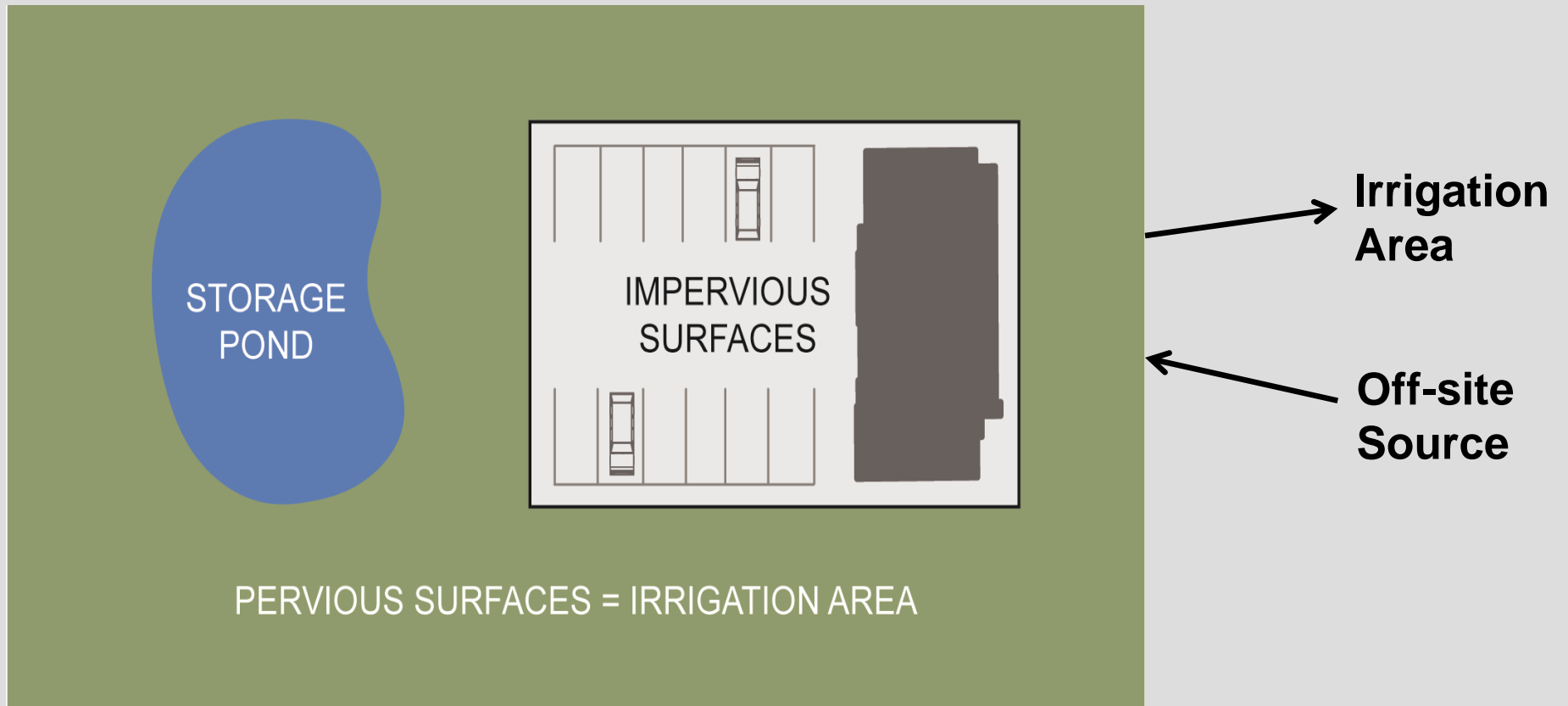
Quantity & Quality

Literature Review:

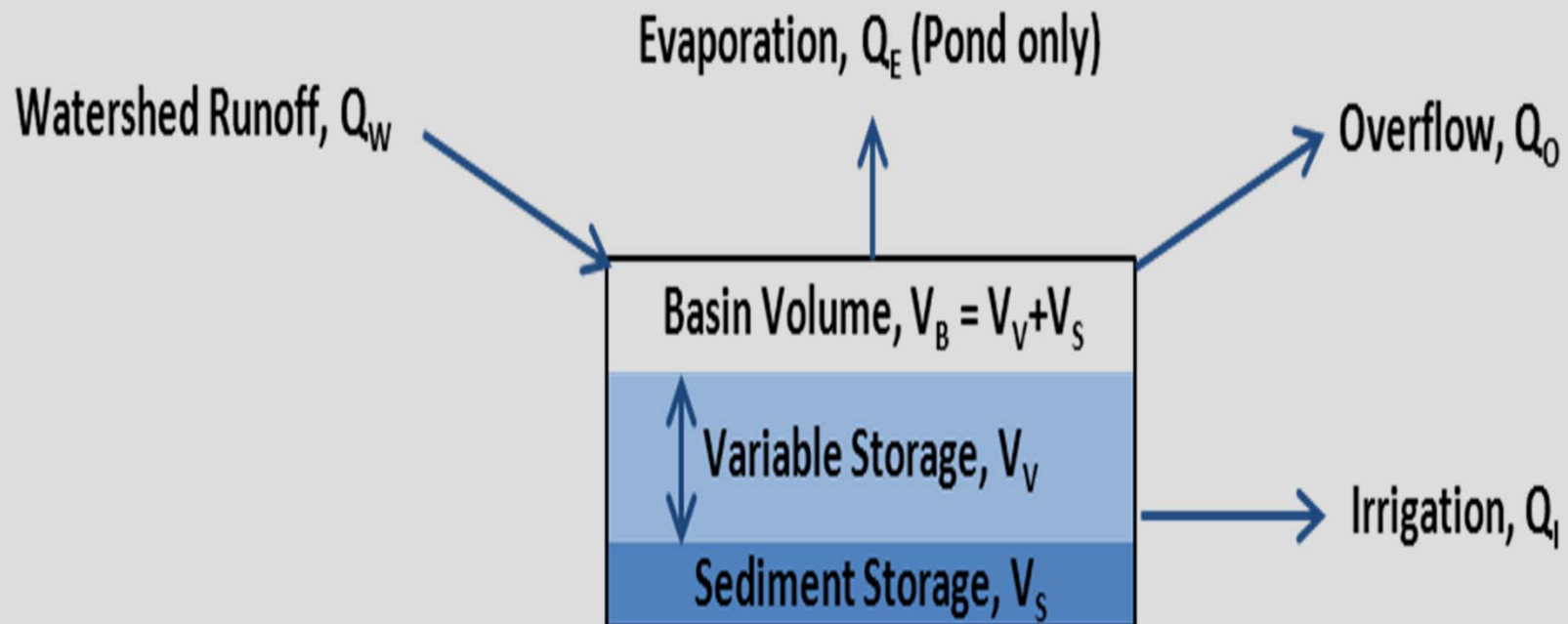
Reuse vs. Harvesting Water Quality Guidance – Australia

Water Sources	Stormwater reuse			Rainwater harvesting		
	AUST	FLOR	TEX	VIRG	NCAR	WASH
Roofwater – Residential	✓		✓	✓	✓	✓
Roofwater – Nonresidential	✓		✓	✓	✓	✓
Stormwater – Wet Detention Pond	✓	✓	✓			
Stormwater – Urban sewers	✓		✓			
Stormwater – Waterways	✓		✓			
Stormwater – Wetlands	✓		✓			
Sewage	✓					
Greywater	✓					

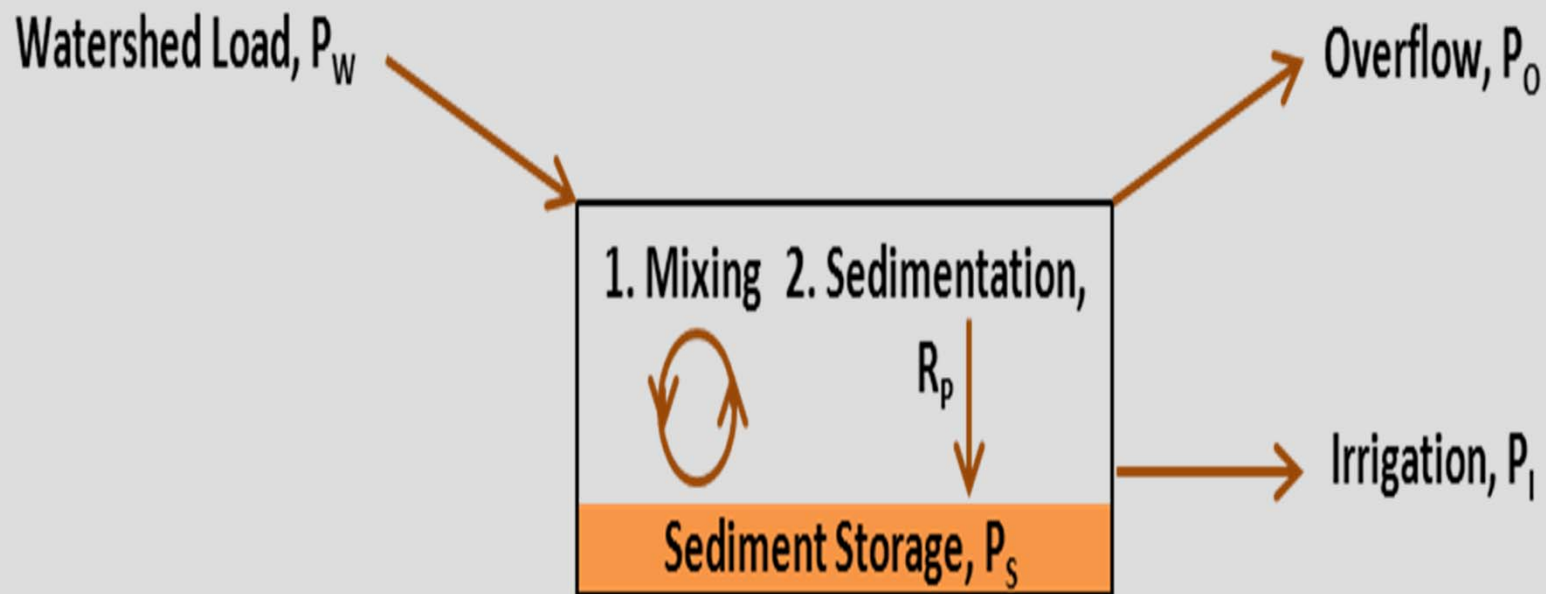
Model Setup:



Water Mass Balance:



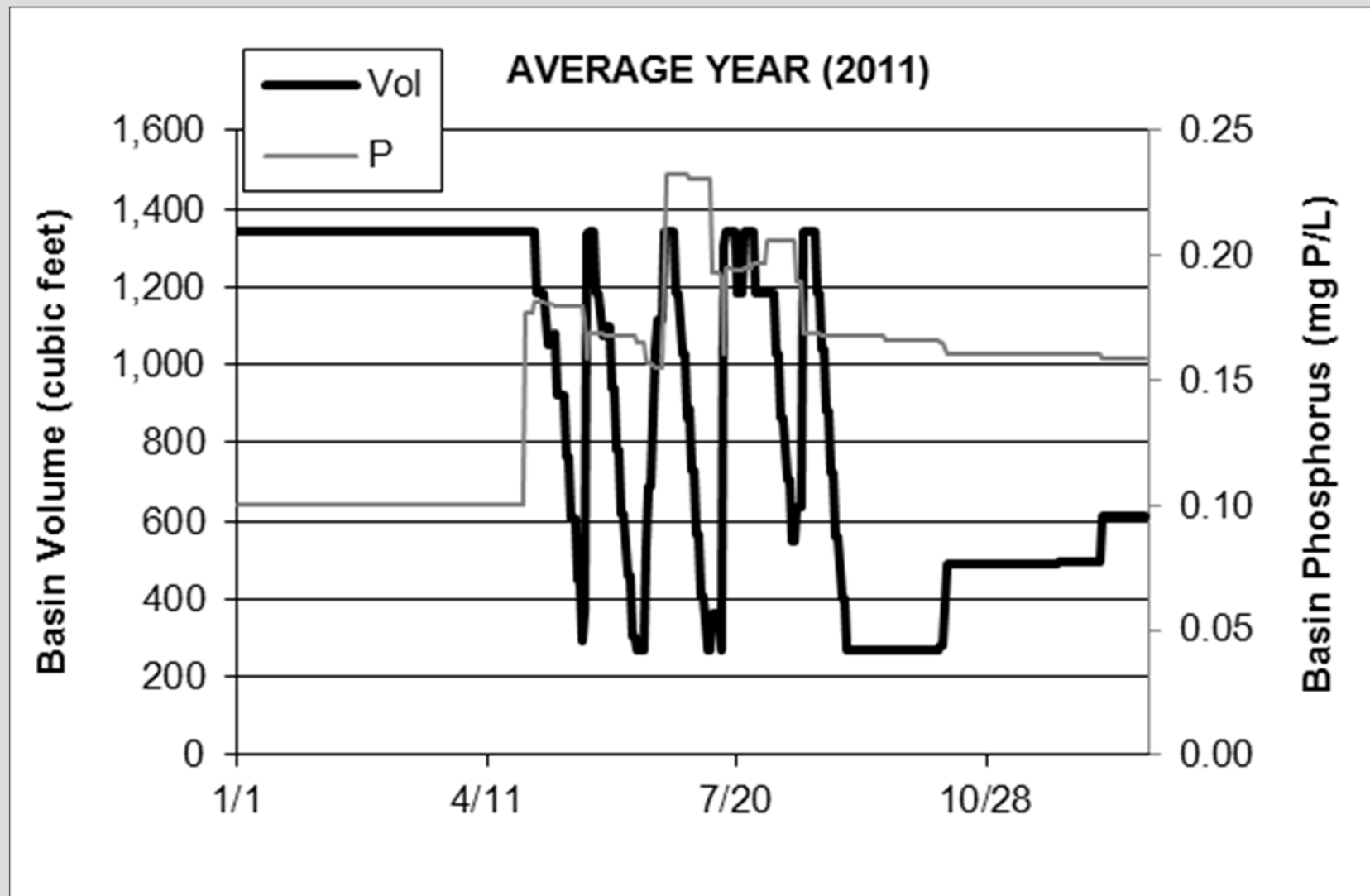
Phosphorus Mass Balance:



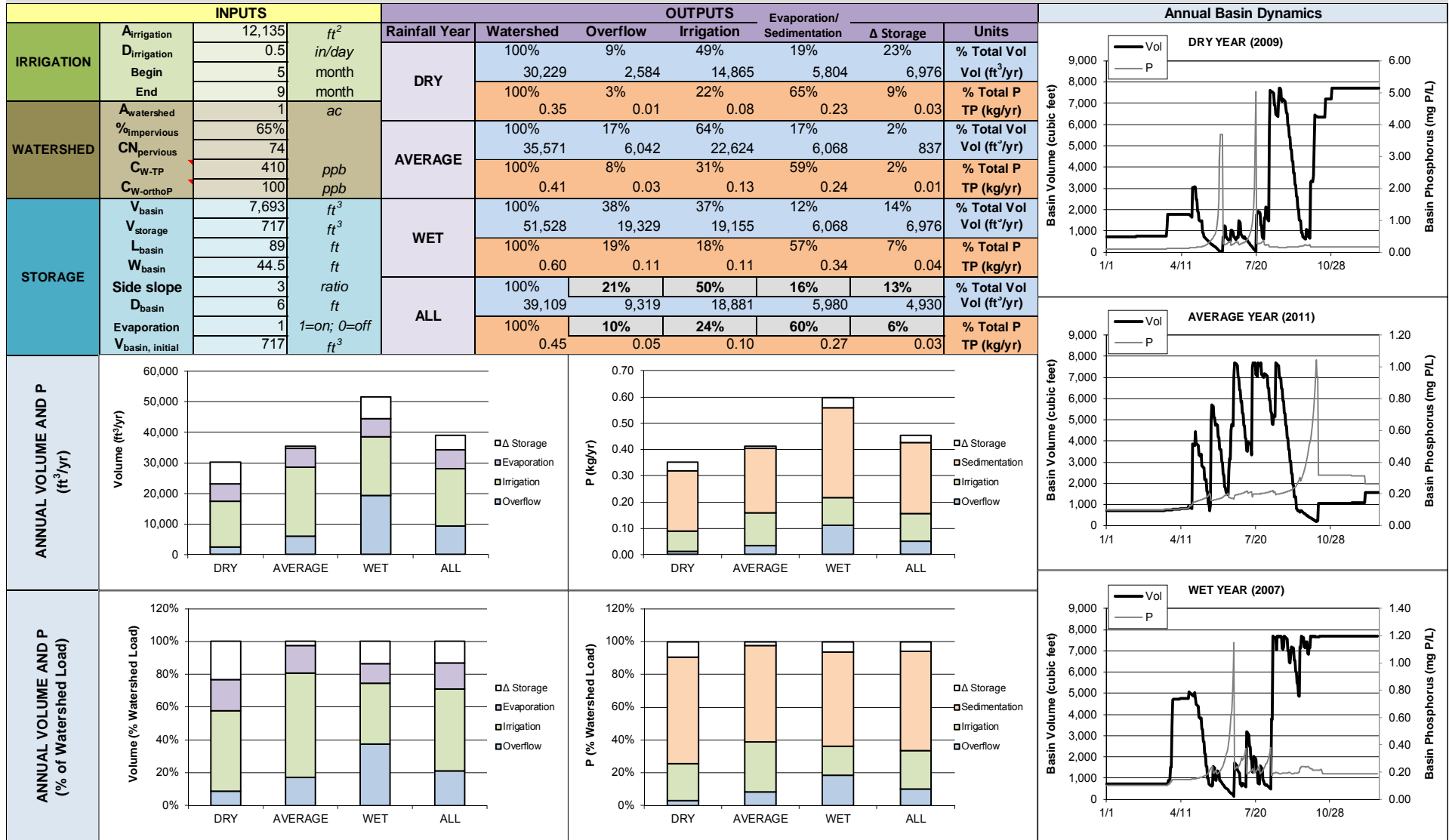
Inputs:

INPUTS			
IRRIGATION	$A_{\text{irrigation}}$	15,246	ft^2
	$D_{\text{irrigation}}$	0.5	in/day
	Begin	5	month
	End	9	month
WATERSHED	$A_{\text{watershed}}$	1	ac
	$\%_{\text{impervious}}$	30%	
	CN_{pervious}	74	
	C_{W-TP}	410	ppb
	$C_{W-orthoP}$	100	ppb
STORAGE	V_{basin}	7,693	ft^3
	V_{storage}	1,539	ft^3
	L_{basin}	90	ft
	W_{basin}	22	ft
	D_{basin}	5	ft
	Evaporation	0	1=on; 0=off
	$V_{\text{basin, initial}}$	1,539	ft^3

Example Output:



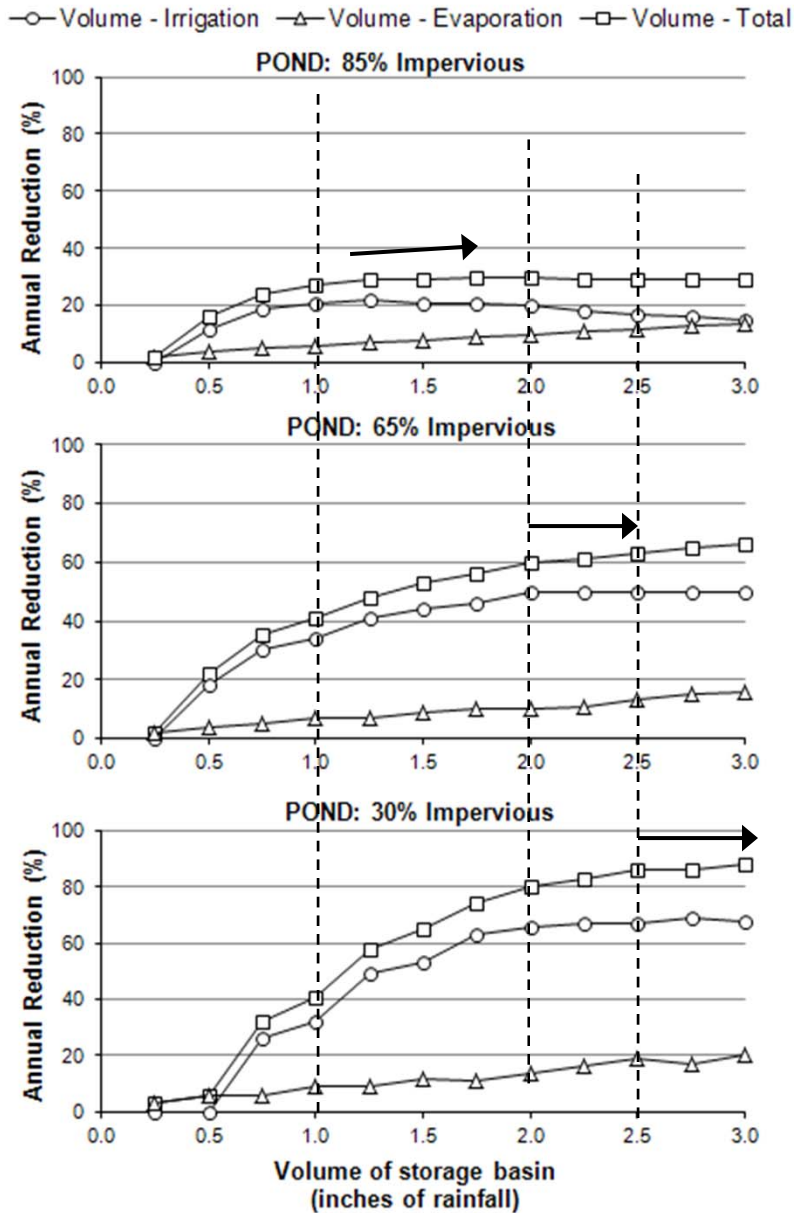
Output Summary:



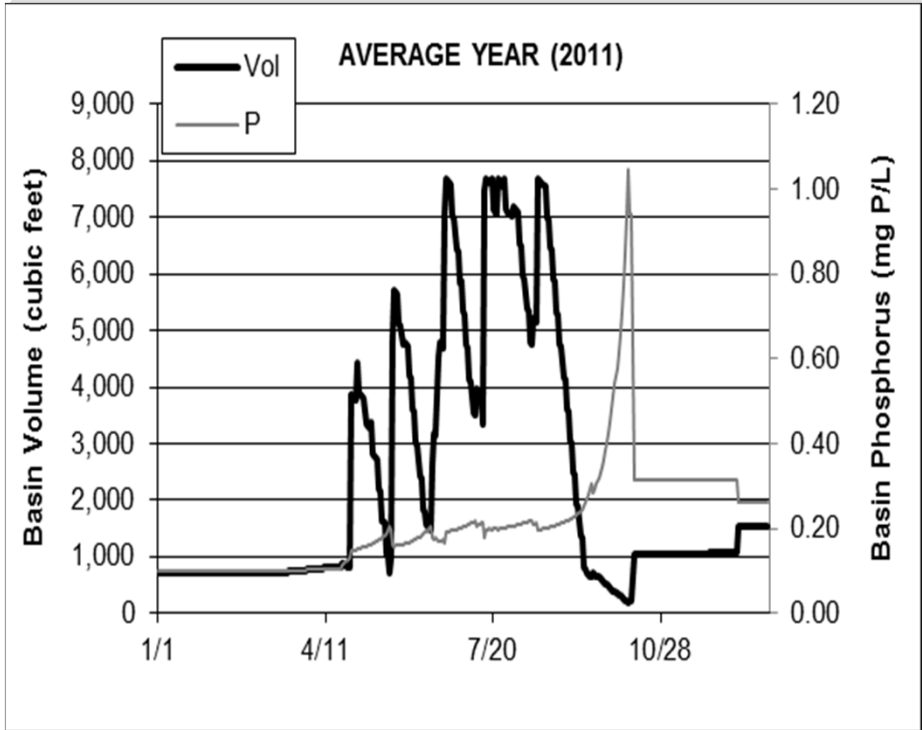
Opportunities to Repurpose Wet Ponds



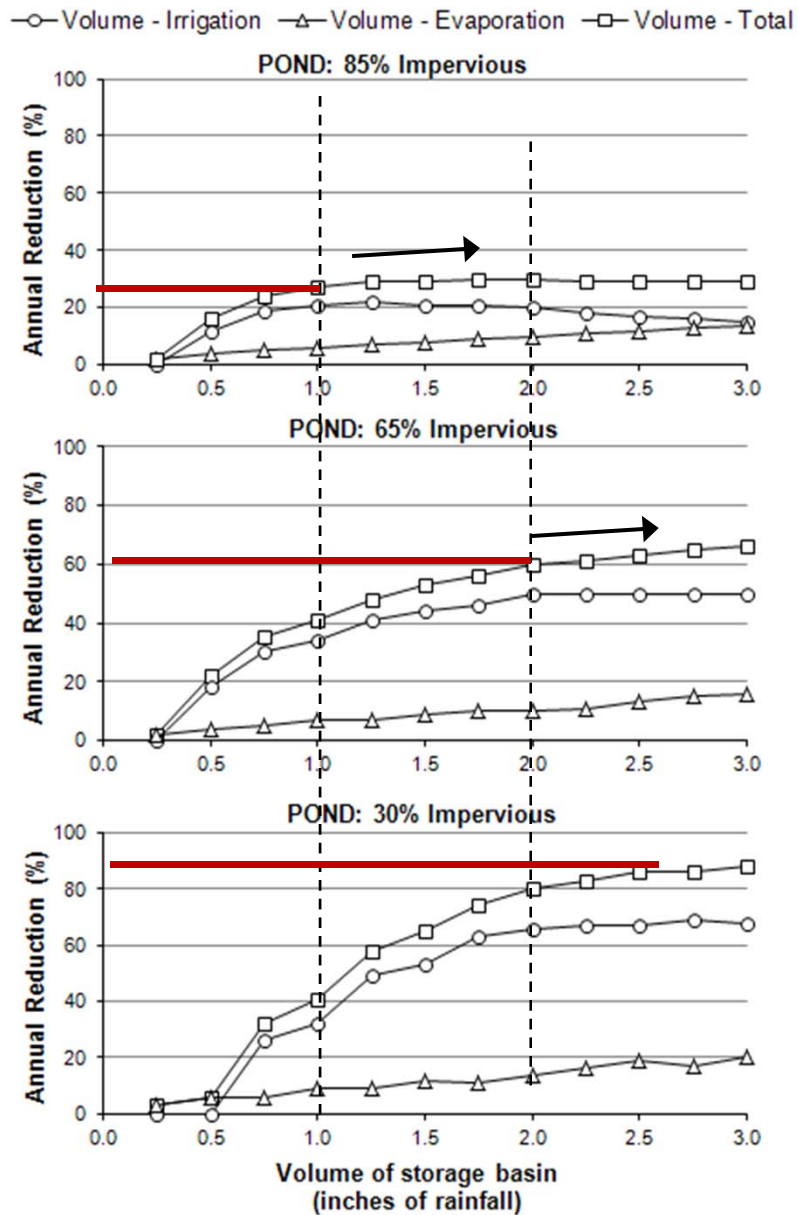
Conclusions



Optimize Storage (\$) & Stormwater Consumption

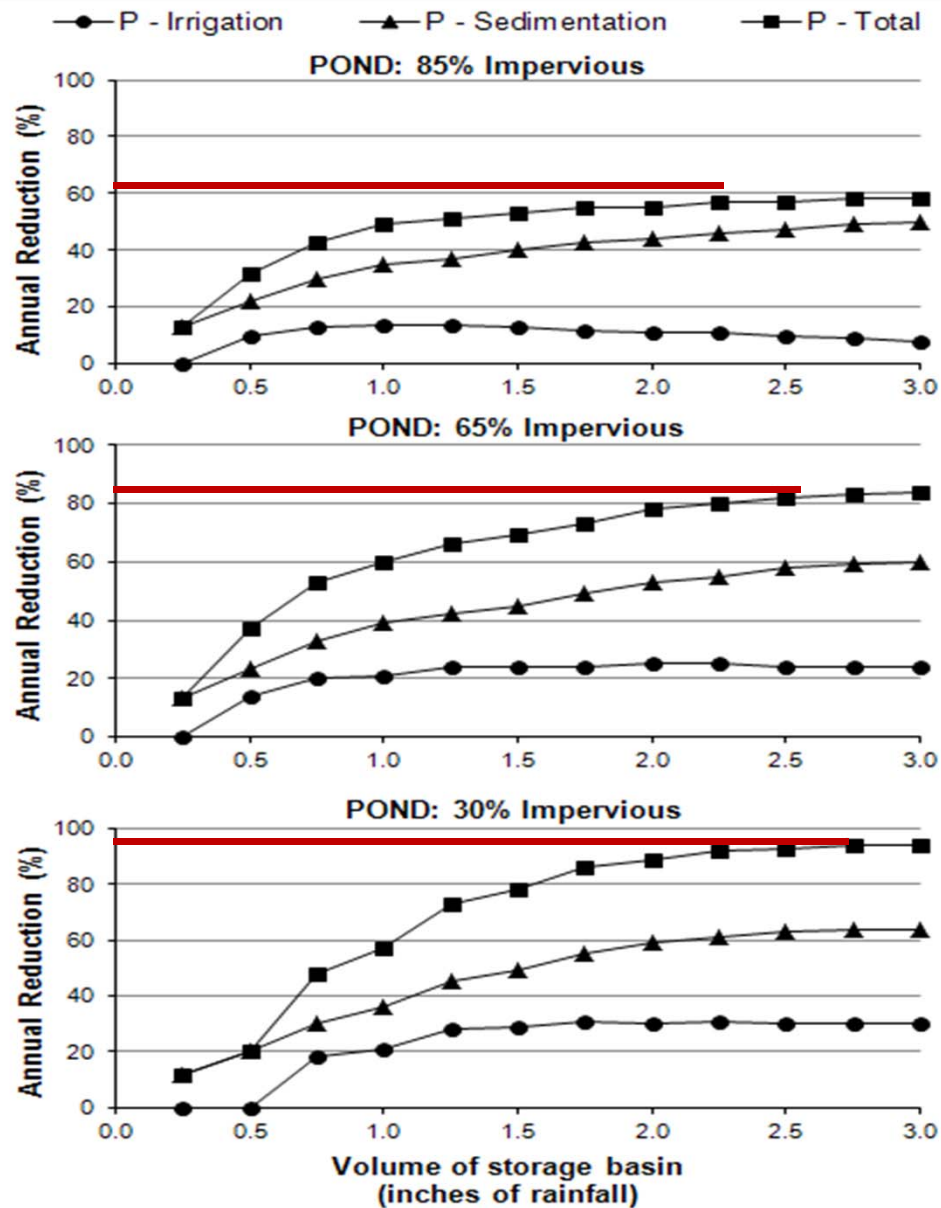


Conclusions



Available Green Space as Limitation

Conclusions



Quantify Water
Quality Benefits (P)

Acknowledgements



**Mississippi Watershed
Management Organization
&
Minnehaha Creek
Watershed District
(Joint Research Grant)**

