Retention

Stormwater Management Systems

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 (SAIC) Facilities
Orlando, Florida

a program from the

University of Central Florida Stormwater Management Academy
"Managed Stormwater is Good Water"

Presented by

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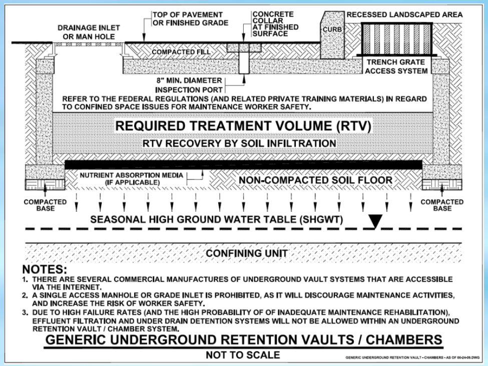
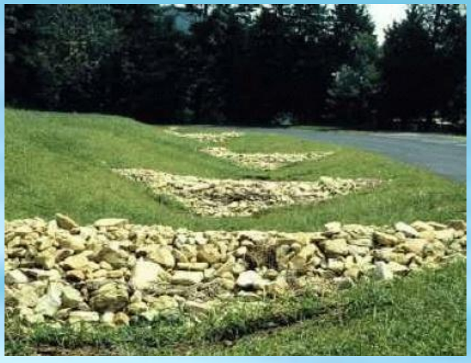
Southwest Florida Water Management District

Power Point© file name: AAEE presentation on 09-22-09 as of 09-14-09.ppt





Presentation Objective

To provide additional information, training and reference materials to Florida licensed professionals so they may successfully design storm water management systems that meet their client's objectives, while protecting the interests of the public.

DRAFT *Applicant's Handbook*

Proposed Statewide Stormwater Treatment Rule (SSTR)

July, 2009 Revision

DEPARTMENT OF ENVIRONMENTAL PROTECTION
AND WATER MANAGEMENT DISTRICTS

ENVIRONMENTAL RESOURCE PERMIT
DRAFT (JULY 2009)

STORMWATER QUALITY
APPLICANT'S HANDBOOK

DESIGN REQUIREMENTS FOR
STORMWATER TREATMENT SYSTEMS IN
FLORIDA

<insert effective date>

Available on-line at:

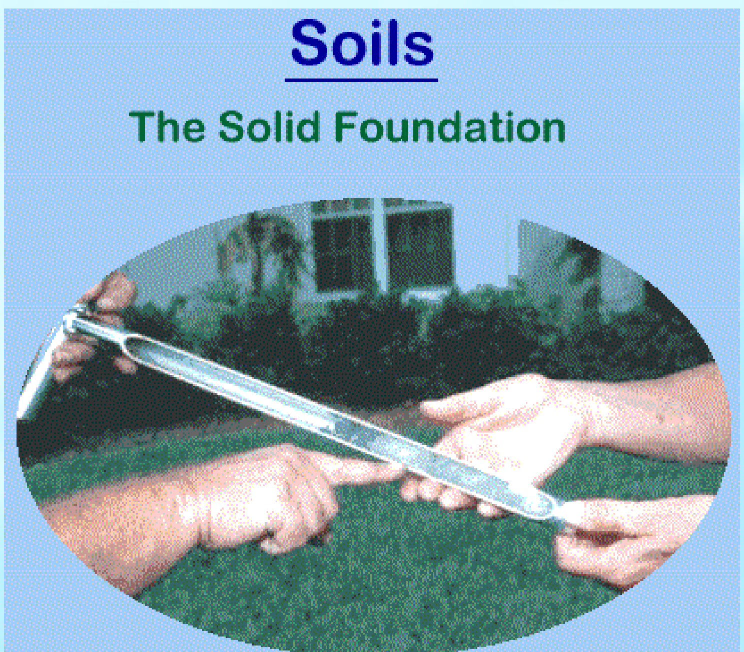
http://www.dep.state.fl.us/water/wetlands/erp/rules/stormwater/docs/ah_rule_draft7809.pdf

First things First

Obtain ACCURATE Soils data

The *"Tail that wags the Dog"* in regard to designing RETENTION systems.

Seasonal High Ground Water Table (SHGWT) & confining unit depths, and horizontal & vertical hydraulic conductivity (Kv & Kh) rates at the correct depths.



Obtaining ACCURATE Soils data

Requirements, Guidance and Recommendations for Soil Testing are currently addressed in Sub-Section 16.7 of the July, 2009 DRAFT *Applicant's Handbook*, for the proposed SSTR.

Basic Soil Conditions in Florida

Typical landscape over Candler soils

Candler soil profile

Excessively* Drained

HSG = "A" soils,

SHGWT > 6 feet Below Land Surface (B.L.S.)

These are the best soil conditions for RETENTION systems

Typical landscape over Tavares soils

Tavares soil profile

Somewhat Excessively* to Well* Drained

HSG = "A" and "B" soils,

SHGWT 42 inches to 72 inches Below Land Surface (B.L.S.)

*** Refer to the following NRCS web site for the *Natural Drainage Class* definitions:**
http://soils.usda.gov/technical/manual/print_version/chapter3.html#27

Basic Soil Conditions in Florida

Typical landscape over Nobleton soils

Narcoossee soil profile

Moderately* to Somewhat Poorly* Drained

HSG = "C" soils,

SHGWT 18 inches to 42 inches Below Land Surface (B.L.S.)

These soil conditions may require imported "hydraulically clean soils" for the proper operation of RETENTION systems

Typical landscape over Pomona soils

Immokalee soil profile

Poorly* to Very Poorly* Drained

HSG = "D" soils,

SHGWT Zero (0) to Twelve (12) inches Below Land Surface (B.L.S.)

*** Refer to the following NRCS web site for the *Natural Drainage Class* definitions: http://soils.usda.gov/technical/manual/print_version/chapter3.html#27**

Natural Drainage Class definitions*

Natural Drainage Classes

Natural drainage class refers to the frequency and duration of wet periods under conditions similar to those under which the soil developed. Alteration of the water regime by man, either through drainage or irrigation, is not a consideration unless the alterations have significantly changed the morphology of the soil. The classes follow:

Excessively drained. Water is removed very rapidly. The occurrence of internal free water commonly is very rare or very deep. The soils are commonly coarse-textured and have *very high hydraulic conductivity* or are very shallow.

Somewhat excessively drained. Water is removed from the soil rapidly. Internal free water occurrence commonly is very rare or very deep. The soils are commonly coarse-textured and have *high saturated hydraulic conductivity* or are very shallow.

Well drained. Water is removed from the soil readily but not rapidly. Internal free water occurrence commonly is deep or very deep; annual duration is not specified. Water is available to plants throughout most of the growing season in humid regions. Wetness does not inhibit growth of roots for significant periods during most growing seasons. The soils are mainly free of the deep to redoximorphic features that are related to wetness.

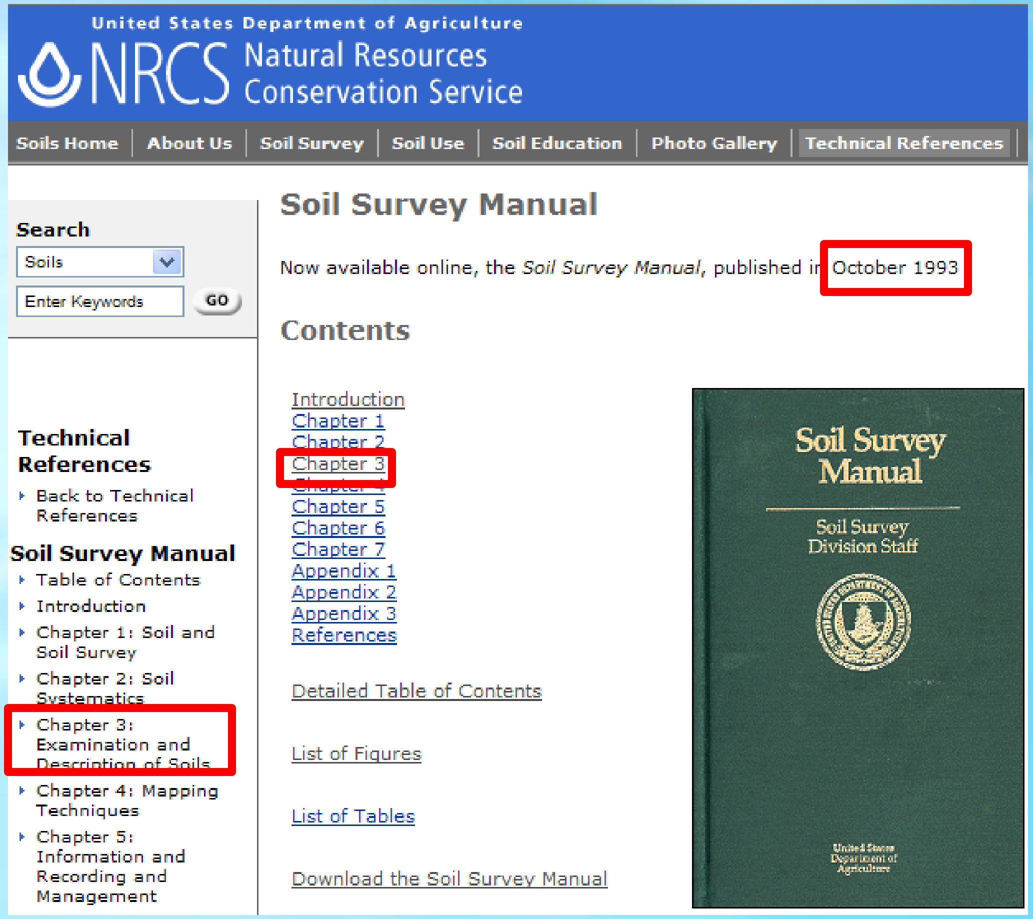
Moderately well drained. Water is removed from the soil somewhat slowly during some periods of the year. Internal free water occurrence commonly is moderately deep and transitory through permanent. The soils are wet for only a short time within the rooting depth during the growing season, but long enough that most mesophytic crops are affected. They commonly have a *moderately low* or *lower saturated hydraulic conductivity* in a layer within the upper 1 m, periodically receive high rainfall, or both.

Somewhat poorly drained. Water is removed slowly so that the soil is wet at a shallow depth for significant periods during the growing season. The occurrence of internal free water commonly is shallow to *moderately deep* and transitory to permanent. Wetness markedly restricts the growth of mesophytic crops, unless artificial drainage is provided. The soils commonly have one or more of the following characteristics: low or very *low saturated hydraulic conductivity*, a high water table, additional water from seepage, or nearly continuous rainfall.

Poorly drained. Water is removed so slowly that the soil is wet at shallow depths periodically during the growing season or remains wet for long periods. The occurrence of internal free water is shallow or very shallow and common or persistent. Free water is commonly at or near the surface long enough during the growing season so that most mesophytic crops cannot be grown, unless the soil is artificially drained. The soil, however, is not continuously wet directly below plow-depth. Free water at shallow depth is usually present. This water table is commonly the result of *low* or *very low saturated hydraulic conductivity* of nearly continuous rainfall, or of a combination of these.

Very poorly drained. Water is removed from the soil so slowly that free water remains at or very near the ground surface during much of the growing season. The occurrence of internal free water is very shallow and persistent or permanent. Unless the soil is artificially drained, most mesophytic crops cannot be grown. The soils are commonly level or depressed and frequently ponded. If rainfall is high or nearly continuous, slope gradients may be greater.

*** Refer to the following NRCS web site for the *Natural Drainage Class* definitions:**
http://soils.usda.gov/technical/manual/print_version/chapter3.html#27

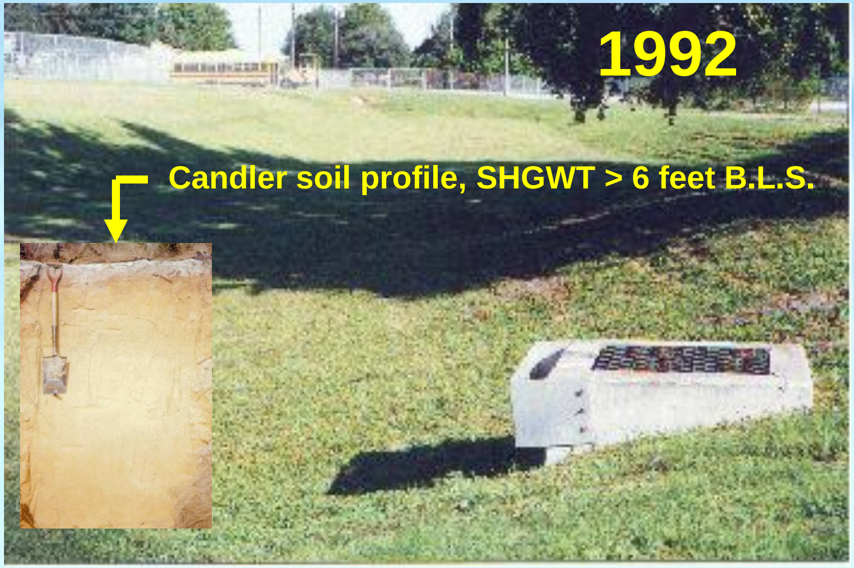


The October, 1993 Soil Survey Manual can be obtained from the following NRCS web site:

http://soils.usda.gov/technical/manual/

Slide #8

"Dry" RETENTION Systems



"Dry" RETENTION systems are currently addressed in Section 4 of the July, 2009 DRAFT *Applicant's Handbook*, for the proposed SSTR.

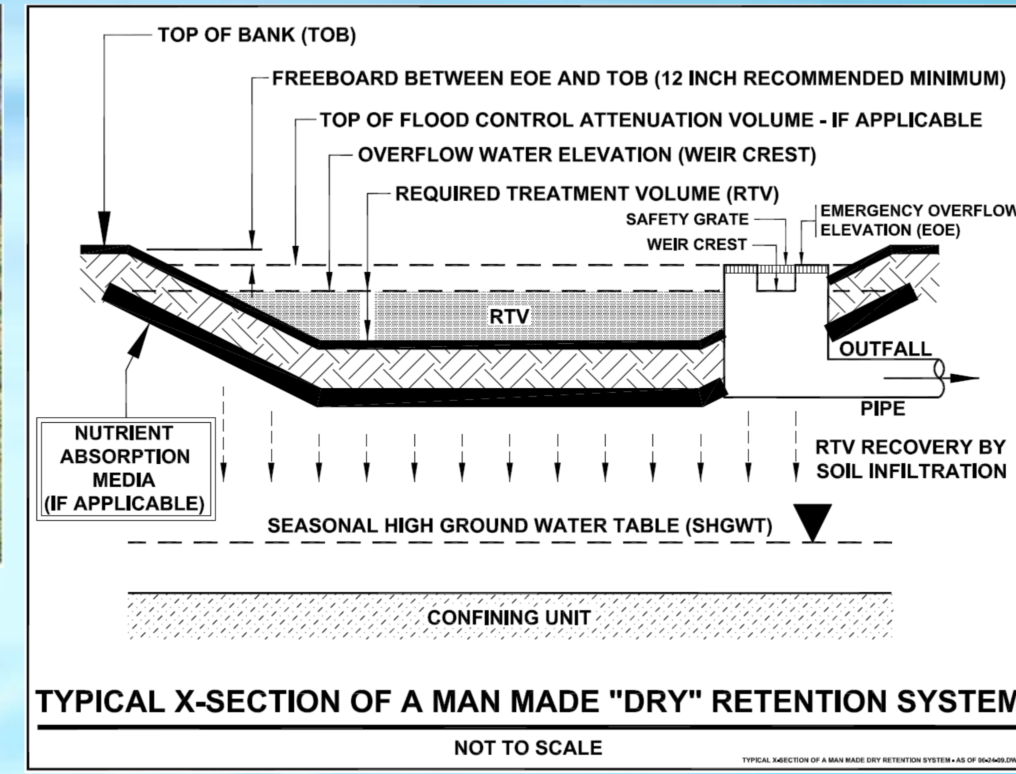


Figure 4.1
Typical Cross-section of "Dry" Retention Basin (From the July, 2009 DRAFT *Applicant's Handbook*, for the proposed SSTR).

Unless "hydraulically clean soils" are imported, these types of retention systems are typically restricted to HSG = "A" and "B" soils.

What are "Hydraulically Clean Soils"?

Hydraulically clean soils* will be defined as materials that are free of materials (clays, organics, etc.) that will impede the soil's saturated vertical and horizontal hydraulic conductivity.

*** Refer to Sub-Section 12.4.2(d) of the July, 2009 DRAFT Applicant's Handbook**

“Dry” Swales with Swale Blocks

Long / linear “Dry” Retention Areas

Stormwater Best Management Practice Design Guide, Volume 2, Vegetative Bio-filters
http://www.epa.gov/ORD/NRMRL/pubs/600r04121/600r04121.htm

Swales with Swale Blocks (linear retention areas) are currently addressed in Section 4.8 of the July, 2009 DRAFT *Applicant’s Handbook*, for the proposed SSTR.

Unless “hydraulically clean soils” are imported, these types of retention systems are typically restricted to HSG = “A”, “B” and “C” soils.

Vegetated "Dry" Swales Without Swale Blocks

"Save the Swales" brochure from FDEP

http://www.dep.state.fl.us/water/nonpoint/pubs.htm#Urban_Stormwater_BMP_Research_Reports

Candler (HSG "A") soil profile, SHGWT > 6 feet B.L.S.

Tavares (HSG = "A") soil profile, SHGWT 42" to 72" B.L.S.

Narcoossee (HSG = "C") soil profile, SHGWT 18" to 42" B.L.S.

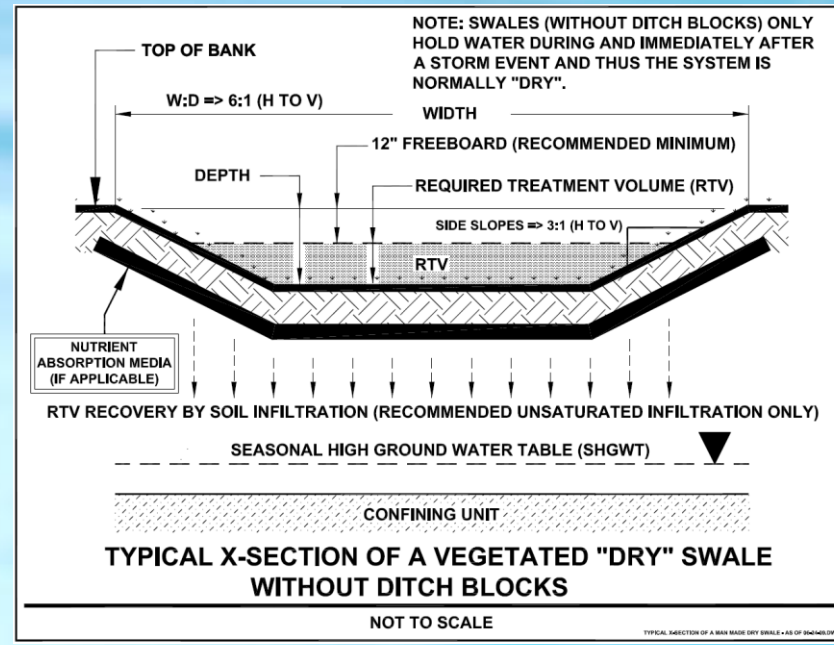


Figure 7.1 Typical Cross-section of a Vegetated Swale without Swale Blocks

Vegetated Swales Without Swale Blocks are currently addressed in Section 7.0 of the July, 2009 DRAFT *Applicant's Handbook*, for the proposed SSTR.

Unless "hydraulically clean soils" are imported, these types of retention systems are typically restricted to HSG = "A", "B" and "C" soils.

Underground Exfiltration Trench Systems

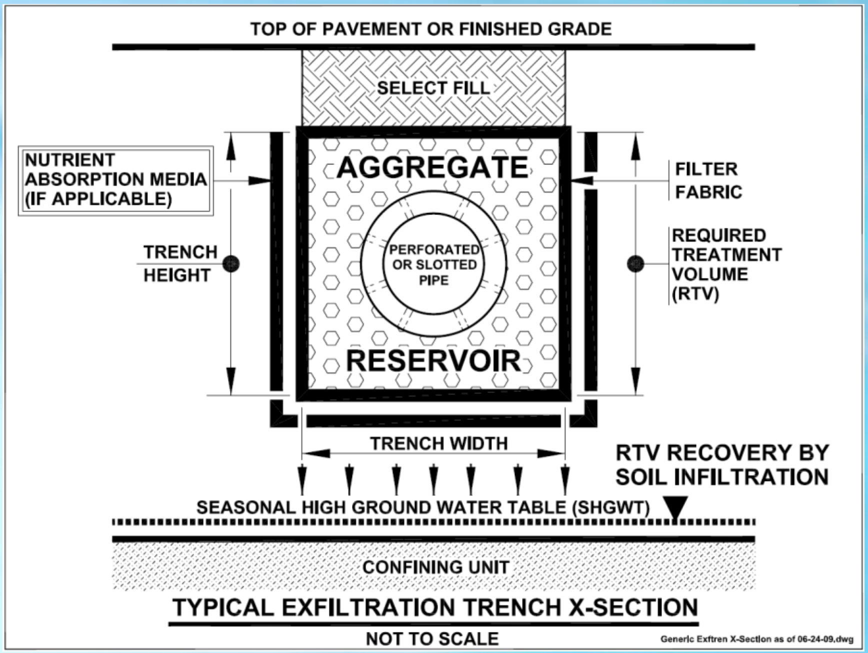


Figure 6.1
Cross-section of a Typical Underground Exfiltration Trench

Candler (HSG "A") soil profile, SHGWT > 6 feet B.L.S.

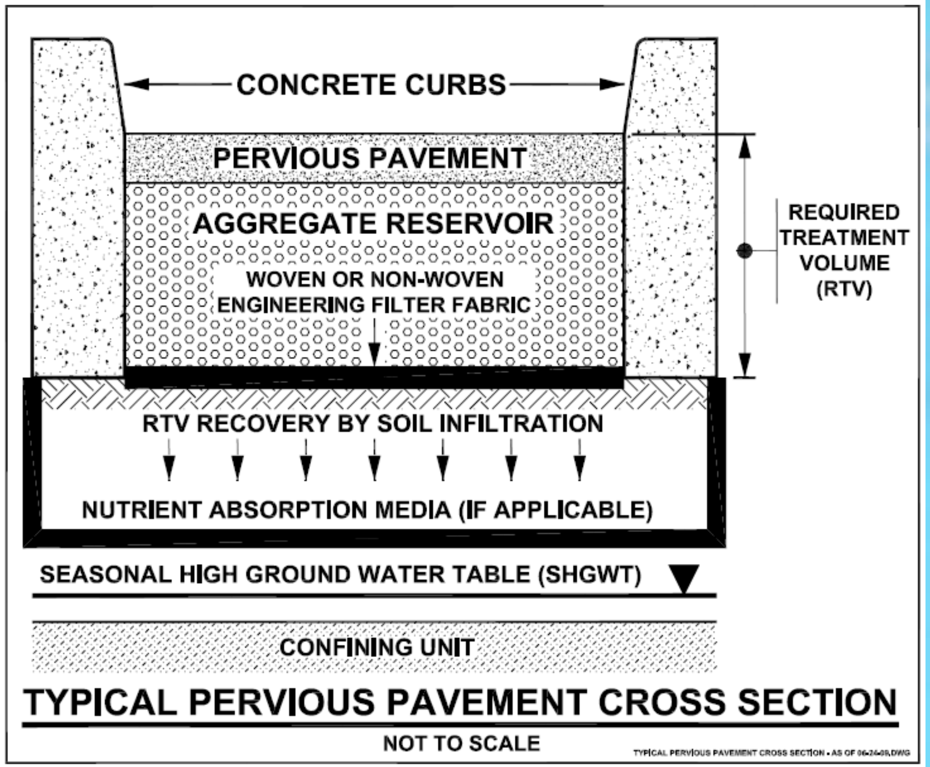
Tavares (HSG = "A") soil profile, SHGWT 42" to 72" B.L.S.

Underground Exfiltration Trench Systems are currently addressed in Section 6.0 of the July, 2009 DRAFT *Applicant's Handbook*, for the proposed SSTR.

Unless "hydraulically clean soils" are imported, these types of retention systems are typically restricted to HSG = "A" and "B" soils.

Pervious Pavement Systems*

* Dr. Manoj Chopra will provide a more in-depth discussion of these types of retention systems later in tonight's program.



Candler (HSG "A") soil profile, SHGWT > 6 feet B.L.S.

Tavares (HSG = "A") soil profile, SHGWT 42" to 72" B.L.S.

Narcoossee (HSG = "C") soil profile, SHGWT 18" to 42" B.L.S.

Unless "hydraulically clean soils" are imported, these types of retention systems are typically restricted to HSG = "A", "B" and "C" soils.

Pervious Pavement Systems are currently addressed in Sub-Section 12.4 of the July, 2009 DRAFT *Applicant's Handbook*, for the proposed SSTR.

Underground Retention Vault / Chamber Systems

Maintenance worker safety is a concern in these types of "confined space" systems due to the anaerobic environment.

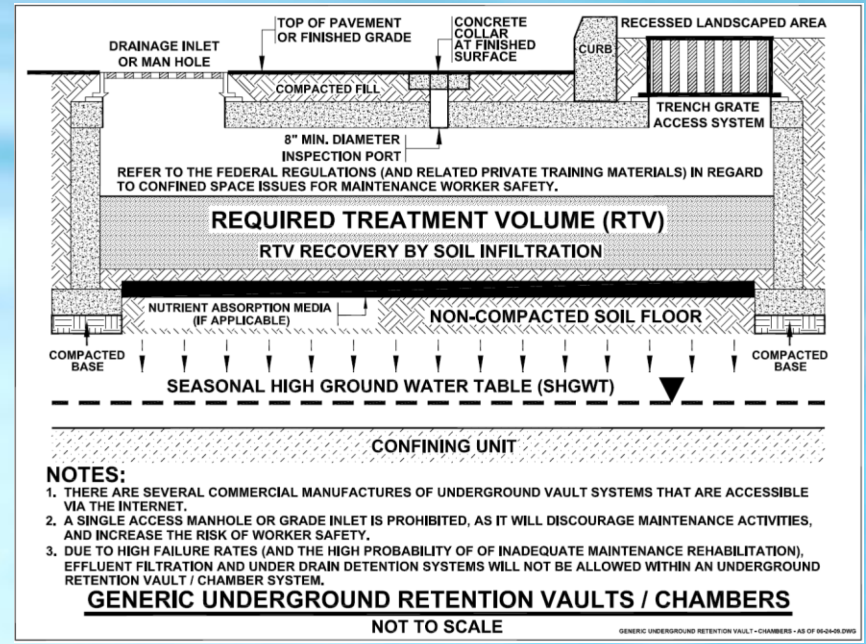


Figure 13.1
Generic Underground Retention Vaults / Chambers

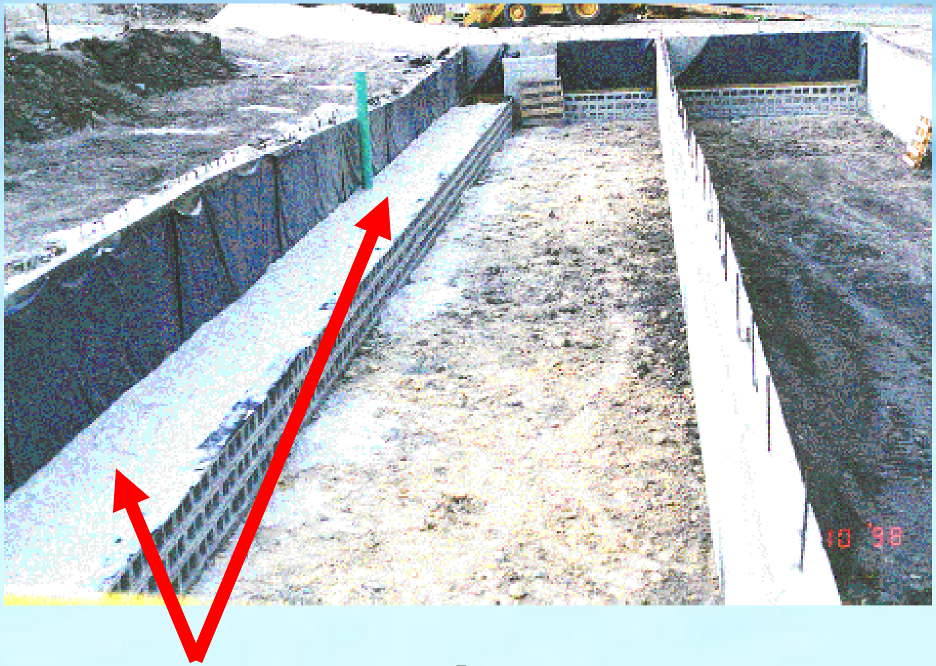
Candler (HSG "A") soil profile, SHGWT > 6 feet B.L.S.

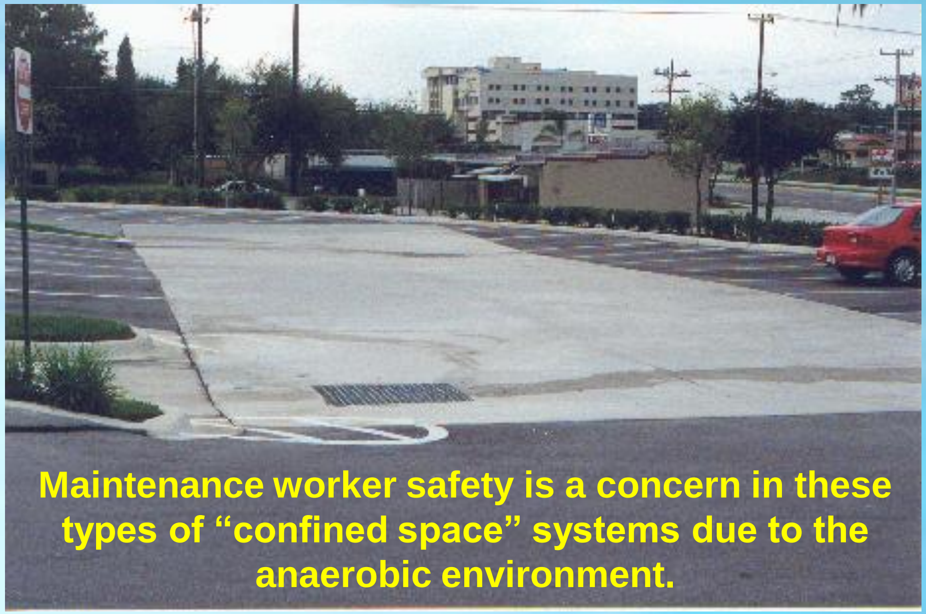
Tavares (HSG = "A") soil profile, SHGWT 42" to 72" B.L.S.

Unless "hydraulically clean soils" are imported, these types of retention systems are typically restricted to HSG = "A" and "B" soils.

Underground Retention Vault / Chamber Systems are currently addressed in Section 13 of the July, 2009 DRAFT *Applicant's Handbook*, for the proposed SSTR.

Underground Retention Vault / Chamber Systems





Filter System *

*** Due to a high degree of difficulty in rehabilitation and maintenance, filter and underdrain detention systems will not be permitted. (Refer to Sub-Section 13.6 of the July, 2009 DRAFT *Applicant's Handbook*, for the proposed SSTR).**

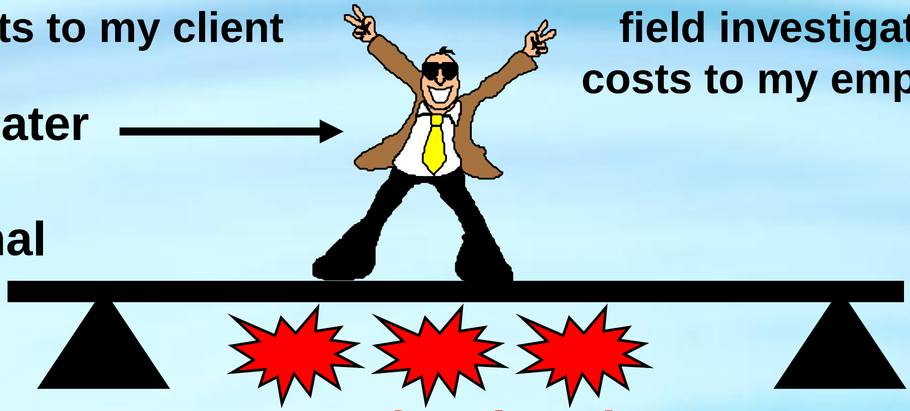
"Confined Space" issues are discussed in greater detail in Sub-Section 13.7 of the July, 2009 DRAFT *Applicant's Handbook*, for the proposed SSTR).

A major consideration in storm water management is the balancing of Risk (and Liability) vs. Cost.

Higher development costs to my client

Higher research & field investigation costs to my employer

The storm water design professional



My Client

Professional liability risk

My Employer

What level of risk are you willing to take in the design of your surface water management system?

The RTV*

Recovery Analysis

of Retention Systems Designs

*** RTV = Required Treatment Volume**

The Soil Infiltration Process

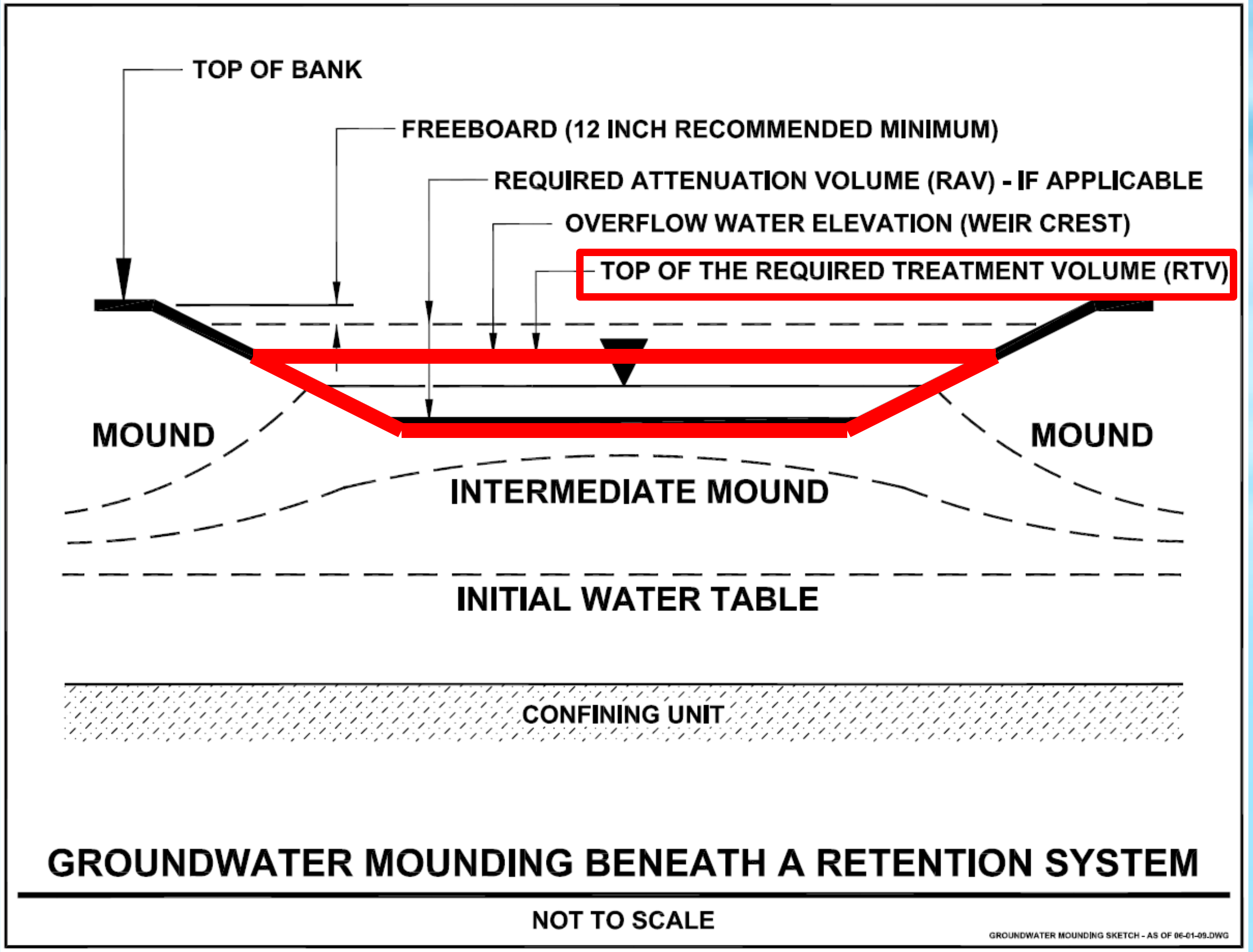
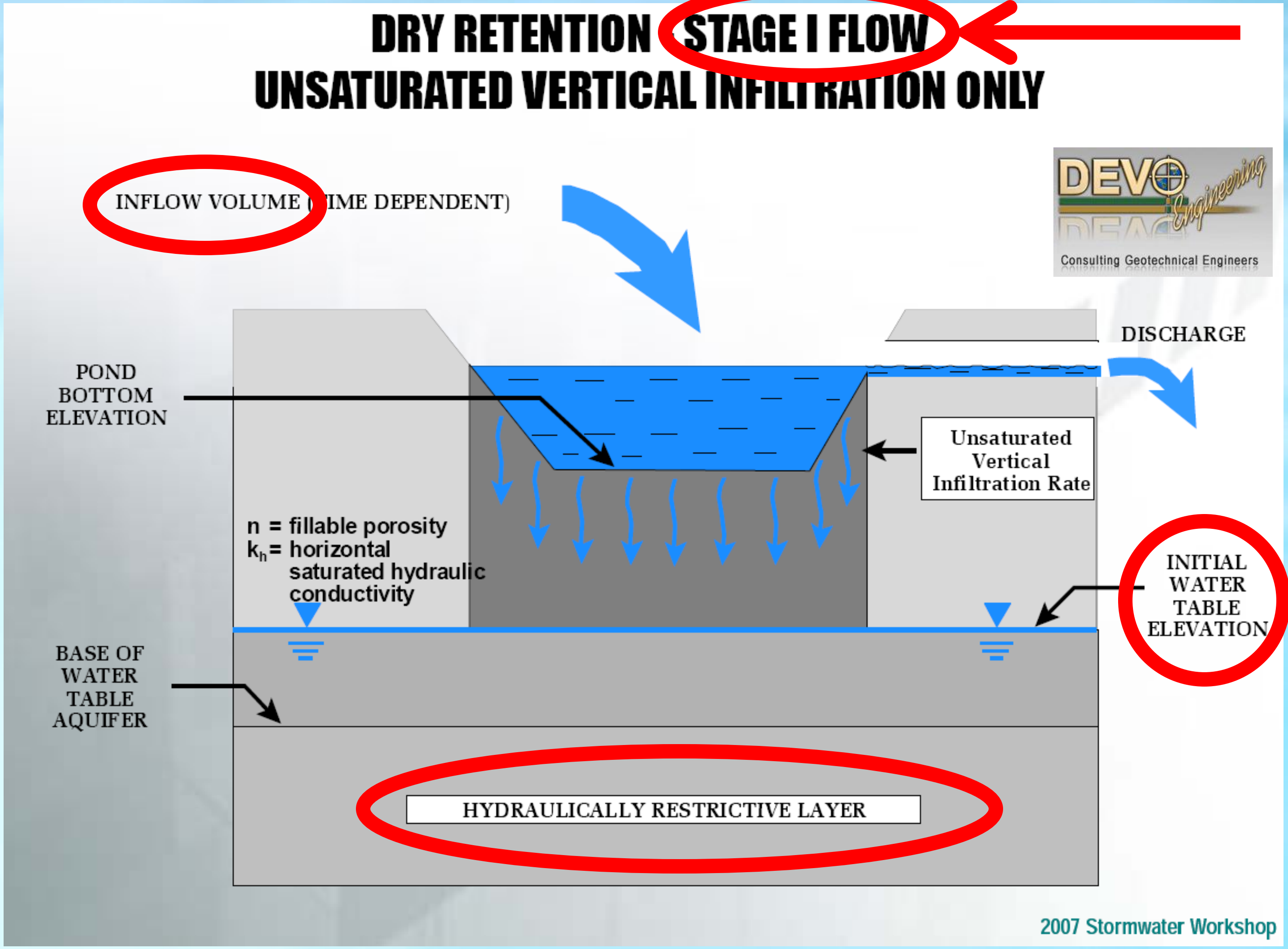


Figure 16.2. Ground Water Mounding Beneath a Retention System

Infiltration processes are currently addressed in Sub-Section 16.4 of the July, 2009 DRAFT *Applicant's Handbook*, for the proposed SSTR.

Recovery / Mounding analysis of the Required Treatment Volume (RTV)



"Dry" ponds & swales, underground exfiltration trenches, pervious pavement and underground vault / chamber systems

Graphic courtesy of Devo Seereeram, P.E., Ph.D.

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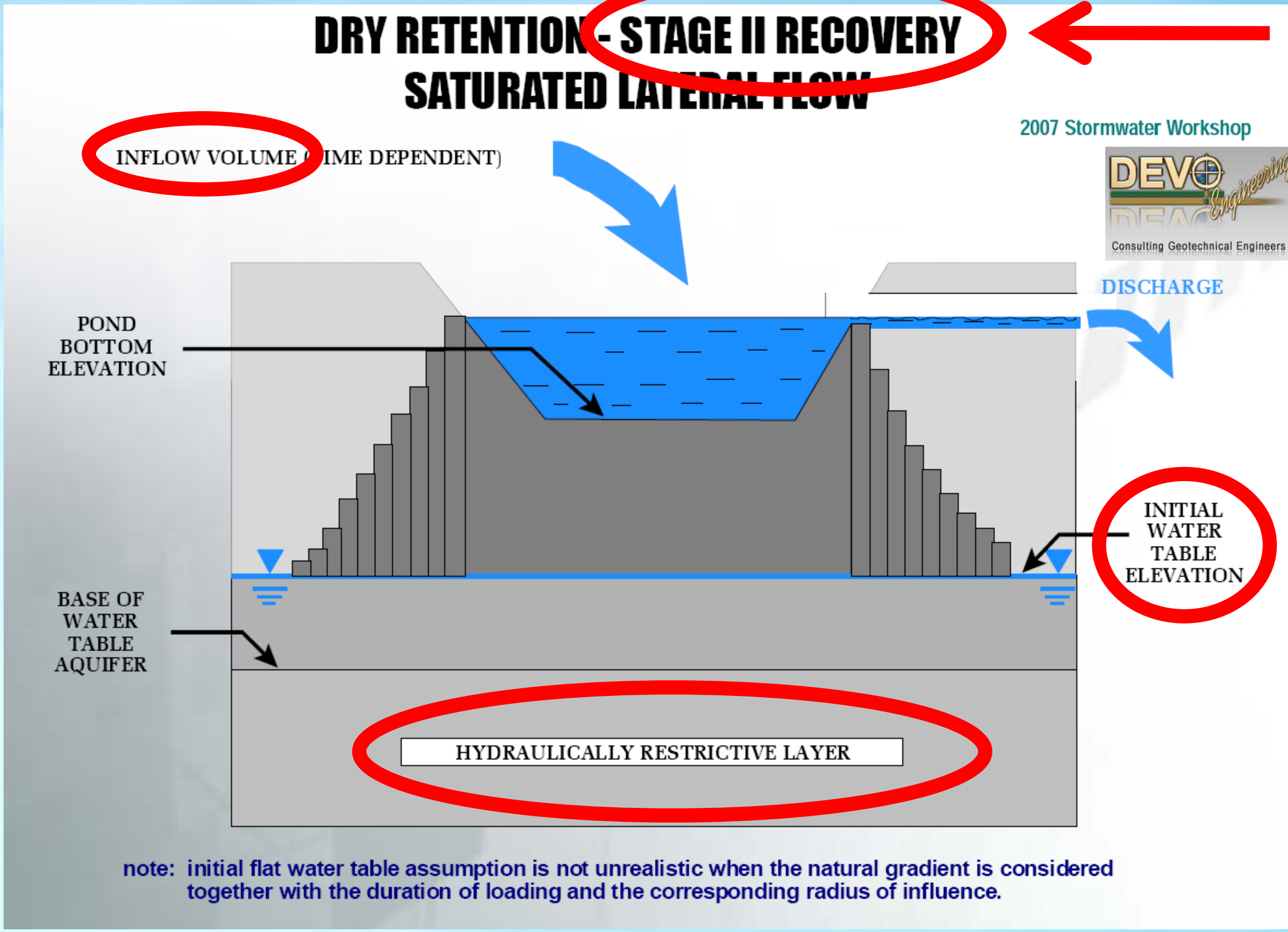
Devo Engineering - Orlando, Florida

http://devoeng.com/

Recovery / Mounding analysis of the Required Treatment Volume (RTV)



"Dry" ponds & swales, underground exfiltration trenches, pervious pavement and underground vault / chamber systems

Graphic courtesy of Devo Seereeram, P.E., Ph.D.

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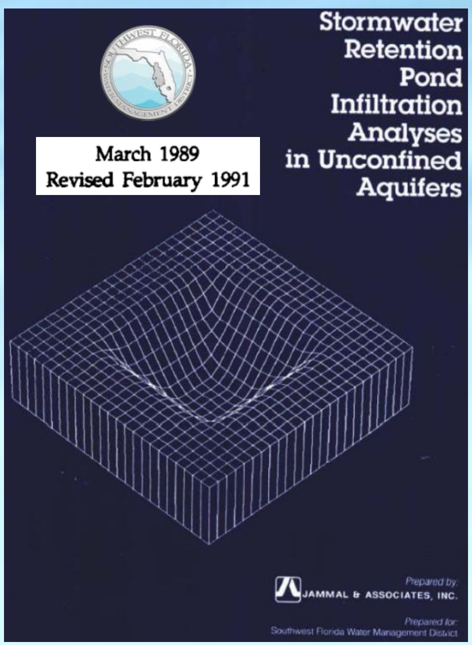
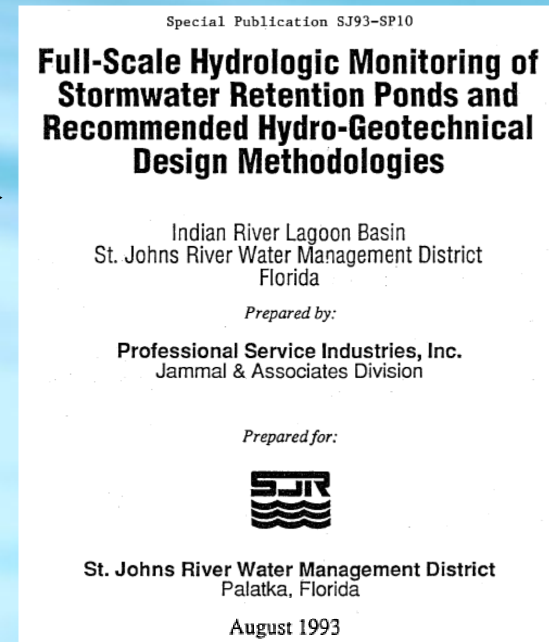
Recovery Analysis of Retention Systems Designs



← These publications → are available on FDEP's web site as follows:

http://www.dep.state.fl.us/water/wetlands/erp/rules/stormwater/issue_lid.htm


Special Publication SJ93-SP10

Full-Scale Hydrologic Monitoring of Stormwater Retention Ponds and Recommended Hydro-Geotechnical Design Methodologies

Indian River Lagoon Basin
St. Johns River Water Management District
Florida

Prepared by:

Professional Service Industries, Inc.
Jammal & Associates Division

Prepared for:

St. Johns River Water Management District
Palatka, Florida

August 1993

Vertical Unsaturated Flow	Horizontal Saturated Flow
Green and Ampt Equation	Simplified Analytical Method
Hantush Equation	PONDFLOW
Horton Equation	Modified MODRET
Darcy Equation	
Holton Equation	

Table 16.1. Accepted Methodologies for Retention BMP Recovery

Several of these methodologies are available commercially in computer programs (PONDS©, Modret©, ICPR Perc Pack©, etc.). The Department / District can neither endorse any program nor certify program results.

Accepted Methodologies for Determining Retention BMP Recovery are currently addressed in Sub-Sections 16.5 and 16.6 of the July, 2009 DRAFT *Applicant's Handbook*, for the proposed SSTR.

Accuracy of Manual Computations or Computer Model Simulations

"Garbage In – Garbage Out"

Please remember that these computations / simulations are only as good as the input data (i.e. accurate soils information)

Some Closing Thoughts

There never seems to be enough time and $$$ to conduct field reconnaissance, obtain field verified topographic survey information, digital photography or soils data, nor to verify the results of computer modeling. However, there is always enough time and $$$ to defend yourself in an Administrative Hearing or a Court of Law.

Statue of justice atop the dome of the Old Bailey court in London, a woman (without a blindfold), holding in her right hand a sword standing for the power to punish, and in her left hand a balance standing for equity.

Engineers Creed

As a Professional Engineer, I dedicate my professional knowledge and skill to the advancement and betterment of human welfare.

I pledge:

To give the utmost of performance;

To participate in none but honest enterprise;

To live and work according to the laws of man and the highest standards of professional conduct;

To place service before profit, the honor and standing of the profession before personal advantage, and the public welfare above all other considerations.

In humility and with need for Divine Guidance, I make this pledge.

Adopted by the National Society of Professional Engineers, June, 1954

This concludes our presentation

– thanks for your attention

Good engineering protects the environment!

Questions and Discussion to follow.

a program from the

University of Central Florida Stormwater Management Academy "Managed Stormwater is Good Water"

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Southwest Florida Water Management District