Stormwater Harvesting

Stormwater Harvesting and Greenroofs

The Proposed Statewide Stormwater Rule: How We Got There

At a Meeting of the

AMERICAN ACADEMY OF ENVIRONMENTAL ENGINEERS®

Proudly Serving the Environmental Engineering Profession since 1955

September 22, 2009

At the Science Applications International Corporation Facilities, Orlando Fl

a program from the

University of Central Florida Stormwater Management ACADEMY

"Managed Stormwater is Good Water"

Presentation by

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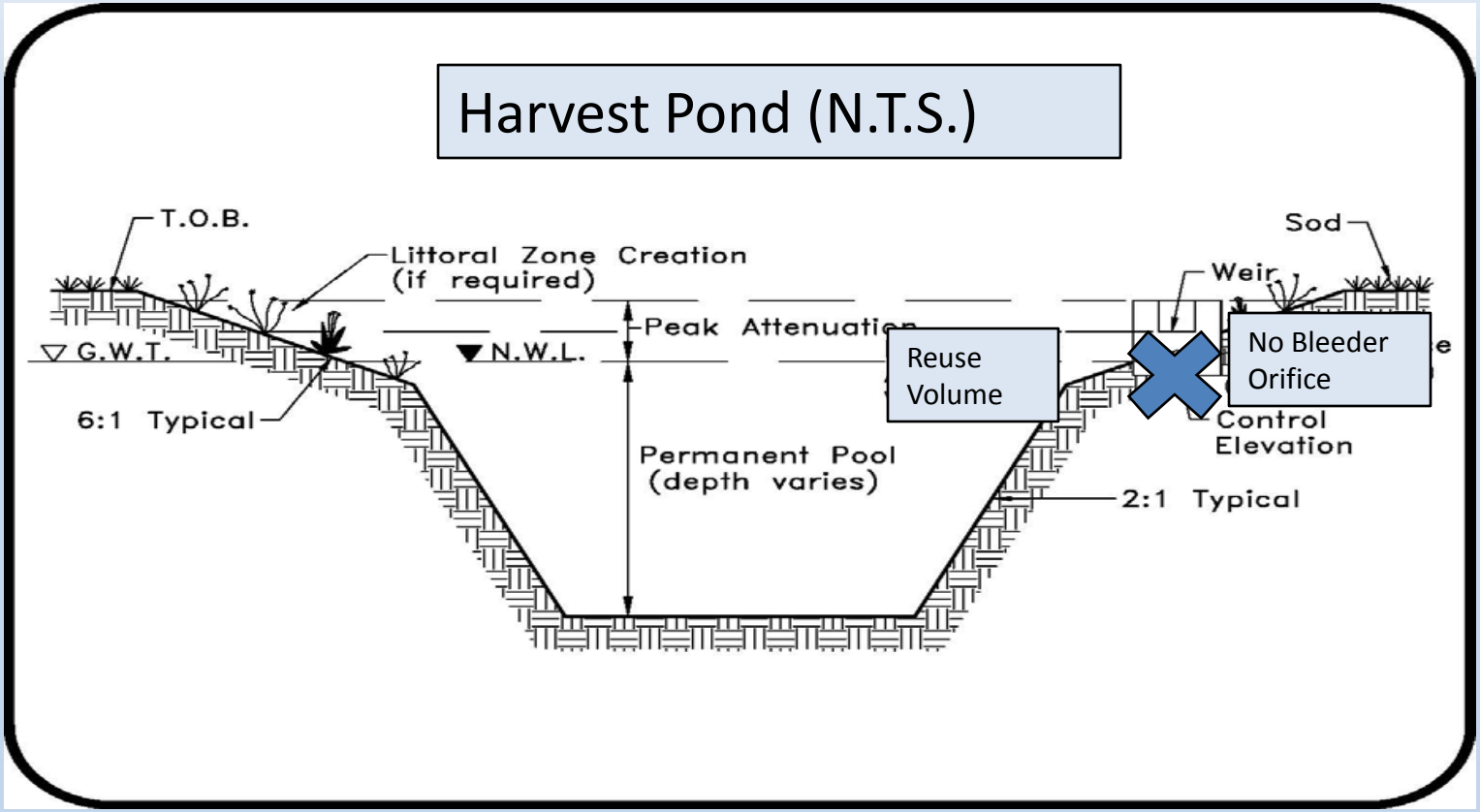
Professor, University of Central Florida

University of Central Florida 1963

Stormwater Harvesting

Stormwater harvesting means the use of treated stormwater to reduce the volume of stormwater and the associated pollutant load discharged from a stormwater management system, such as for irrigation, car washes, and cooling systems, but specifically not including reclaimed water as defined in Chapter 62-610, F.A.C.

Harvest Pond – enhanced stormwater pond



1. No bleed down orifice or pipe.
2. Harvest volume can be smaller or larger than the pollution control volume.
3. Permanent pool may be decreased during operation. Positive effect on flood control, however, can affect water use (consumptive use) permits.

Examples: Over 300 in Florida

Sources: Horizontal Subsurface Systems and G. Hartman

www.stormwater.ucf.edu

South Bay Utilities

- Upscale residential irrigation demand
- No CUP
- No FPSC
- No FDEP

- 50¢/1,000 gallons
- Shallow wells
- Customer agreements 900 homes - HOA
- Coastal / fragile resource

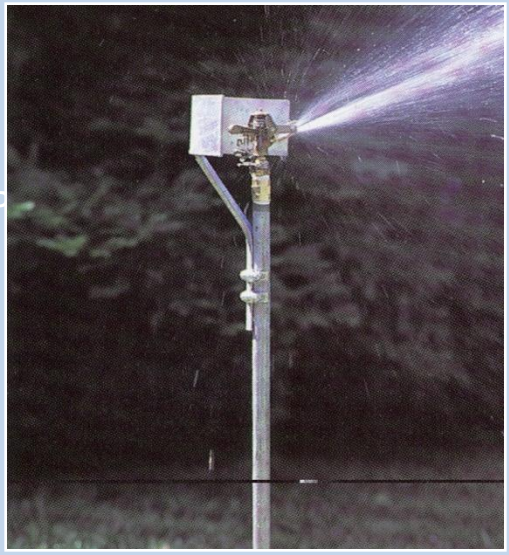
Largest in Florida is south of the Beach Line in Orange and Osceola Counties

Agricultural and future urban

- Approximately 550,000 acres
- FPSC (Exclusive)

- 19.2¢/1,000 gallons (2004)
- Canals, Ponds and wells
- 20 MGD
- Expandable

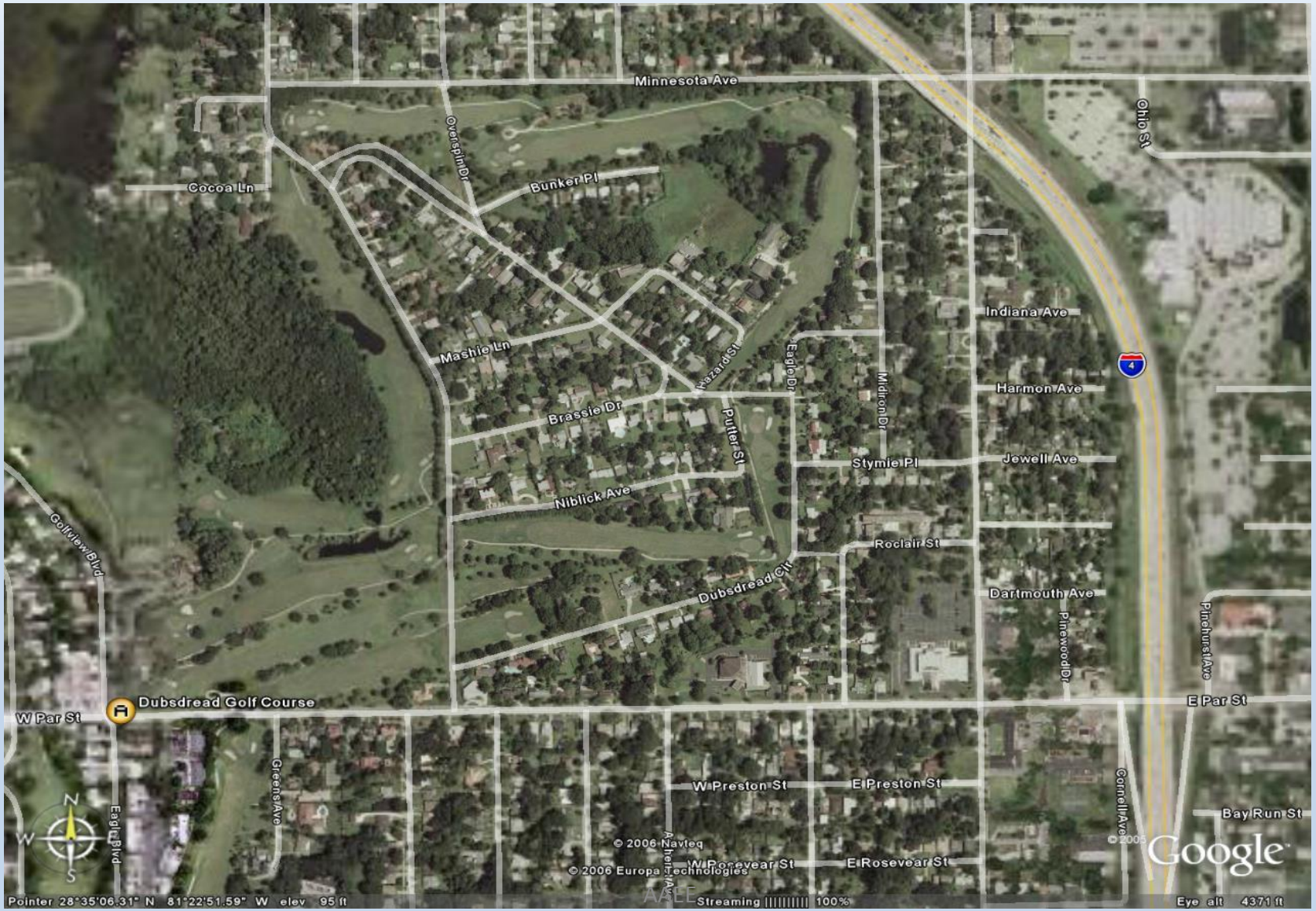
Test F



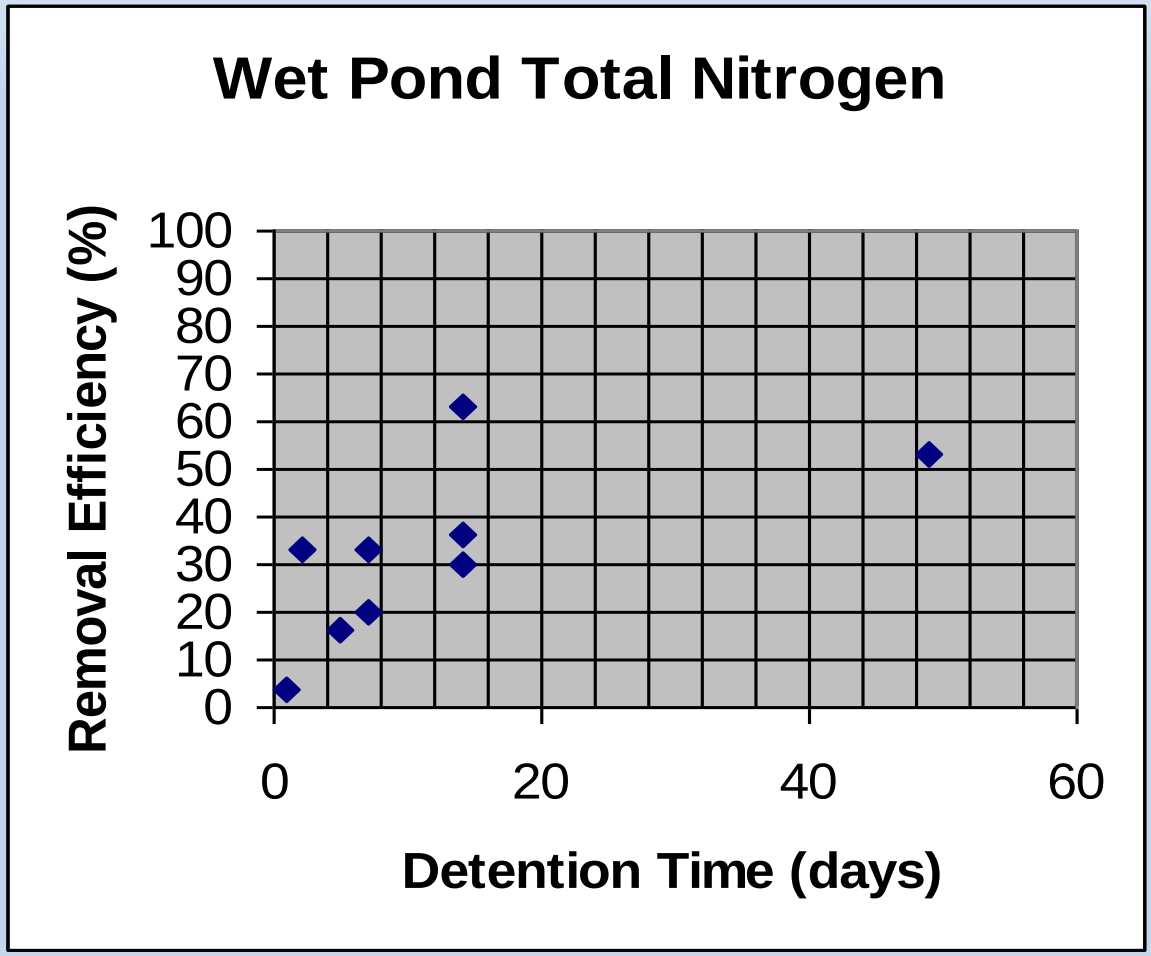
Dubstread Golf Course and I-4 Stormwater Management Plan

- Plan – Provide water on golf course to improve the play and image of the course.
- FDOT – We got the water for you.
- WIN WIN FDOT and a high school gets stormwater plans, citizens get a real golf course.
- All get stormwater treatment and saving of potable water that would otherwise be used for irrigation.
- And oh yes, Wekiva is protected.

District Signature Project

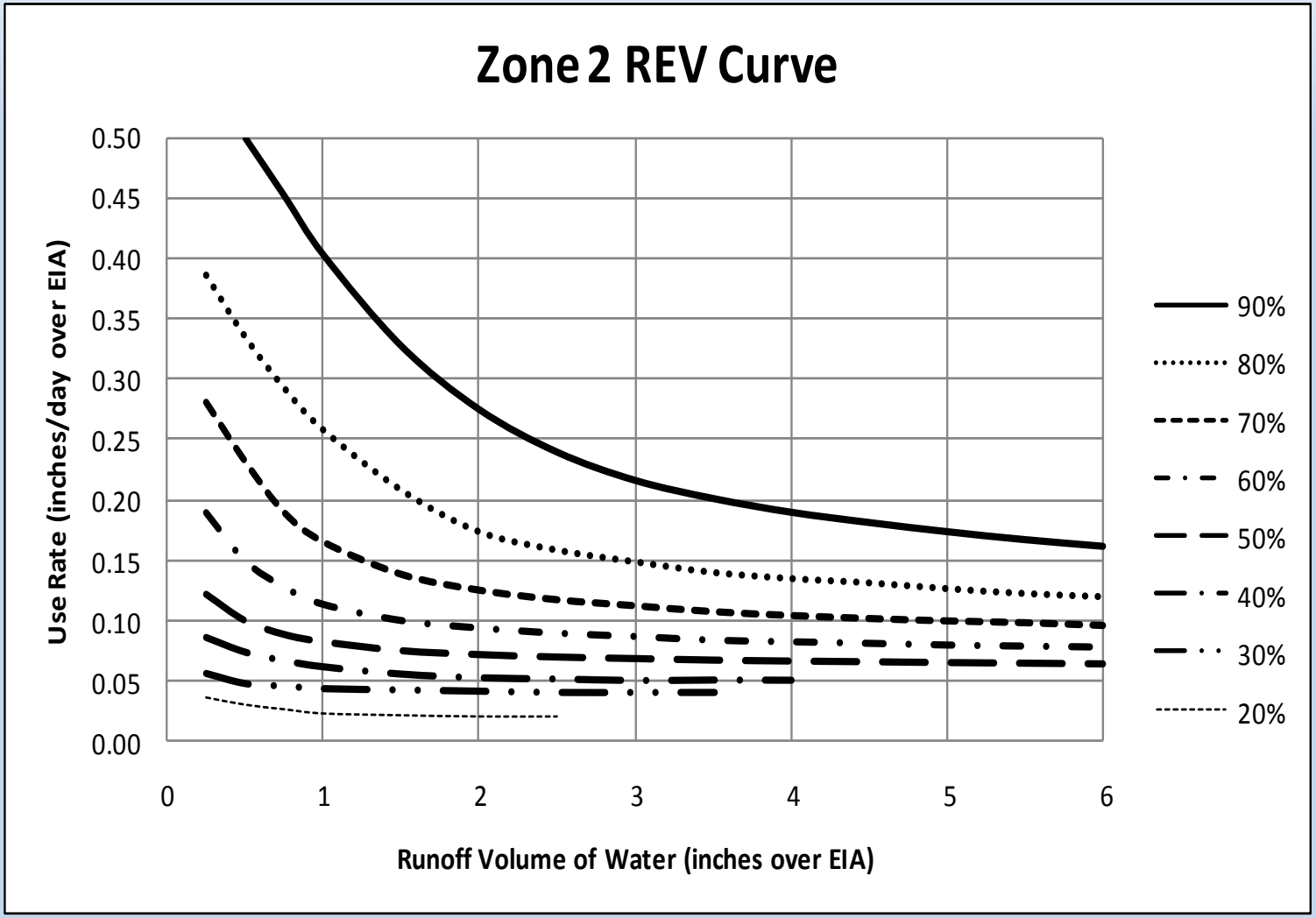


Wet Pond Effectiveness

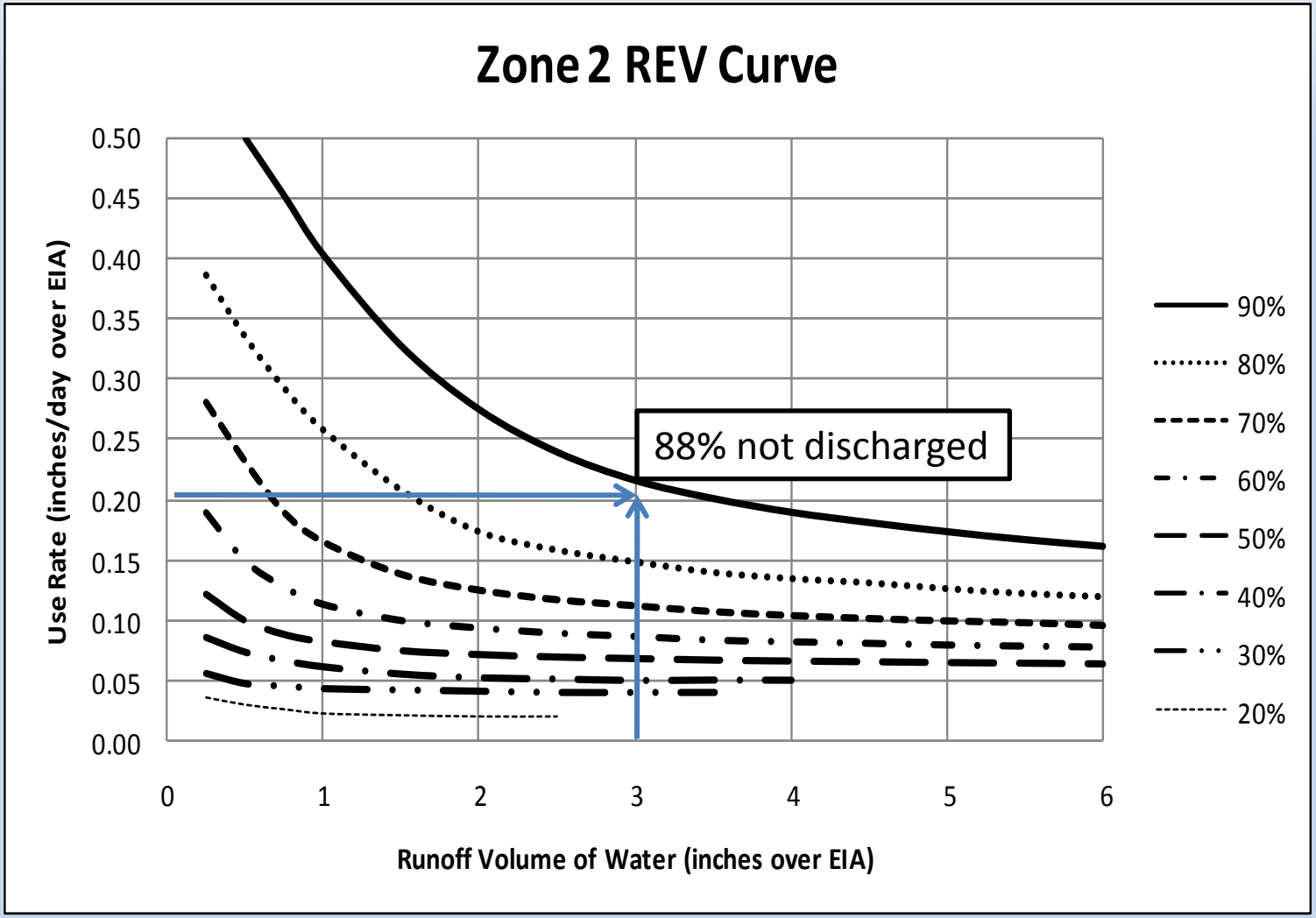


From Harper, 2006, page 5-46

Design Curve

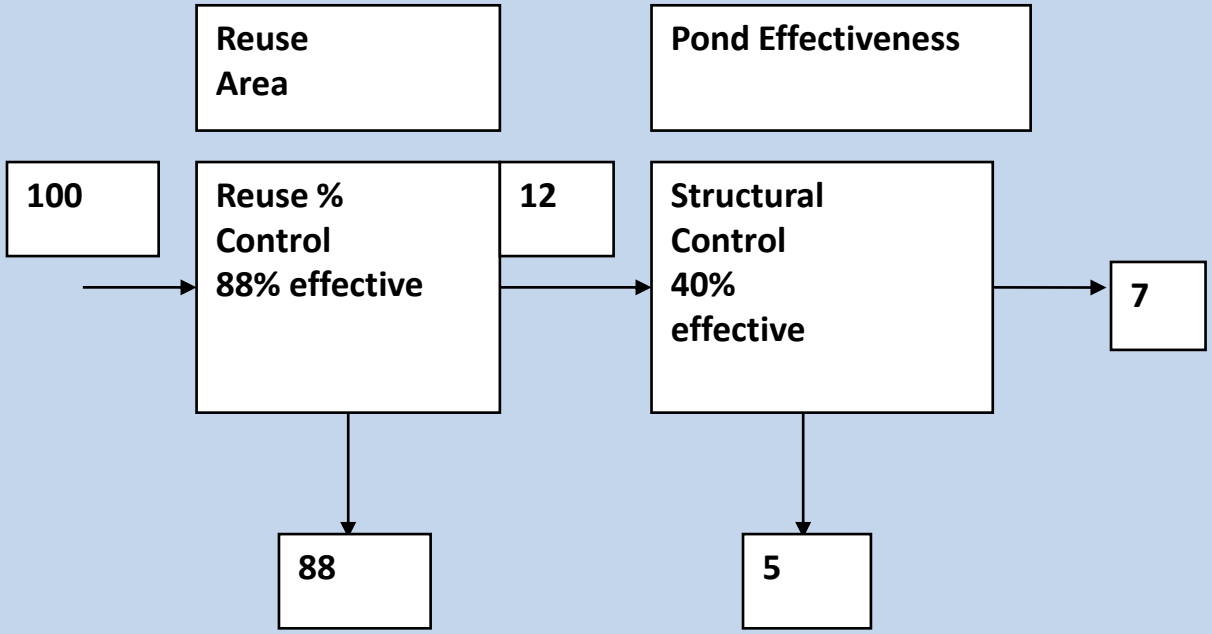


Example: irrigation 0.7 inch/week on 48 acres and EIA area is 24 acres with 3 inch storage



Enhanced Nitrogen Removal of a Detention Pond by Harvesting the Detained Water

- 88% of water not discharged: mass removed is 100[1-{(1-.88)(1-.4)}] = 93%
- 88 acre-feet supplied to 48 acres (from 24 acres, 50 inch rain, @ 88%)
- @$2.00/1000 gallons, net revenue is about $1000/acre irrigated/year.*
- make up water is = Need – Harvested = 145.6 – 88 = 57.6 Acre-Feet.



*Assumes a production and delivery cost of about $0.45/1000 gallons

Key Points

- The harvesting pond is considered as a supplemental water supply.
- Can be managed to benefit downstream and local users.
- Water use agreements are needed.
- Must have a storage area (existing pond or new area) and storage can be underground.
- Since pumps are used, must maintain operating records using meters or flow time operation.
- Over 600 Systems have been designed and permitted in the State.

What is a Green Roof?

- Vegetated Roof Cover
- Active (Intensive): Deep Media, Intended for Public Access
- Passive (Extensive): Shallow Media, Intended for Maintenance Access Only, Designed for Aesthetics

UCF student Union Building

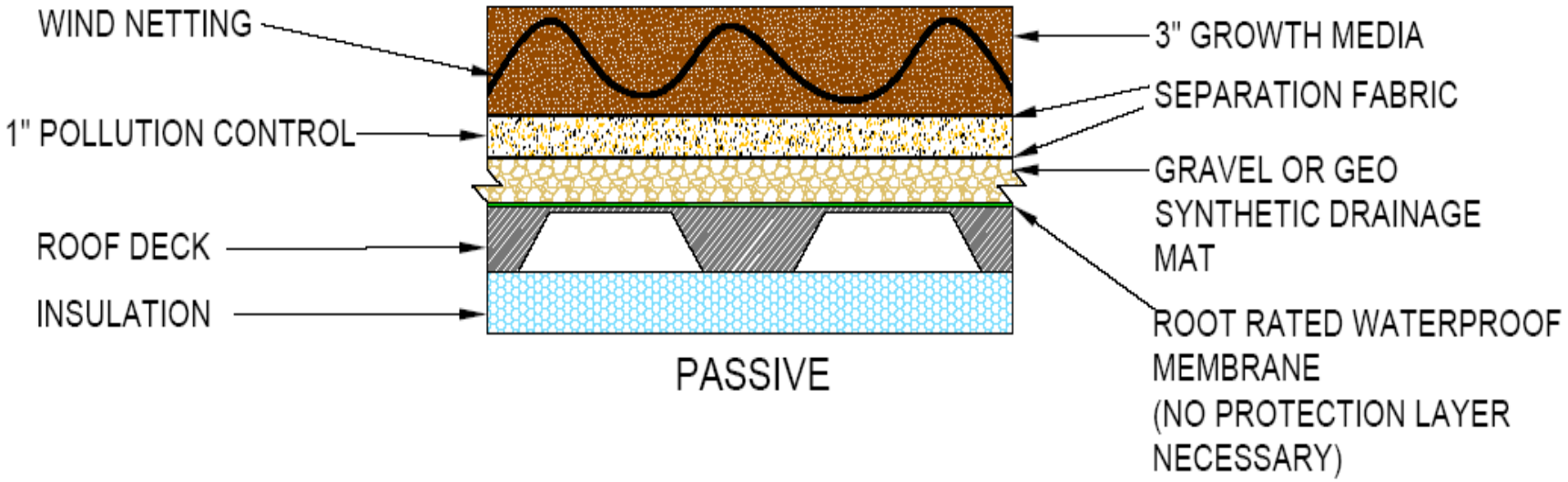
General Works, Monroe St. Seminole Co.

UCF Student Union Green Roof

- Green roof was installed in March 2005
- Full coverage achieved in about one year
- Office space with view of green roof had rent increased by $8 per square foot
- Energy benefits were analyzed by FSEC heat reduction of about 45% in a year [www.stormwater.ucf.edu]

Green Roof Construction

- Green roofs require several layers in order to ensure integrity of the roof structure and healthy plant growth
- Example of Passive (4 inch) without protection layer

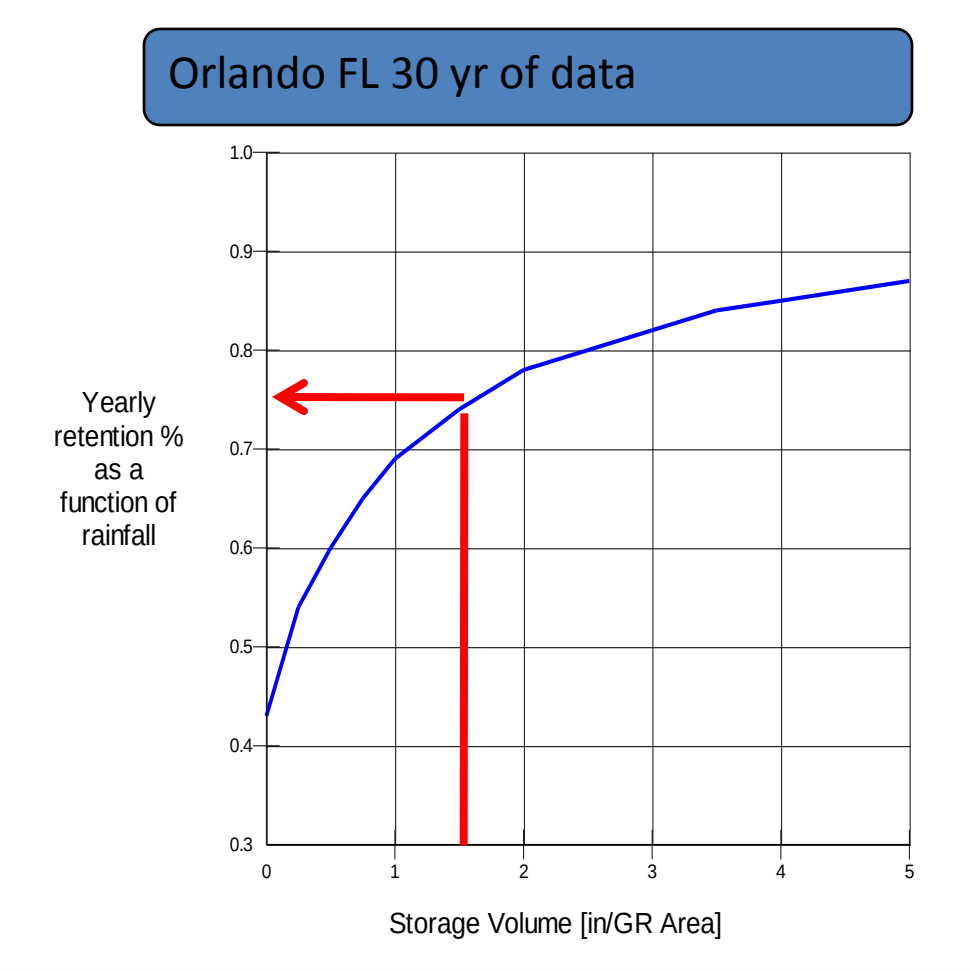


Reproduced Permission of STE

CSTORM Model for Greenroof Cistern Design

Ref: Mike Hardin Thesis UCF M.S.

- Cistern Design
  - Use CSTORM Model
  - Choose Desired Yearly Stormwater Retention
  - Use Respective Cistern Volume
  - Storage Volume Will Vary With Location
  - At UCF, designed for 1.6 inch of Rain (one gallon per SF of GR)



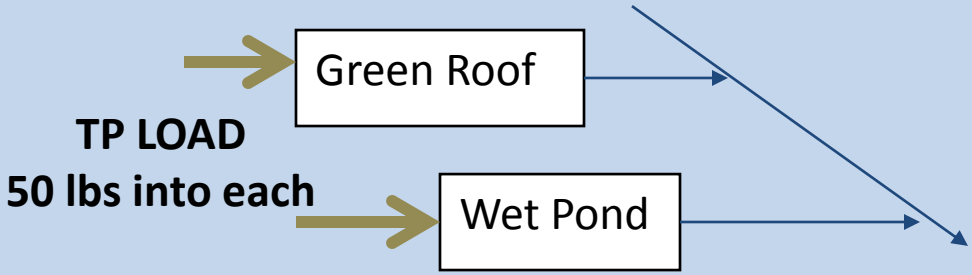
Key Points

- A reduction in public investments with costs off-set by private investments.
- Should have legal agreements for easements and access to private property.
- Since pumps are frequently used, must have operation records from meters or pump times .
- Operating effectiveness can be estimated and systems have been permitted.
- Nine operating systems in the State.

BMP TREATMENT TRAIN CREDITS FOR PARALLEL BMPs

Two BMPs in parallel – the discharge from each BMP goes into one system

Mass Removal = $Mass_1$ + $Mass_2$



Green Roof	+	Wet Pond/Harvesting	TP Removed
Remove 70% = 35 lbs Discharged 15 lbs		Remove 80% = 40 lbs Discharged 10 lbs	75 lbs

BMP TREATMENT TRAIN CREDITS FOR BMPs IN SERIES

Series: when two or more BMPs are connected such that the effluent of an upstream one becomes the influent to the downstream one.

For three BMPs in series.

$$\% \text{ Mass Removal } M = 100 \left[1 - \{(1-r_1)(1-r_2)(1-r_3)\} \right]$$

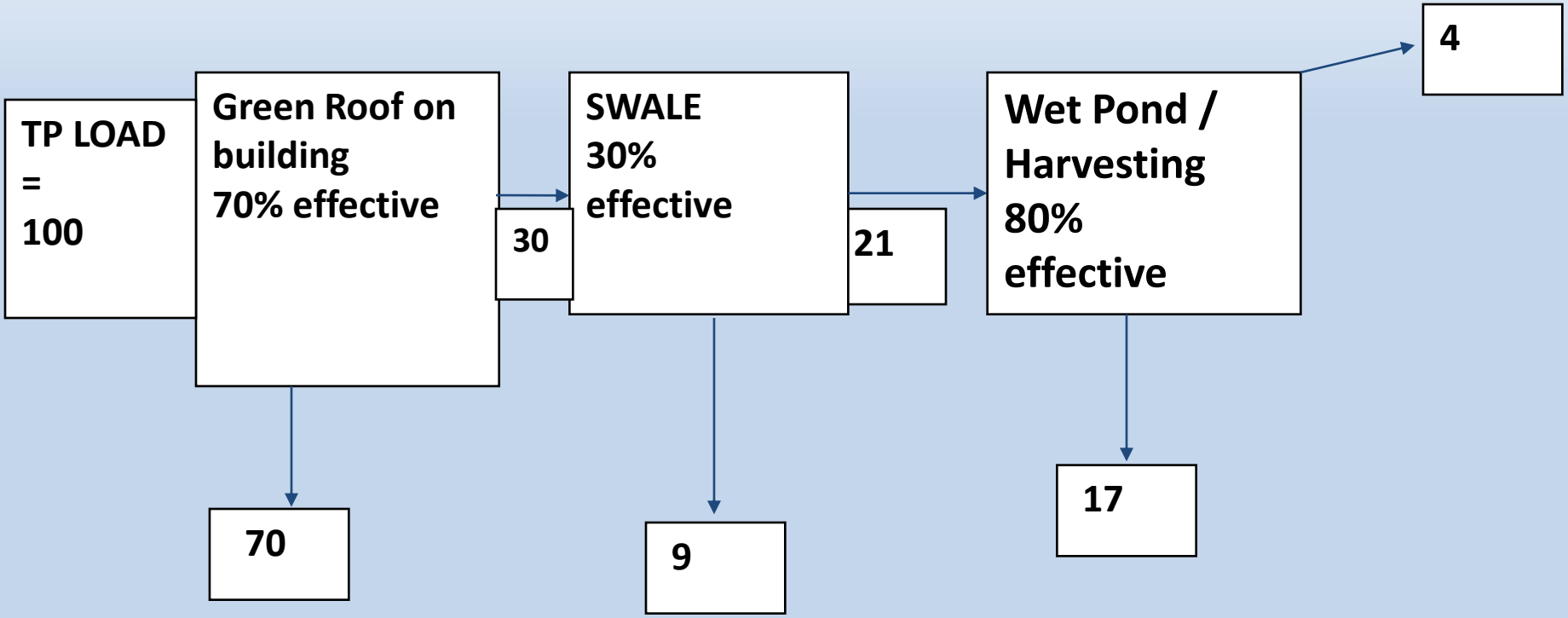
For multiple BMPs in series

$$\% \text{ Mass Removal } M = 100 \left[1 - Pi\ (1-r_i) \right]$$

where M = overall % mass removal

r_i = fraction removed in process "$_i$"

BMP TREATMENT TRAIN CREDITS FOR BMPs IN SERIES



Does the treatment train meet 95% removal of TP?
M = 100 [1- {(1-0.7)(1-0.3)(1-.80)}] = 100[1-.10] = 96 % removed

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