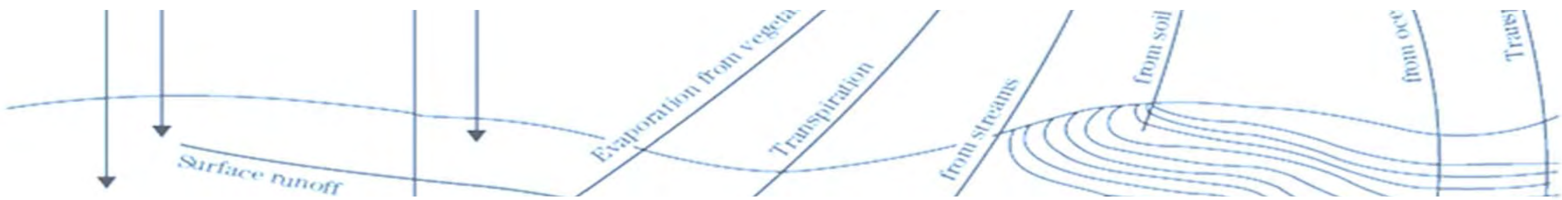
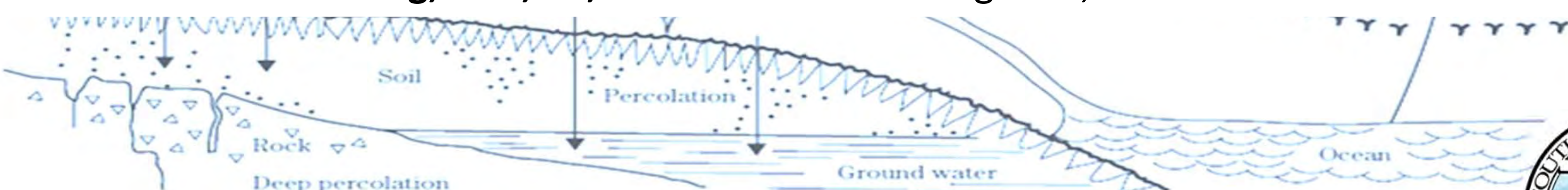
FSA 2019 Annual Conference

My Green-Ampt is Better Than Your Curve Number:
Physically Based Soil Characterization is Better Than the CN Method for Projecting Infiltration and Runoff



Harry Downing, PE, Sr. Water Resources Engineer, Applied Sciences Consulting, Inc.
Lei Yang, PhD, PE, Chief Professional Engineer, SWFWMD



AppliedSciences

June 21, 2019

SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT

Key Points

- Why the Need for Physically Based Methods?
  - Experience in Karst Areas
  - Limitations of the CN Method
  - Physically Based Approaches to Runoff Excess

Development of the CN Method (1 of 4)

- Victor Mockus – memories of the development of the SCS Curve Number Method (CN) based on an interview in 1996 when he was 83 years old.

Development of the CN Method (2 of 4)

- SCS Developed the CN method for watersheds less than 400 square miles for evaluating “before” and “after” hydrologic responses.
- Data collection at various U.S. sites began in 1928.
- Method was based on 10 to 20 years of field research that continued through the 1940s.
- Muskgrave’s idea to classify soils into Hydrologic Soil Groups to simplify the process (60 -70 soil types at the time).
- S (Potential Storage) was converted to the simpler CN.

Development of the CN Method (3 of 4)

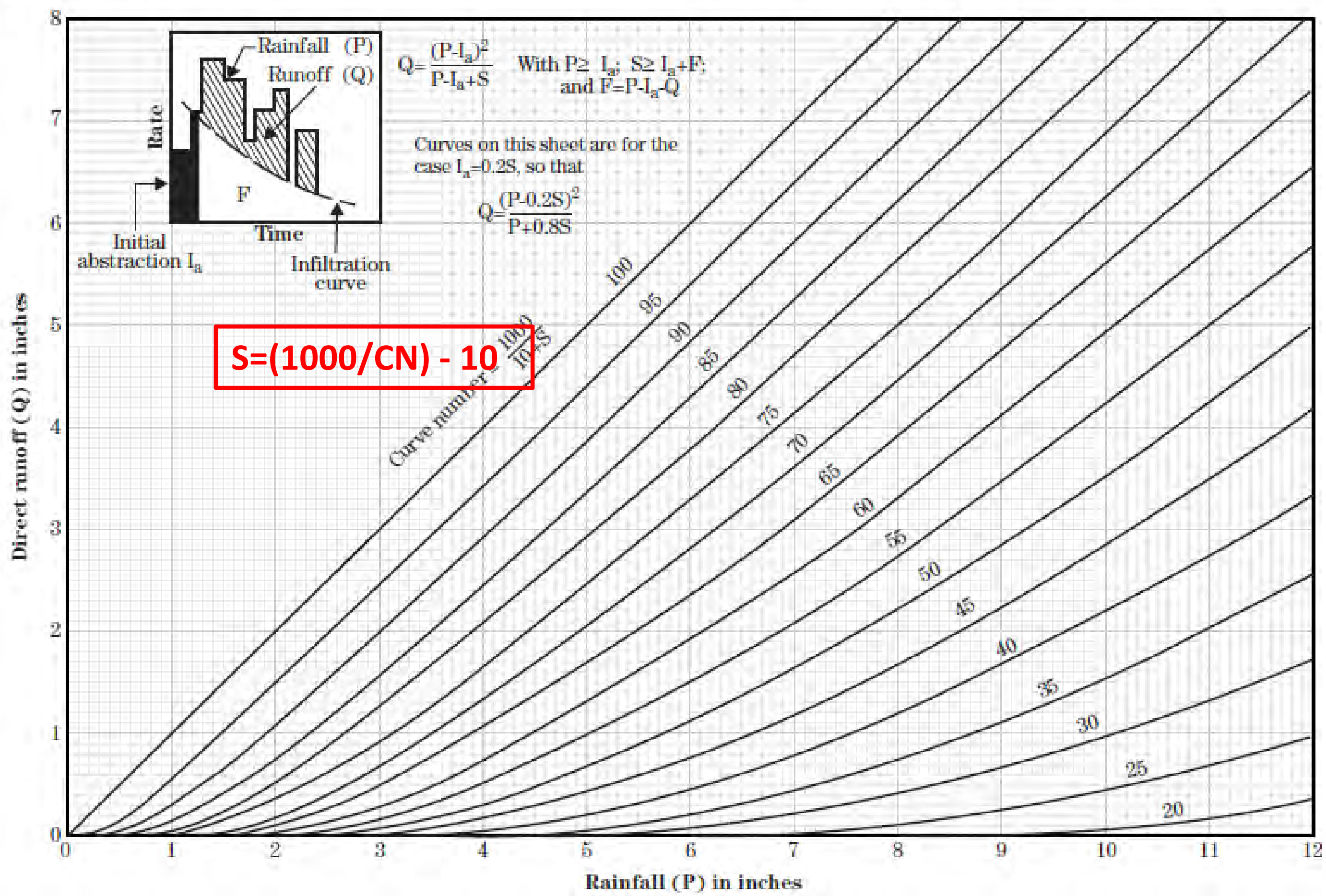
- The relationship between I_a and S was a tough issue that was semi-resolved by using 0.2 ratio for I_a/S. (Mockus said the I_a could be 0.1 or 0.3 but preferred $P - I_a$).
- The hydrologic condition (good, fair, poor) was developed from data developed at Hastings, Nebraska; and Waco, Texas for watersheds of 0.1 acre to 10 square miles.
- Results were based on daily data, because that was the only data available in large volumes.
- Method was **not** to predict the ***rate of infiltration***, but ***total infiltration***.

Development of the CN Method (4 of 4)

- Method was to predict average trends, and not response to each unique storm event.
- Mockus arrived at the equation (P-Q)/S = Q/P one evening after dinner. It seemed to fit the data very well and the Antecedent Moisture Condition (AMC) enveloped all the data.
- He said that the CN method simulated Saturation Overflow and not necessarily Hortonian overland flow.

Development of CN Equation

Figure 10–2 ES–1001 graphical solution of the equation $Q = \frac{(P - 0.2S)^2}{P + 0.8S}$

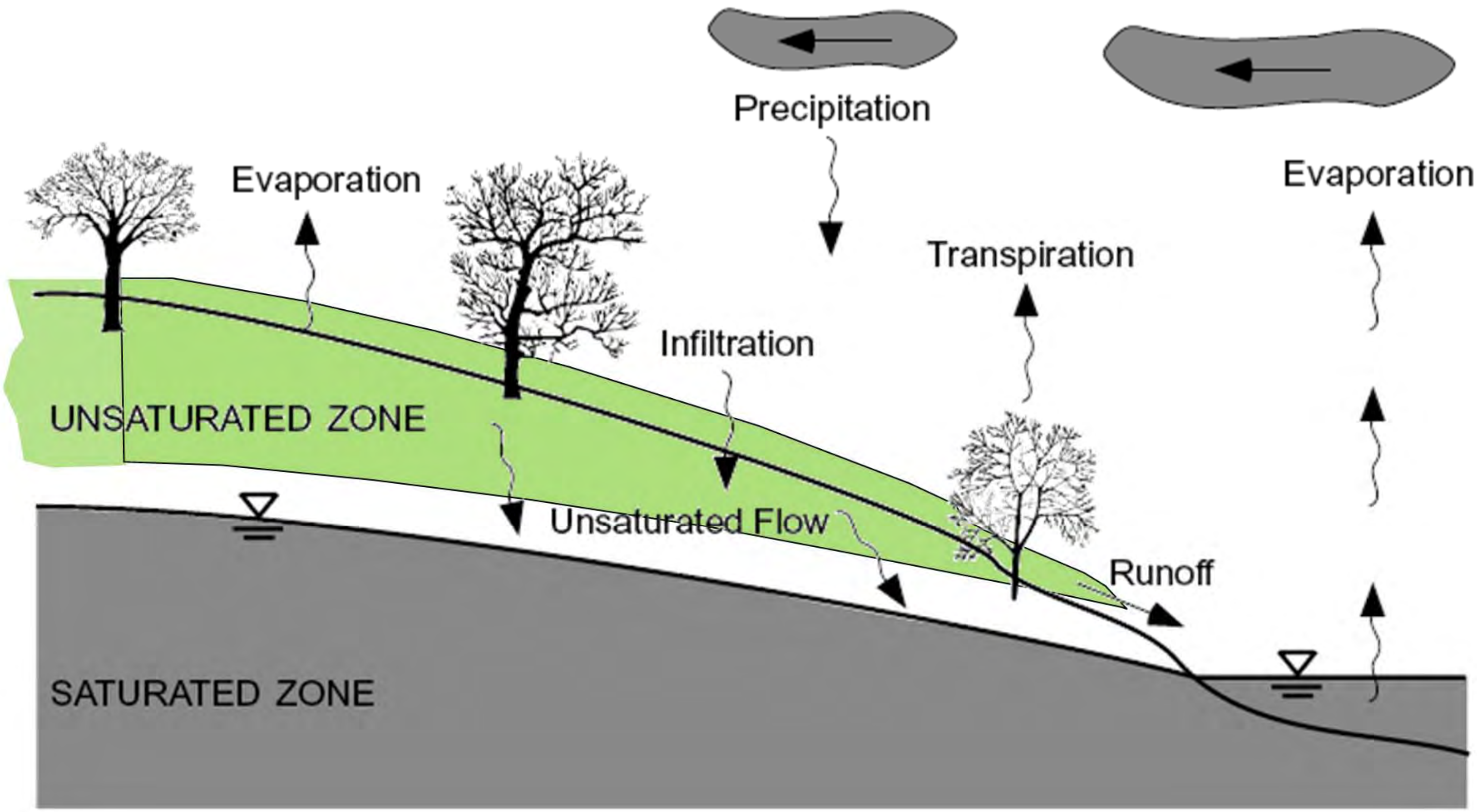


The Parameter CN (Curve Number) is a transformation of S

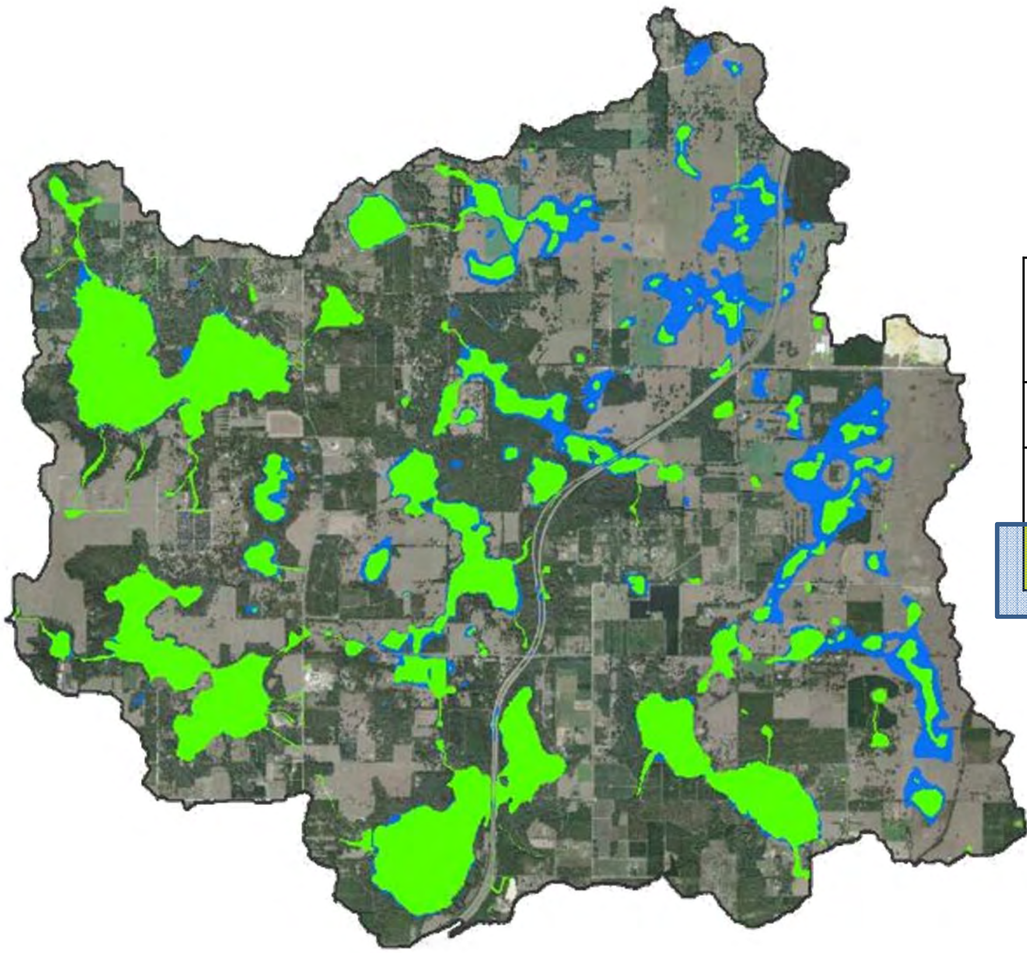
Need for Alternative Method

- Florida watersheds were not considered in the analysis that produced the CN array.
- The SCS methodology excludes time as a variable, and therefore rainfall intensity.
- Limited comparisons elsewhere have suggested significant departures between handbook and data-defined CNs.
- The CN procedure does not work well in karst topography with sandy soils
  - This is because a large portion of the flow is subsurface rather than direct runoff.
- Typically runoff generated from CN procedures do not match rainfall-runoff data for local watersheds, and the 0.2S for initial abstraction (I_a) was not corroborated by linear regression techniques.

Runoff Process and Soil Characterization



Example for Changing to Physical Soil Parameters



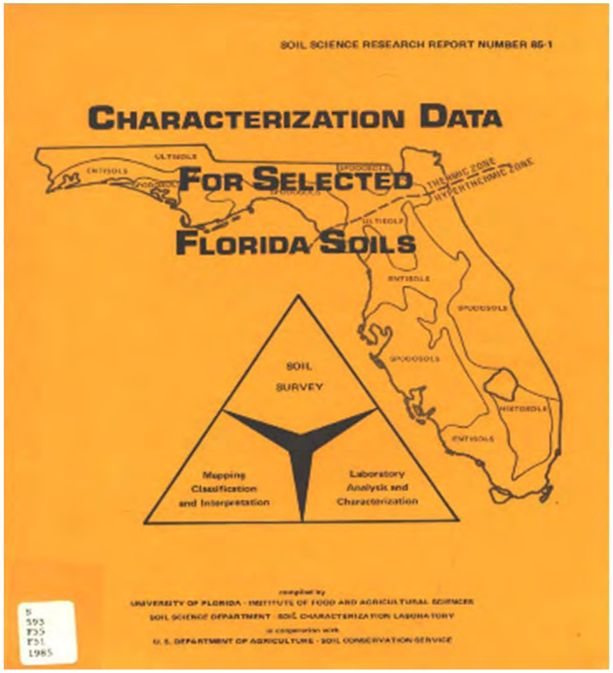
Floodplain	Area (acres)	Area (sq. miles)
FEMA	2108	3.29
Green-Ampt	2976	4.65
CN	3832	5.99

Physically Based Soil Parameters
for
Rainfall Excess Determination

Soil Data Sources

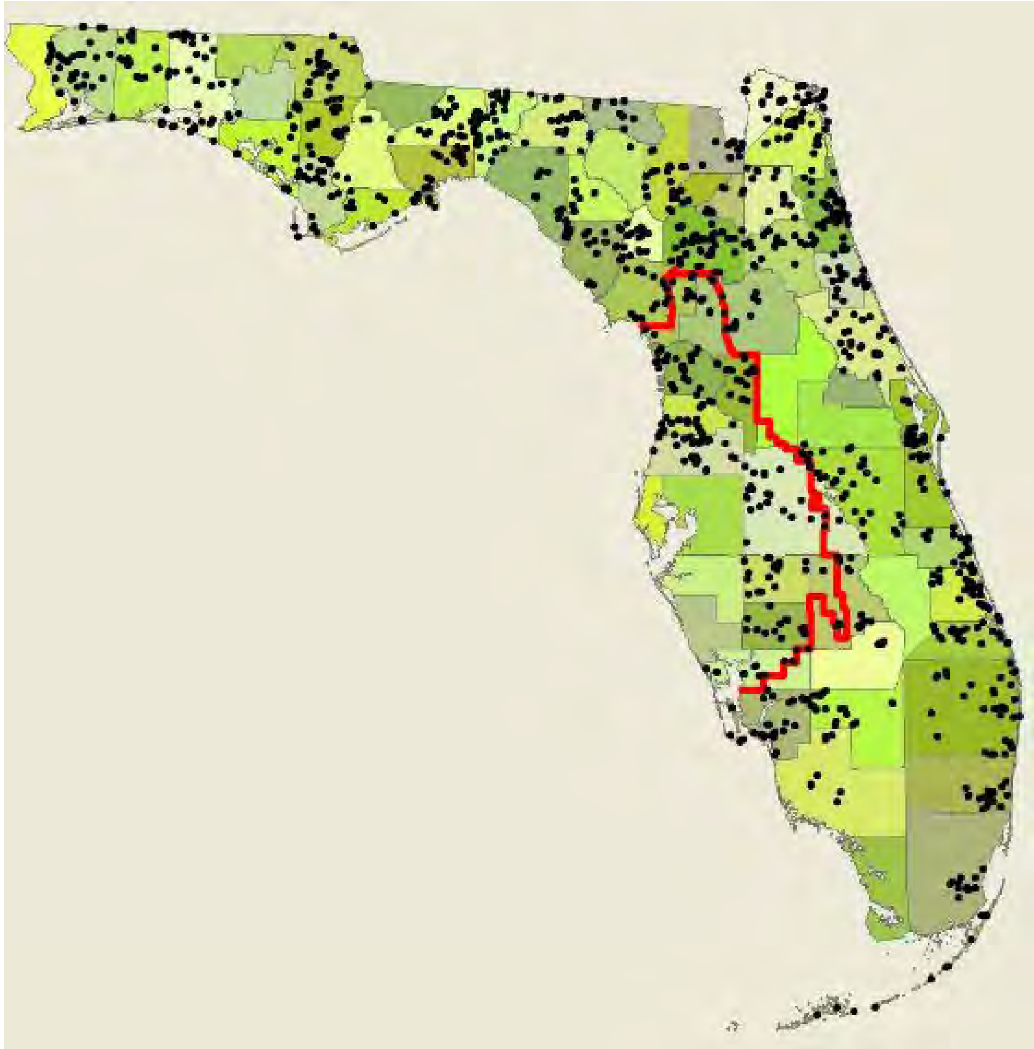
- **IFAS Soil Data**
  - Institute of Food and Agricultural Sciences
  - University of Florida Soils Department
    - Spreadsheet
    - Soil Manuals

- **SSURGO** (Soil Survey Geographic Database)
  - https://catalog.data.gov/dataset/soil-survey-geographic-ssurgo-database-for-various-soil-survey-areas-in-the-united-states-



Location of IFAS Soil Bores

- Data Period (1965 - 1996)
- 58 out of 67 counties
- 1,290 soil profiles
- 2 to 13 soil horizons
- 144 physical and chemical properties
- Soil moisture retention curve



IFAS Characterization Data

SOIL CHARACTERIZATION LABORATORY, IFAS, UNIVERSITY OF FLORIDA

ADAMSVILLE SAND, S51-21-(1-6)
AQUIC QUARTZIPSAMMENTS, HYPERTHERMIC, UNCOATED — DATE SAMPLED 04/12/78
PASCO COUNTY, FLORIDA

				PARTICLE SIZE DISTRIBUTION (% < 2 MM)												
				SAND FRACTIONS					TOTAL				PH			
NO	DEPTH (CM)	HORIZON	LAB NO	VC 2.0-1.0	C 1.0-0.5	M 0.5-0.25	F 0.25-0.10	VF 0.10-0.05	SAND 2.0-0.05	SILT 0.05-0.002	CLAY < 0.002	TEXTURE CLASS	H2O (1:1)	CACL2 (1:2)	KCL (1:1)	TOTAL PHOS (ppm)
1	0- 8	AP1	3555	0.0	1.9	27.9	48.5	17.6	95.9	3.1	1.0	S	5.0	3.9	3.7	
2	8- 20	AP2	3556	0.1	2.1	27.2	47.7	18.4	95.5	3.5	1.0	S	5.2	4.2	4.0	
3	20- 58	C1	3557	0.0	2.2	27.1	48.3	18.0	95.6	3.3	1.1	S	5.4	4.6	4.4	
4	58-102	C2	3558	0.0	2.2	25.0	50.0	18.6	95.8	3.2	1.0	FS	5.4	4.7	4.6	
5	102-145	C2	3559	0.1	2.1	25.7	51.3	17.2	96.4	2.9	0.7	LFS	5.3	4.8	4.6	
6	145-203	C3	3560	0.1	2.4	28.3	47.6	17.8	96.2	3.3	0.5	S	5.7	5.1	5.0	

		WATER CONTENT			WATER CONTENT										
NO	SAT HYDR COND (CM/HR)	1/10 BAR ---(WEIGHT %)---	1/3 BAR	15 BAR	3.5CM ----(VOLUME %)----	20CM	30CM	45CM	60CM	80CM	150CM	200CM	AVAIL H2O (CM/CM)	BULK DENSITY (G/CC)	ELEC COND (MMHO/CM)
1	14.7	7.4	4.0	2.2	36.8	33.6	32.3	28.2	22.8	14.9	8.4	7.4	0.08	1.55	0.02
2	15.5	5.6	2.7	1.0	32.1	27.9	26.0	20.4	16.1	11.4	6.4	5.6	0.07	1.59	0.01
3	28.9	5.5	2.5	0.7	36.5	35.6	34.4	27.1	19.8	11.6	5.8	5.0	0.07	1.56	0.01
4	24.3	5.0	2.0	0.6	33.4	32.7	31.8	23.1	17.8	11.1	5.4	4.6	0.07	1.61	0.01
5	23.4	4.8	2.3	0.4	33.5	32.1	31.7	27.3	21.4	11.5	4.8	4.0	0.07	1.60	0.01
6	21.2	3.7	1.2	0.7	31.4	30.6	30.3	24.4	17.3	9.1	3.1	2.5	0.05	1.59	0.18

SSURGO

- Data retrieval and georeferenced through Data View
- 954 MUKEYs within SWFWMD
- Water table depth
- Hydraulic conductivity
- Other properties

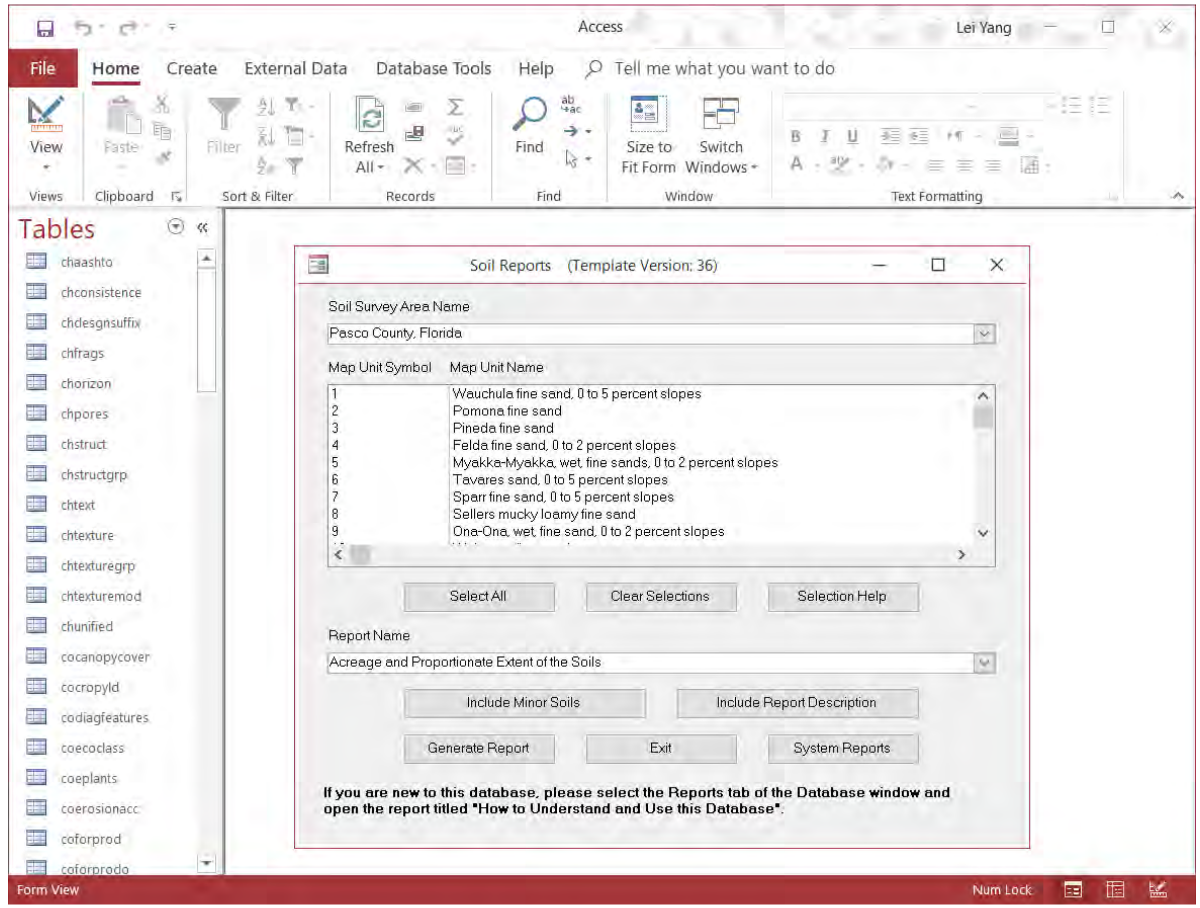


TABLE 2. HYDROLOGIC SOIL PROPERTIES CLASSIFIED BY SOIL TEXTURE

Texture class	Sample size	Total porosity (θ), cm³/cm³	Residual saturation (θ_r) cm³/cm³	Effective porosity (θ_e), cm³/cm³	Bubbling pressure (ψb) Arithmetic, cm	Bubbling pressure (ψb) Geometric,† cm	Pore size distribution (λ) Arithmetic	Pore size distribution (λ) Geometric†	Water retained at -0.33 bar tension, cm³/cm³	Water retained at -15 bar tension, cm³/cm³	Saturated Hydraulic Conductivity‡ (K_s) cm/h
Sand	762	0.437* (0.374–0.500)	0.020 (0.001–0.039)	0.417 (0.354–0.480)	15.98 (0.24–31.72)	7.26 (1.36–38.74)	0.694 (0.298–1.090)	0.592 (0.334–1.051)	0.091 (0.018–0.164)	0.033 (0.007–0.059)	21.00
Loamy sand	338	0.437 (0.368–0.506)	0.035 (0.003–0.067)	0.401 (0.329–0.473)	20.58 (0.0–45.20)	8.69 (1.80–41.85)	0.553 (0.234–0.872)	0.474 (0.271–0.827)	0.125 (0.060–0.190)	0.055 (0.019–0.091)	6.11
Sandy loam	666	0.453 (0.351–0.555)	0.041 (0.0–0.106)	0.412 (0.283–0.541)	30.20 (0.0–64.01)	14.66 (3.45–62.24)	0.378 (0.140–0.616)	0.322 (0.186–0.558)	0.207 (0.126–0.288)	0.095 (0.031–0.159)	2.59
Loam	383	0.463 (0.375–0.551)	0.027 (0.0–0.074)	0.434 (0.334–0.534)	40.12 (0.0–100.3)	11.15 (1.63–76.40)	0.252 (0.086–0.418)	0.220 (0.137–0.355)	0.270 (0.195–0.345)	0.117 (0.069–0.165)	1.32
Silt loam	1206	0.501 (0.420–0.582)	0.015 (0.0–0.058)	0.486 (0.394–0.578)	50.87 (0.0–109.4)	20.76 (3.58–120.4)	0.234 (0.105–0.363)	0.211 (0.136–0.326)	0.330 (0.258–0.402)	0.133 (0.078–0.188)	0.68
Sandy clay loam	498	0.398 (0.332–0.464)	0.068 (0.0–0.137)	0.330 (0.235–0.425)	59.41 (0.0–123.4)	28.08 (5.57–141.5)	0.319 (0.079–0.559)	0.250 (0.125–0.502)	0.255 (0.186–0.324)	0.148 (0.085–0.211)	0.43
Clay loam	366	0.464 (0.409–0.519)	0.075 (0.0–0.174)	0.390 (0.279–0.501)	56.43 (0.0–124.3)	25.89 (5.80–115.7)	0.242 (0.070–0.414)	0.194 (0.100–0.377)	0.318 (0.250–0.386)	0.197 (0.115–0.279)	0.23
Silty clay loam	689	0.471 (0.418–0.524)	0.040 (0.0–0.118)	0.432 (0.347–0.517)	70.33 (0.0–143.9)	32.56 (6.68–158.7)	0.177 (0.039–0.315)	0.151 (0.090–0.253)	0.366 (0.304–0.428)	0.208 (0.138–0.278)	0.15
Sandy clay	45	0.430 (0.370–0.490)	0.109 (0.0–0.205)	0.321 (0.207–0.435)	79.48 (0.0–179.1)	29.17 (4.96–171.6)	0.223 (0.048–0.398)	0.168 (0.078–0.364)	0.339 (0.245–0.433)	0.239 (0.162–0.316)	0.12
Silty clay	127	0.479 (0.425–0.533)	0.056 (0.0–0.136)	0.423 (0.334–0.512)	76.54 (0.0–159.6)	34.19 (7.04–166.2)	0.150 (0.040–0.260)	0.127 (0.074–0.219)	0.387 (0.332–0.442)	0.250 (0.193–0.307)	0.09
Clay	291	0.475 (0.427–0.523)	0.090 (0.0–0.195)	0.385 (0.269–0.501)	85.60 (0.0–176.1)	37.30 (7.43–187.2)	0.165 (0.037–0.293)	0.131 (0.068–0.253)	0.396 (0.326–0.466)	0.272 (0.208–0.336)	0.06

* First line is the mean value
Second line is + one standard deviation about the mean

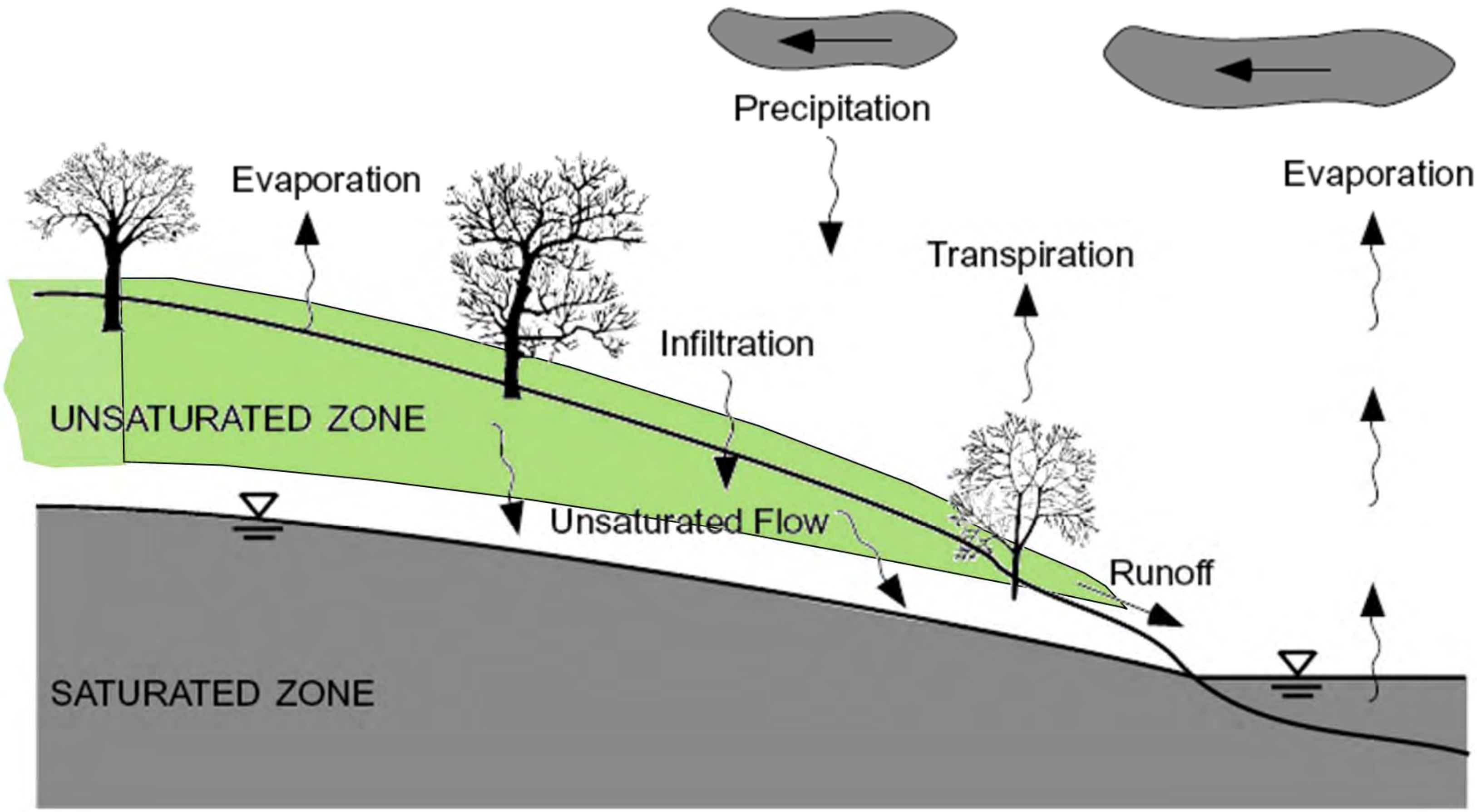
† Antilog of the log mean

‡ Obtained from Fig. 2

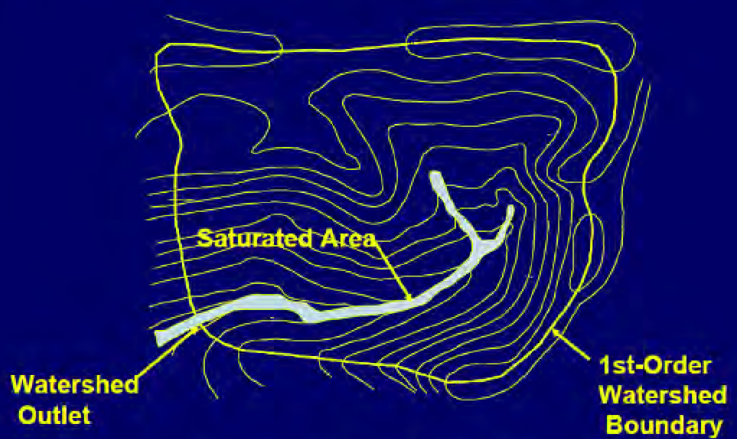
General Runoff Concepts

And Soil Characterization

Runoff Process and Soil Characterization

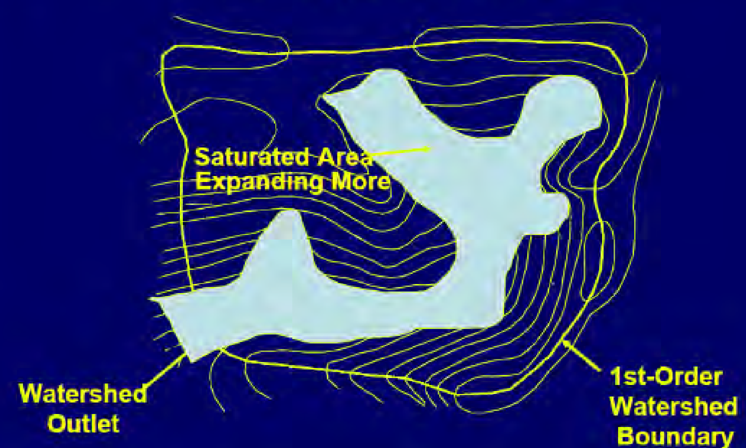


Watershed Response Processes – Partial (Variable) source Area



An example of saturated watershed areas at the beginning of a storm in a humid region

Watershed Response Processes – Partial (Variable) source Area



An example of saturated watershed areas during a major storm in a humid region

Learning Points

- Gain an understanding of soil properties regarding moisture, hydraulic conductivity, and tensions (capillarity); and how they are obtained.
- Present data sources for soil properties used along with SWFWMD utilities to account for changes in potential soil water storage.
- How the empirical CN and the physical approaches compare using an example.

Natural Resources Conservation Services

- The state of Florida has the largest total acreage of Aquods (wet, sandy soils with an organic-stained subsoil layer) on flatwood landforms in the nation. Myakka (pronounced My-yakah), a Native American word for Big Waters, is a native soil and exclusive to Florida. The most extensive soil in the state, it occurs on more than 1½ million acres. On May 22, 1989, Governor Bob Martinez signed Senate bill number 524 into law, making Myakka Florida's Official State Soil.

Spodosol

Myakka sand

A horizon: Surface layer containing organic matter.

E horizon: Leached horizon between the A and B horizons.

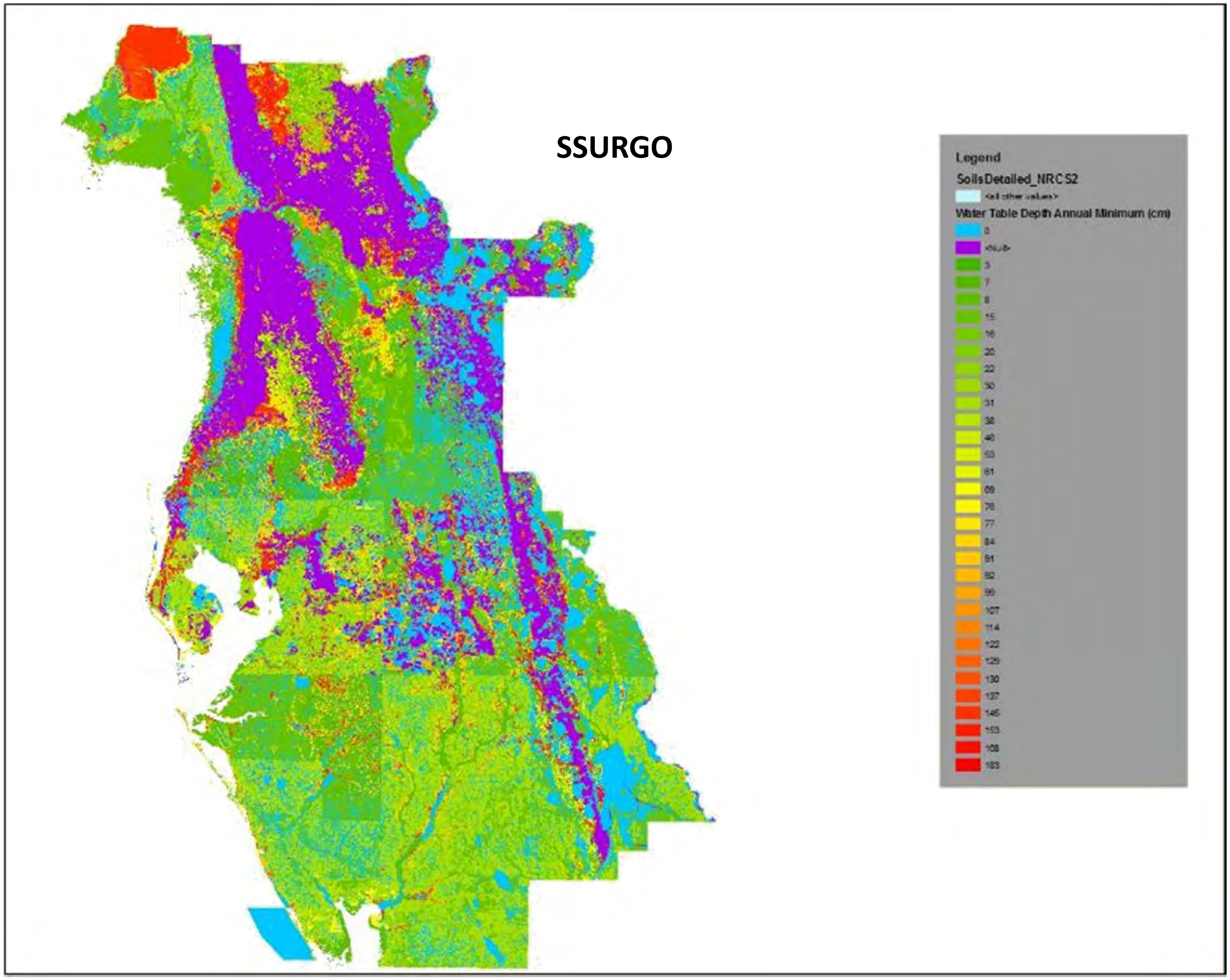
B horizon: Zone of accumulation of material leached from the A and B horizons.

C horizon: Layer not affected by soil forming processes.

Source of Graphic:

Soil and Water Science Department, University of Florida

USDA NRCS
United States Department of Agriculture
Natural Resources Conservation Service

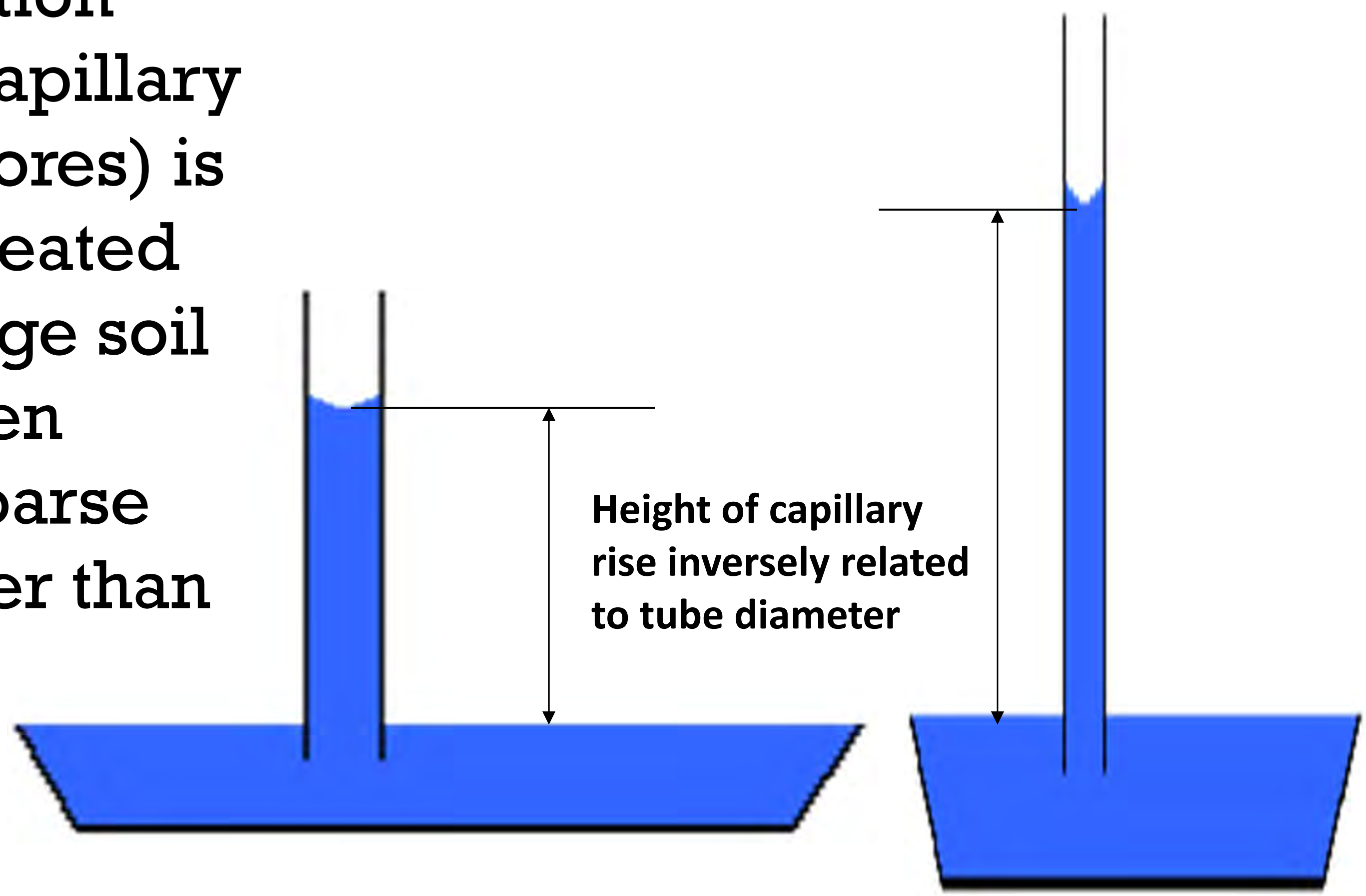


SSURGO
Legend
SoilsDetailed_NRCS2
<all other values>
Water Table Depth Annual Minimum (cm)
0
<Null>
3
7
8
15
16
20
22
30
31
38
46
53
61
69
76
77
84
91
92
99
107
114
122
129
130
137
145
153
168
183

Capillarity (Matric Potential)

Matric Potential and Soil Texture

The tension or suction created by small capillary tubes (small soil pores) is greater that that created by large tubes (large soil pores). At any given metric potential coarse soils hold less water than fine-textured soils.



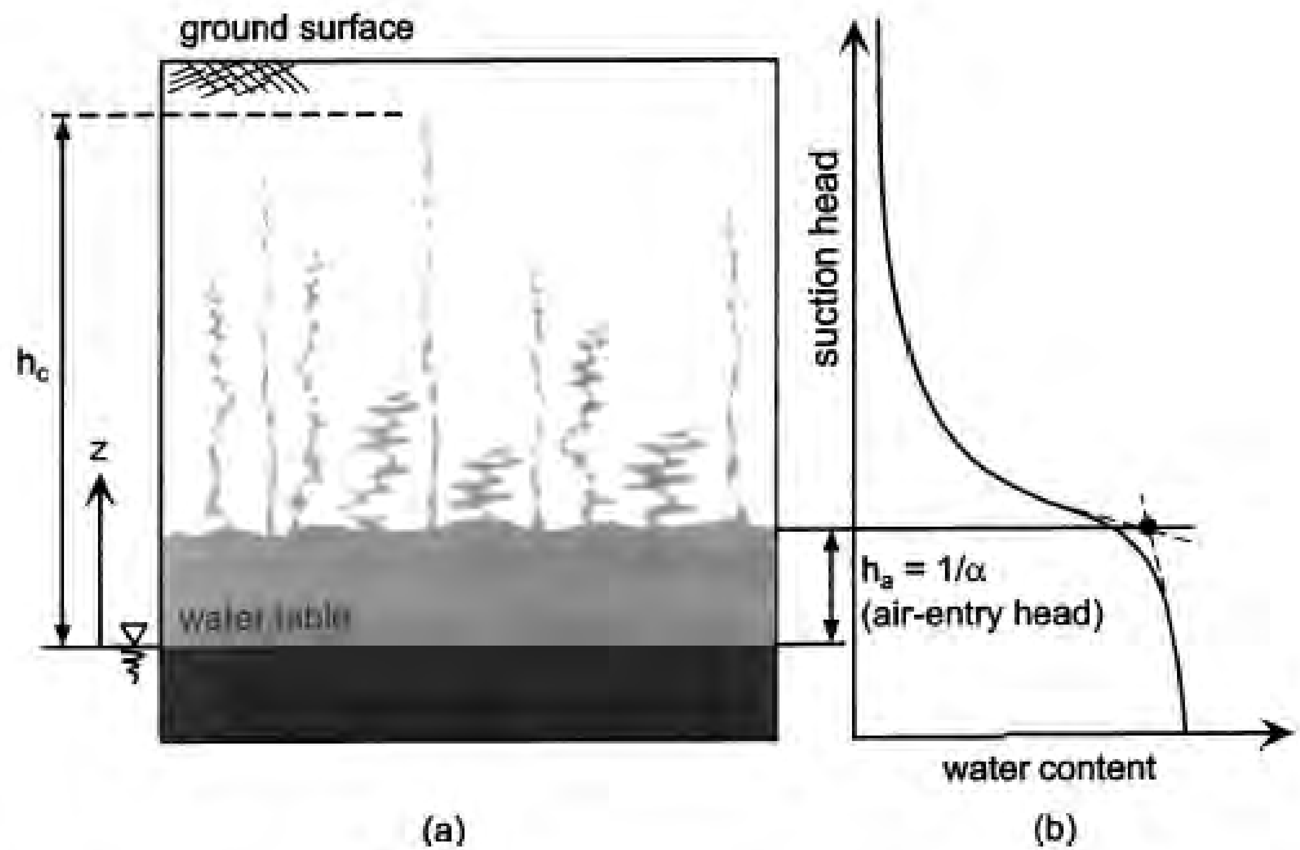
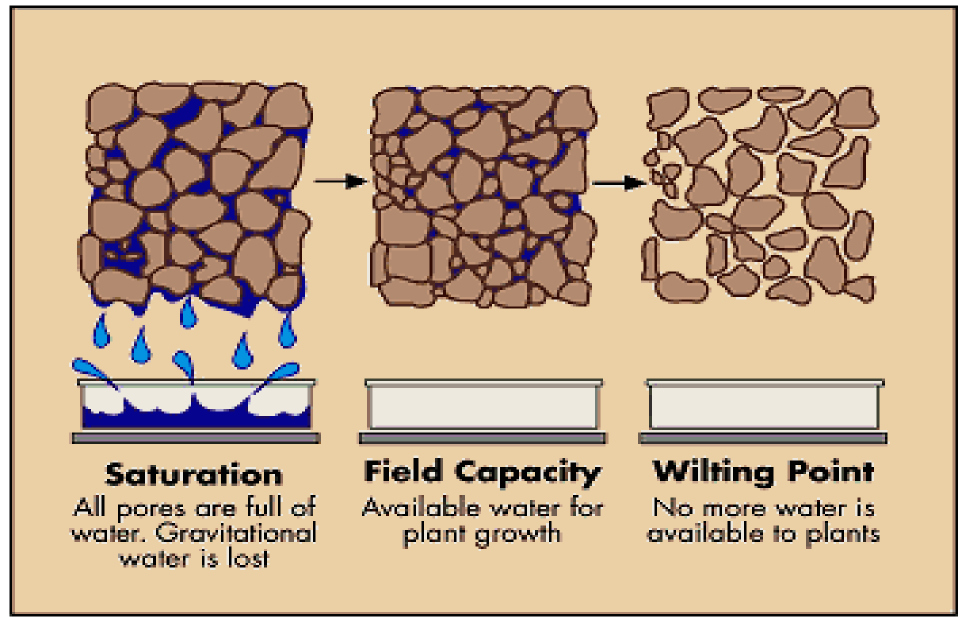


Fig. 1. Conceptual model for capillary rise and associated soil–water characteristic curve

By: N. Lu and W.J. Likos

Outline

- Soil concepts and properties - capillarity
- Moisture and hydraulic relations to tension
- Runoff concepts (infiltration and storage)
- Data sources for soil parameters
- Soil Properties for Florida Soils
- Soil Retention (S_e) Curves
- Brooks-Corey and van Genuchten Equations
- Comparison of CN, and Physically Parameterized Soils for projecting runoff.



Soil Storage Examples

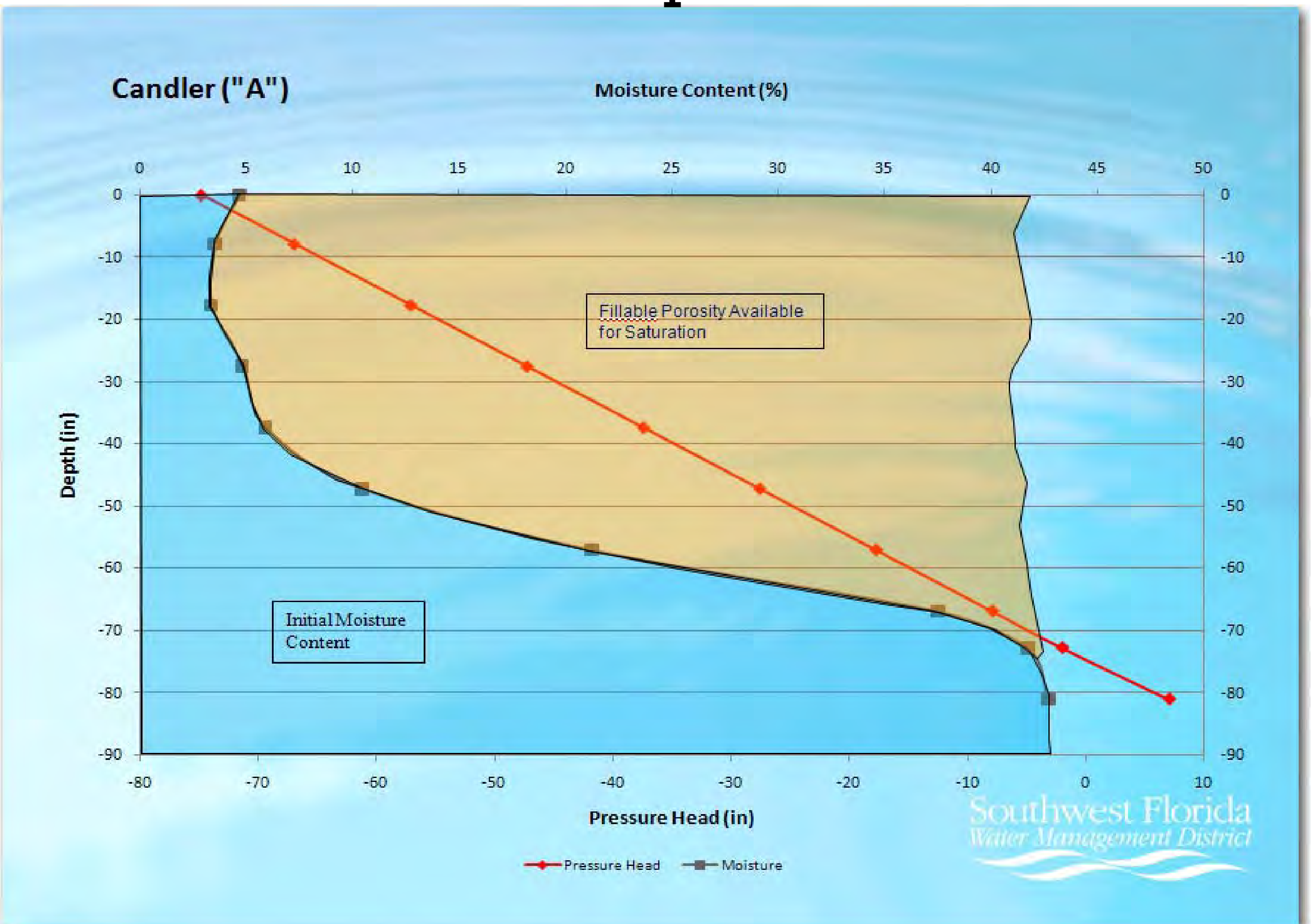
Soil Suction Parameters for Moisture Curves

SOIL CHARACTERIZATION LABORATORY, IFAS, UNIVERSITY OF FLORIDA

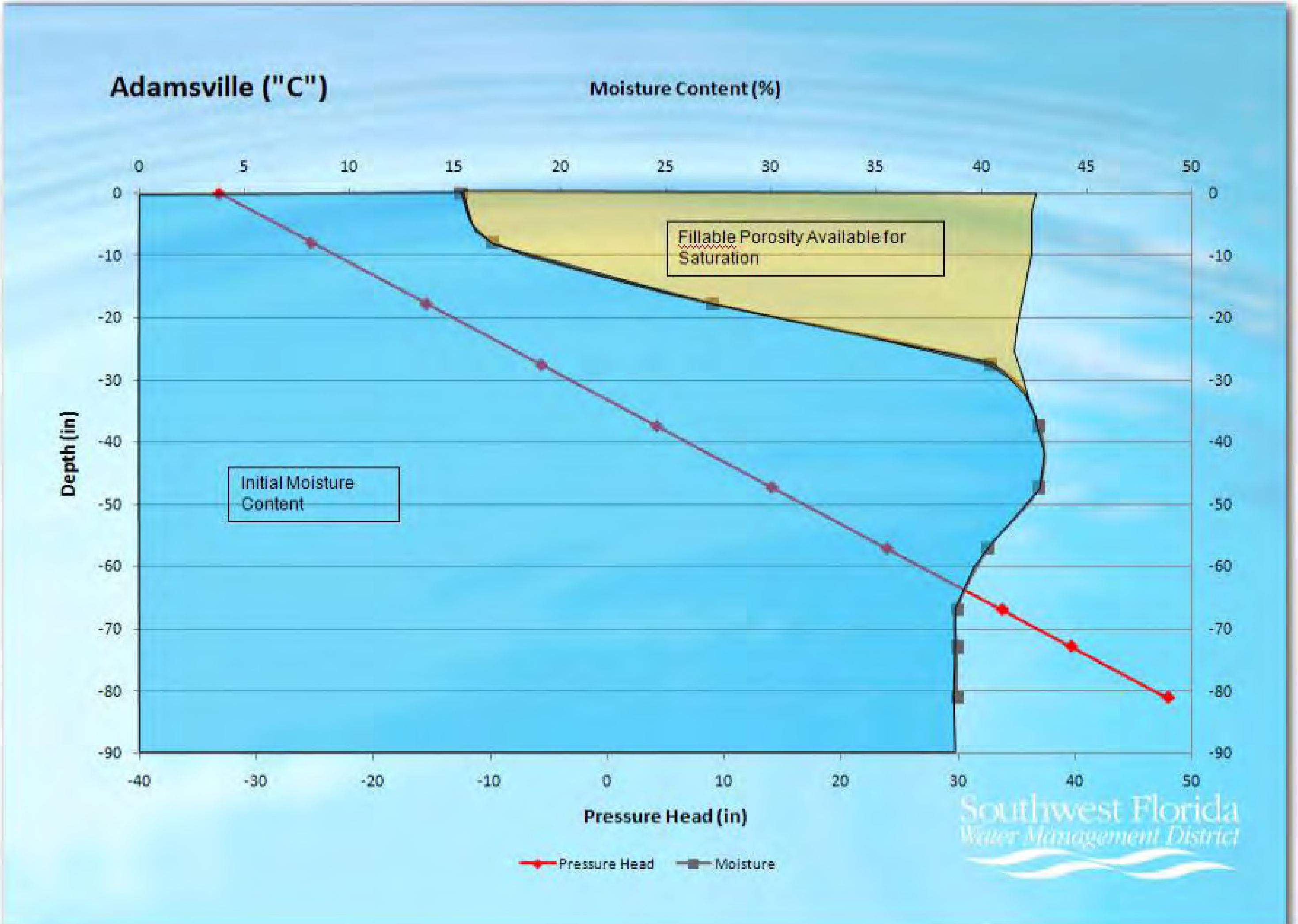
BASINGER FINE SAND, S28-17-(1-7)
SPODIC PSAMMAQUENTS, SILICEOUS, HYPERTHERMIC
HIGHLANDS COUNTY, FLORIDA

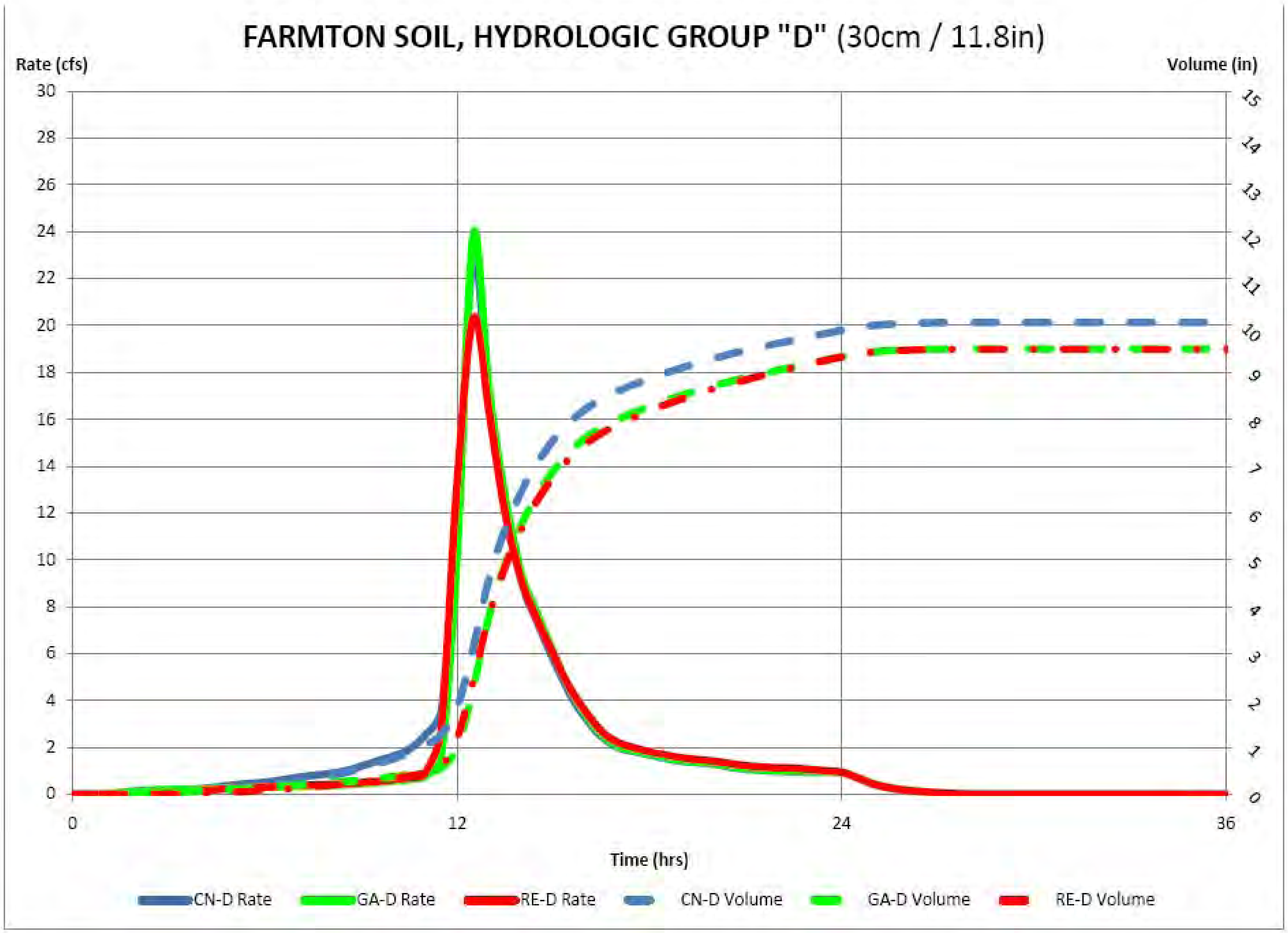
SAT HYDR COND (CM/HR)	WATER CONTENT 1/10 BAR (WEIGHT %)	WATER CONTENT 1/3 BAR (WEIGHT %)	WATER CONTENT 15 BAR (WEIGHT %)	WATER CONTENT 3.5CM (VOLUME %)	20CM	30CM	45CM	60CM	80CM	150CM	200CM
24.6	7.2	4.6	2.3	42.6	39.1	35.4	25.2	17.3	12.6	8.6	7.8
23.7	4.5	2.5	0.9	38.5	37.0	36.2	27.7	15.2	9.4	5.5	4.9
20.4	5.1	2.6	0.3	33.9	33.1	33.0	24.1	15.8	10.7	6.0	5.2
12.1	6.4	3.6	0.4	35.2	34.4	34.4	27.4	19.5	13.3	8.2	7.2
6.4	7.1	4.3	0.5	35.4	33.8	33.7	33.5	27.7	15.7	9.7	8.6
9.3	6.0	3.7	0.7	34.8	34.4	34.3	34.1	28.7	13.4	8.1	7.3
0.1	16.7	14.9	4.8	32.7	32.1	31.9	31.1	30.4	29.9	28.8	28.2

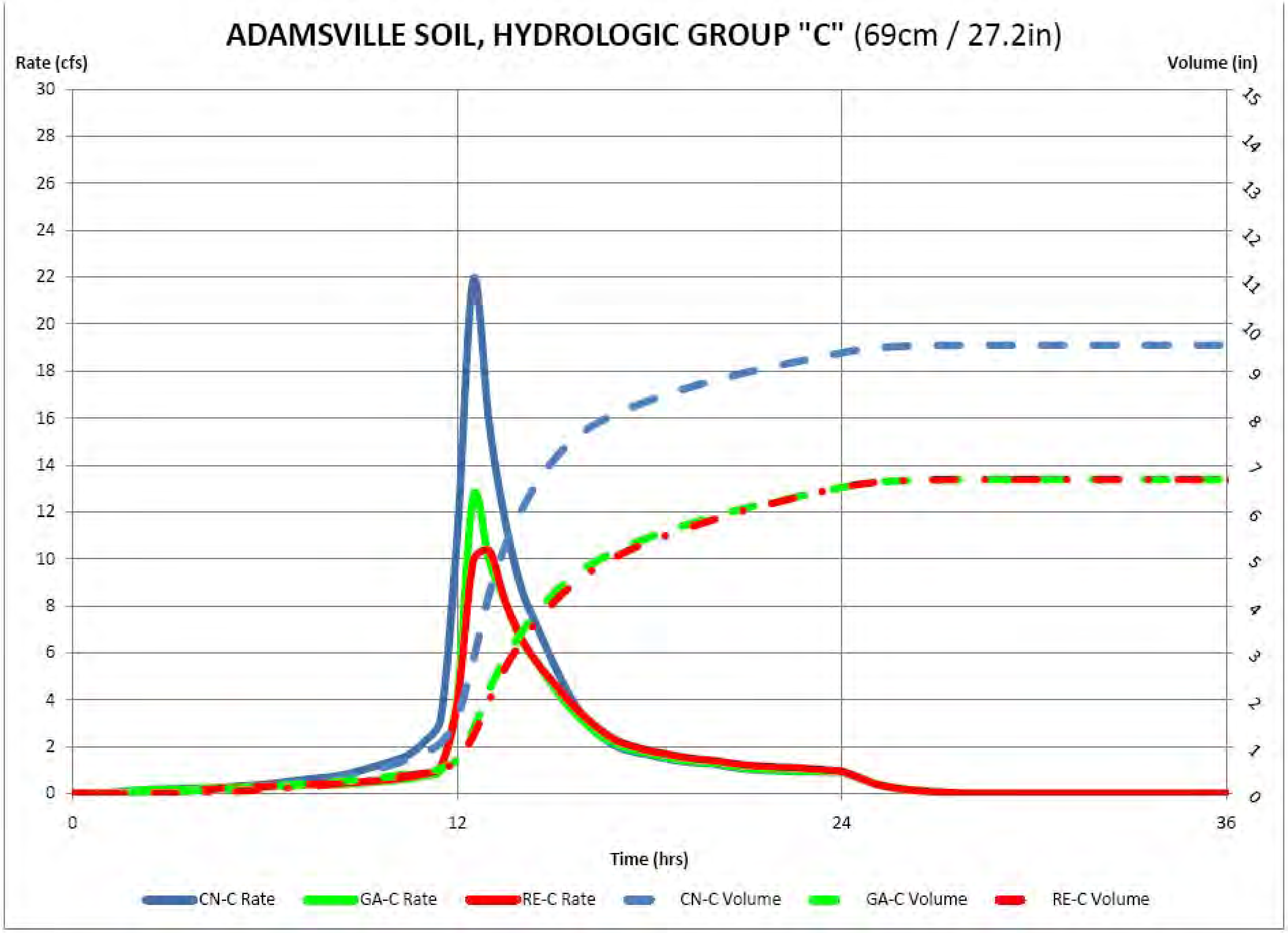
Soil Moisture Comparison - Candler



Soil Moisture Comparison - Adamsville




FARMTON SOIL, HYDROLOGIC GROUP "D" (30cm / 11.8in)
Rate (cfs)
Volume (in)
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
0
12
24
36
Time (hrs)
CN-D Rate
GA-D Rate
RE-D Rate
CN-D Volume
GA-D Volume
RE-D Volume



ADAMSVILLE SOIL, HYDROLOGIC GROUP "C" (69cm / 27.2in)
Rate (cfs)
Volume (in)
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
0
12
24
36
Time (hrs)
CN-C Rate
GA-C Rate
RE-C Rate
CN-C Volume
GA-C Volume
RE-C Volume

Hydraulic Conductivity Limited Soil (Clays)

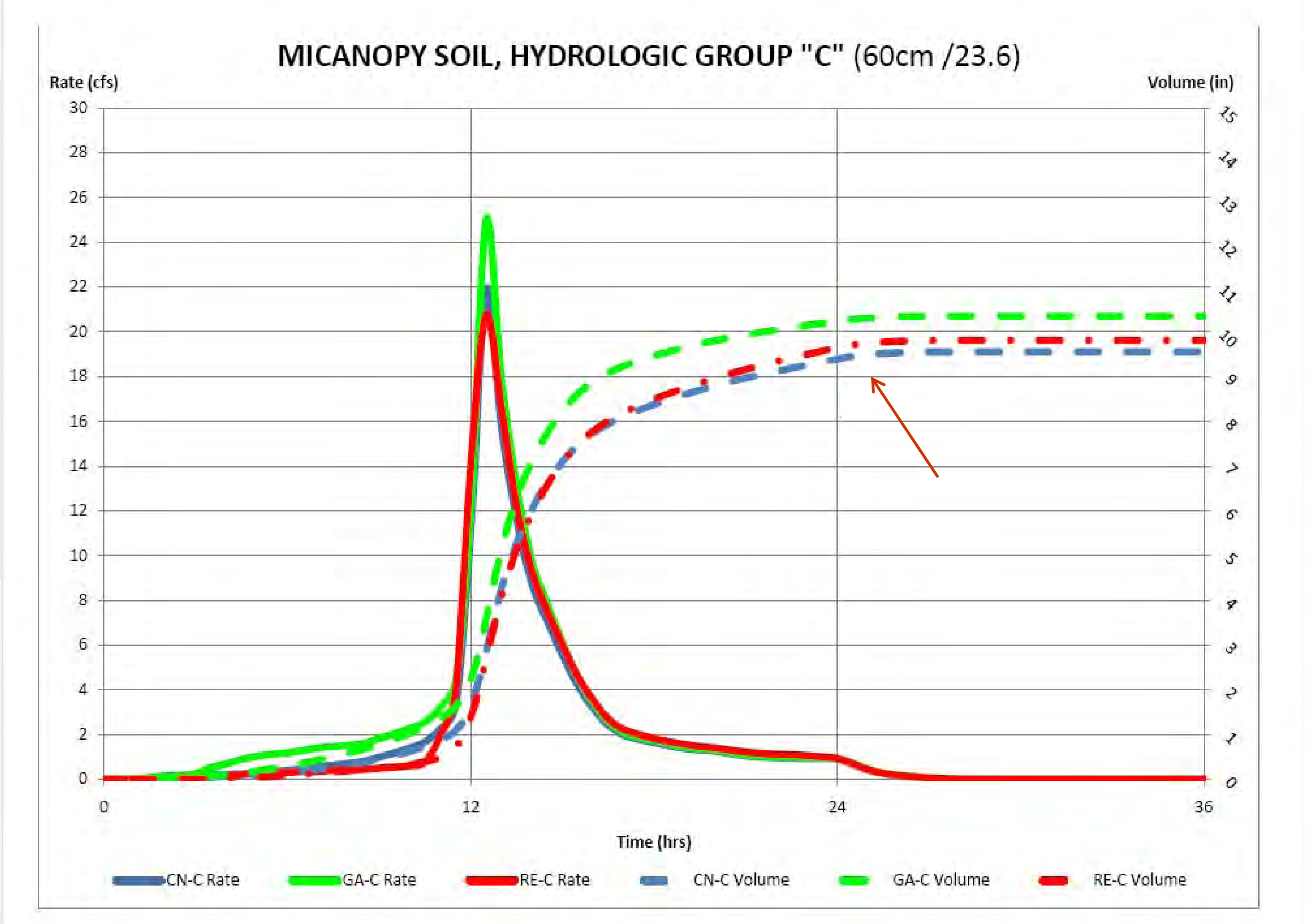
SOIL CHARACTERIZATION LABORATORY, IFAS, UNIVERSITY OF FLORIDA

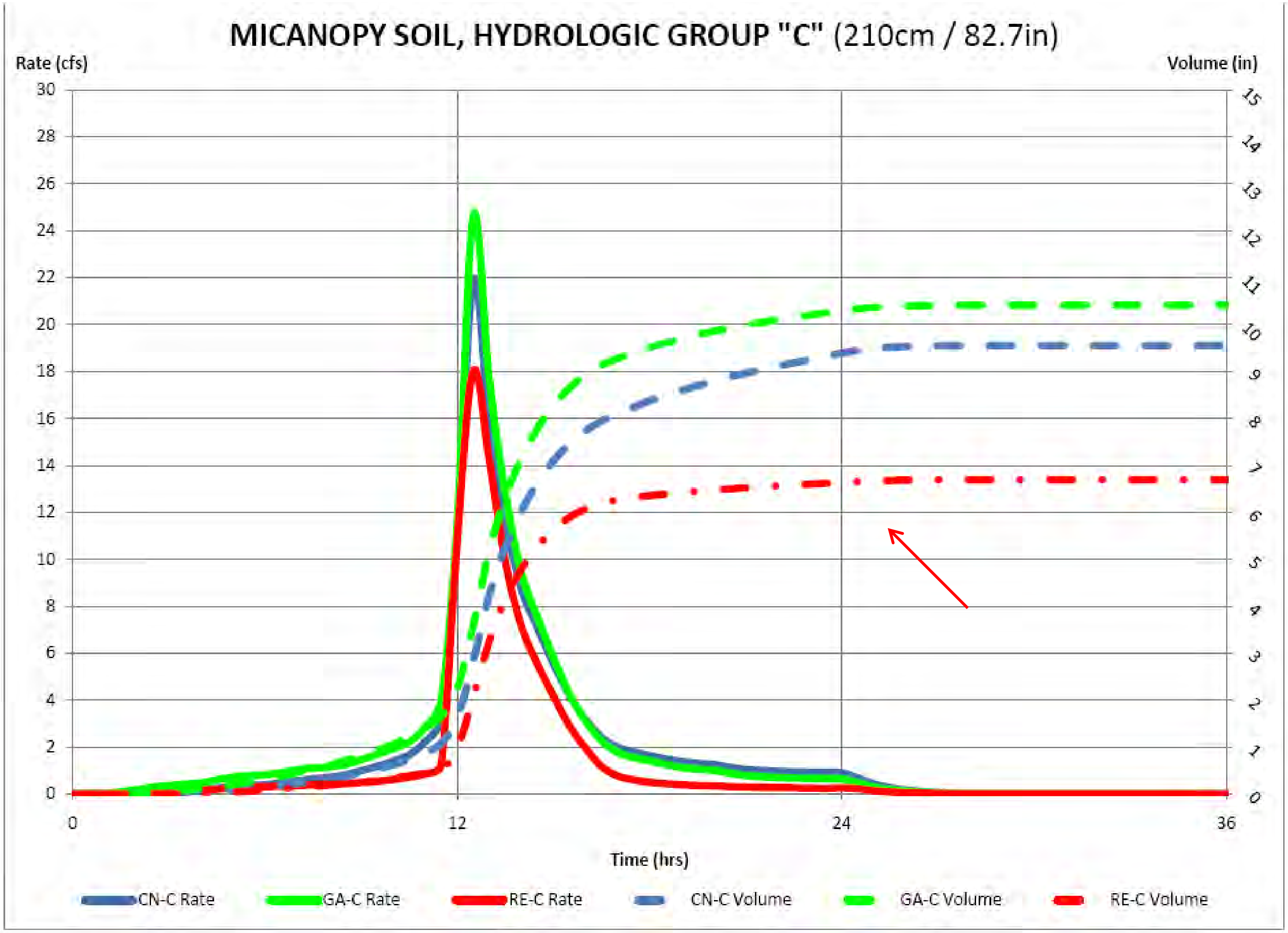
MICANOPY LOAMY FINE SAND, S1-94-(1-7)
AQUIC PALEUDALFS, FINE, MIXED, HYPERTHERMIC
ALACHUA COUNTY, FLORIDA

DATE SAMPLED 11/08/78

NO	DEPTH (CM)	HORIZON	LAB NO	PARTICLE SIZE DISTRIBUTION (% < 2 MM) SAND FRACTIONS VC 2.0-1.0	C 1.0-0.5	M 0.5-0.25	F 0.25-0.10	VF 0.10-0.05	TOTAL SAND 2.0-0.05	TOTAL SILT 0.05-0.002	TOTAL CLAY < 0.002	TEXTURE CLASS	PH H2O (1:1)	PH CACL2 (1:2)	PH KCL (1:1)	TOTAL PHOS (ppm)
1	0- 15	AP	3901	0.0	1.8	21.8	50.2	13.0	86.8	5.1	8.1	LFS	5.2	5.0	4.8	
2	15- 30	B21T	3902	0.2	3.0	19.2	40.2	10.4	73.0	7.0	20.0	SCL	4.8	4.3	4.1	
3	30- 46	B22TG	3903	0.0	1.4	14.6	27.4	7.2	50.6	7.3	42.1	SC	4.5	3.9	3.7	
4	46- 96	B23TG	3904	0.0	1.4	13.4	29.2	7.0	51.0	5.3	43.7	SC	4.4	3.8	3.7	
5	96-140	B24TG	3905	0.0	1.8	18.2	33.2	6.8	60.0	4.5	35.5	SC	4.5	3.8	3.6	
6	140-196	B3G	3906	0.0	1.8	19.0	34.0	6.6	61.4	5.2	33.4	SCL	4.6	3.8	3.6	
7	196-216	C	3907	0.0	2.0	17.7	33.0	7.1	59.8	6.5	33.7	SCL	4.8	3.9	3.5	

NO	SAT HYDR COND (CM/HR)	WATER CONTENT 1/10 BAR ---(WEIGHT %)---	1/3 BAR	15 BAR	WATER CONTENT 3.5CM ---(VOLUME %)---	20CM	30CM	45CM	60CM	80CM	150CM	200CM	AVAIL H2O (CM/CM)	BULK DENSITY (G/CC)	ELEC COND (MMHO/CM)
1	42.2	14.2	8.6	5.0	43.4	39.8	36.3	33.1	28.6	23.7	16.2	14.3	0.14	1.50	0.05
2	3.2	16.2	11.3	5.2	41.6	36.3	35.2	31.8	29.2	26.6	21.0	19.3	0.17	1.51	0.03
3	0.3	29.2	26.9	20.3	47.6	46.7	45.0	43.5	42.5	41.8	40.3	39.5	0.13	1.41	0.02
4	0.8	25.4	23.7	18.5	45.4	43.5	41.5	40.7	40.2	39.5	38.2	37.6	0.11	1.54	0.01
5	0.1	21.5	20.3	16.7	38.4	37.4	37.3	37.2	37.1	36.7	36.6	35.3	0.08	1.69	0.01
6	0.1	22.2	20.3	14.9	39.0	38.1	38.0	37.8	37.6	37.3	36.1	35.6	0.12	1.68	0.01
7	0.2	18.5	17.1	13.8	35.6	34.7	34.5	34.3	33.5	32.9	31.9	31.3	0.08	1.76	0.01


MICANOPY SOIL, HYDROLOGIC GROUP "C" (60cm /23.6)
Rate (cfs)
Volume (in)
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
0
12
24
36
Time (hrs)
CN-C Rate
GA-C Rate
RE-C Rate
CN-C Volume
GA-C Volume
RE-C Volume



MICANOPY SOIL, HYDROLOGIC GROUP "C" (210cm / 82.7in)
Rate (cfs)
Volume (in)
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
0
12
24
36
Time (hrs)
CN-C Rate
GA-C Rate
RE-C Rate
CN-C Volume
GA-C Volume
RE-C Volume

Variation in Potential Soil Storage Based on Depth to WT

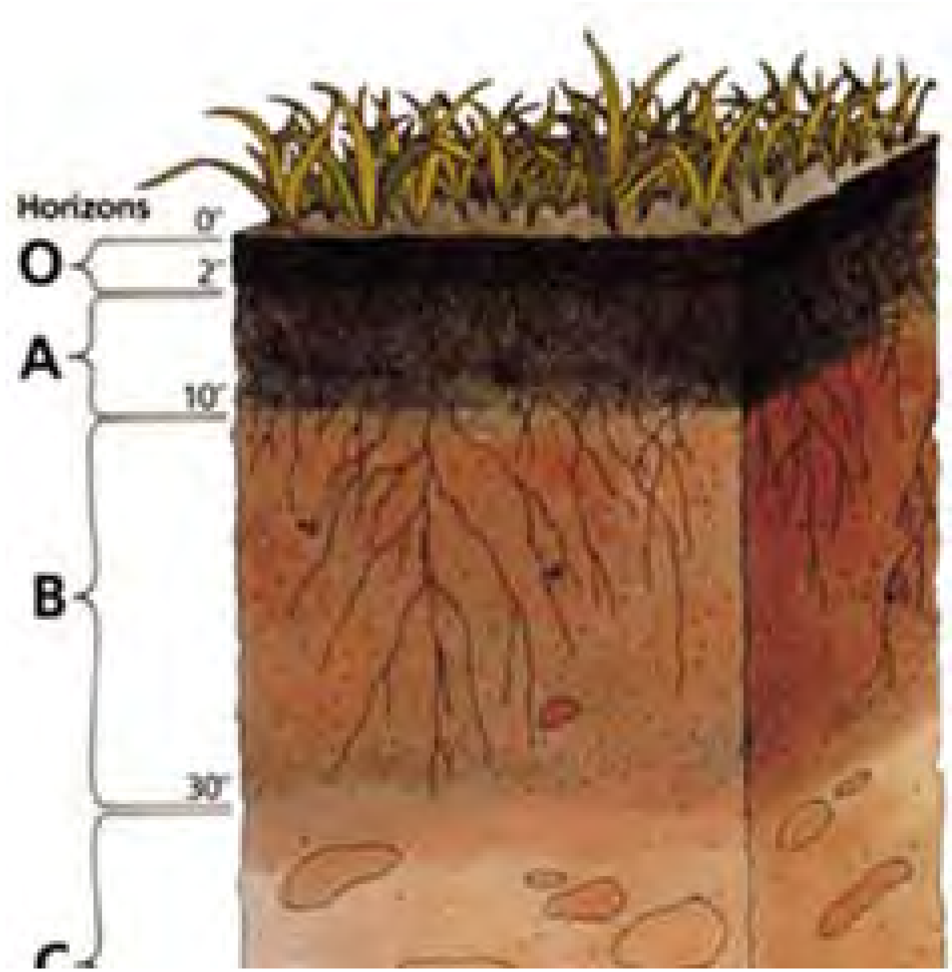
SoilName	Mukey	Avg_Int_Mc	Avg_Sat_Mc	SST in Inche	Layer	D2WT	TP_Stor	[redacted]	LayThck
POMPANO FINE	321046	0.478	0.478	0.000	1	0		[redacted]	13
POMPANO FINE	321046	0.390	0.390	0.000	2	0		[redacted]	17
POMPANO FINE	321046	0.355	0.355	0.000	3	0		[redacted]	44
POMPANO FINE	321046	0.359	0.359	0.000	4	0		[redacted]	81
POMPANO FINE	321046	0.383	0.383	0.000	5	0	0.000		48
POMPANO FINE	321046	0.451	0.478	0.148	1	30		[redacted]	13
POMPANO FINE	321046	0.369	0.390	0.141	2	30		[redacted]	17
POMPANO FINE	321046	0.355	0.355	0.000	3	30		[redacted]	44
POMPANO FINE	321046	0.359	0.359	0.000	4	30		[redacted]	81
POMPANO FINE	321046	0.383	0.383	0.000	5	30	0.290		48
POMPANO FINE	321046	0.386	0.478	0.507	1	60		[redacted]	13
POMPANO FINE	321046	0.288	0.390	0.680	2	60		[redacted]	17
POMPANO FINE	321046	0.348	0.355	0.123	3	60		[redacted]	44
POMPANO FINE	321046	0.359	0.359	0.000	4	60		[redacted]	81
POMPANO FINE	321046	0.383	0.383	0.000	5	60	1.311		48
POMPANO FINE	321046	0.312	0.478	0.914	1	91		[redacted]	13
POMPANO FINE	321046	0.152	0.390	1.594	2	91		[redacted]	17
POMPANO FINE	321046	0.269	0.355	1.496	3	91		[redacted]	44
POMPANO FINE	321046	0.358	0.359	0.037	4	91		[redacted]	81
POMPANO FINE	321046	0.383	0.383	0.000	5	91	4.042		48
POMPANO FINE	321046	0.287	0.478	1.053	1	121		[redacted]	13
POMPANO FINE	321046	0.110	0.390	1.874	2	121		[redacted]	17
POMPANO FINE	321046	0.149	0.355	3.567	3	121		[redacted]	44
POMPANO FINE	321046	0.349	0.359	0.314	4	121		[redacted]	81
POMPANO FINE	321046	0.383	0.383	0.000	5	121	6.808		48

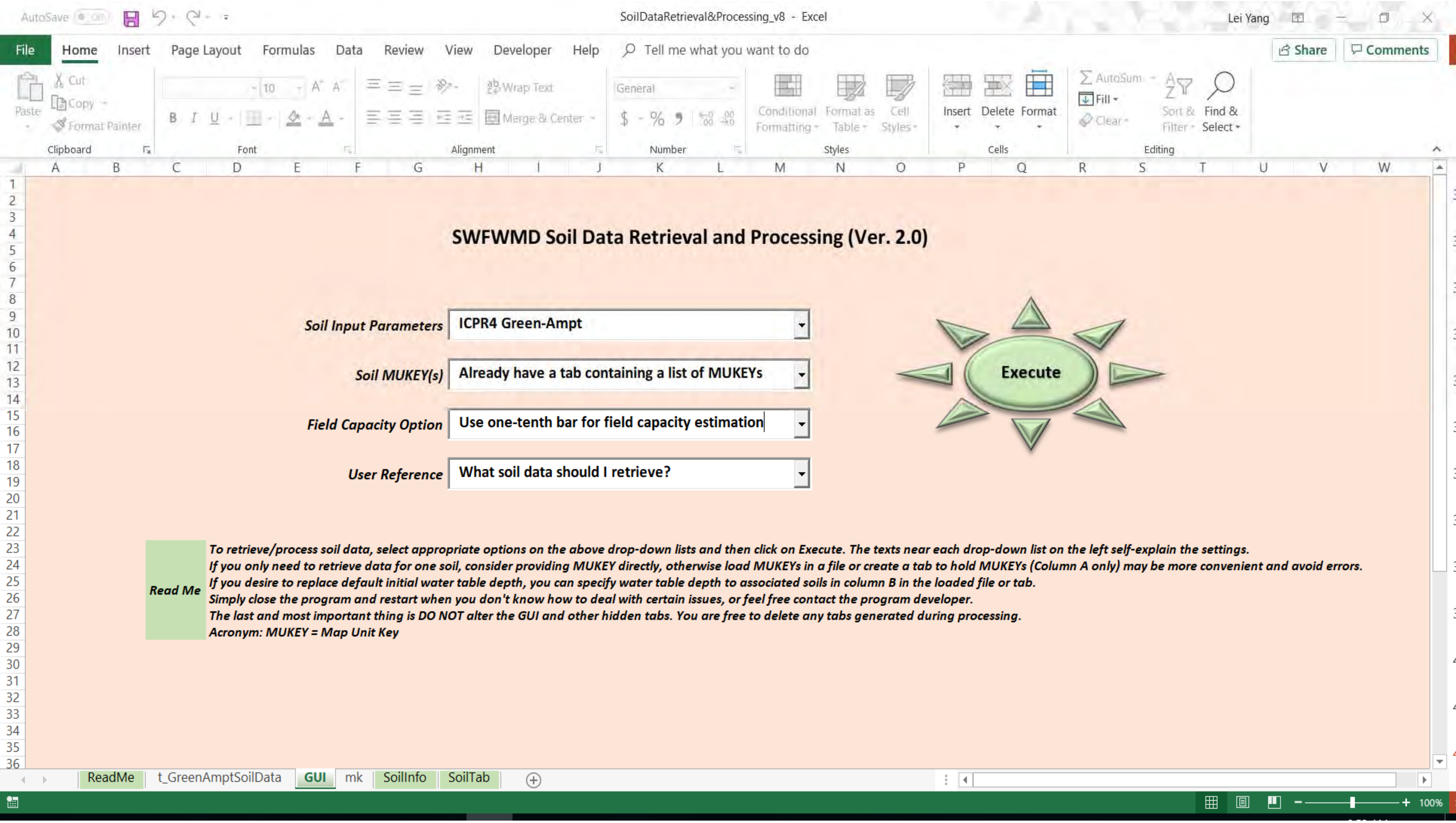
Soil Data Retrieving and Processing Program

A Customized Tool Using Visual Basic Application

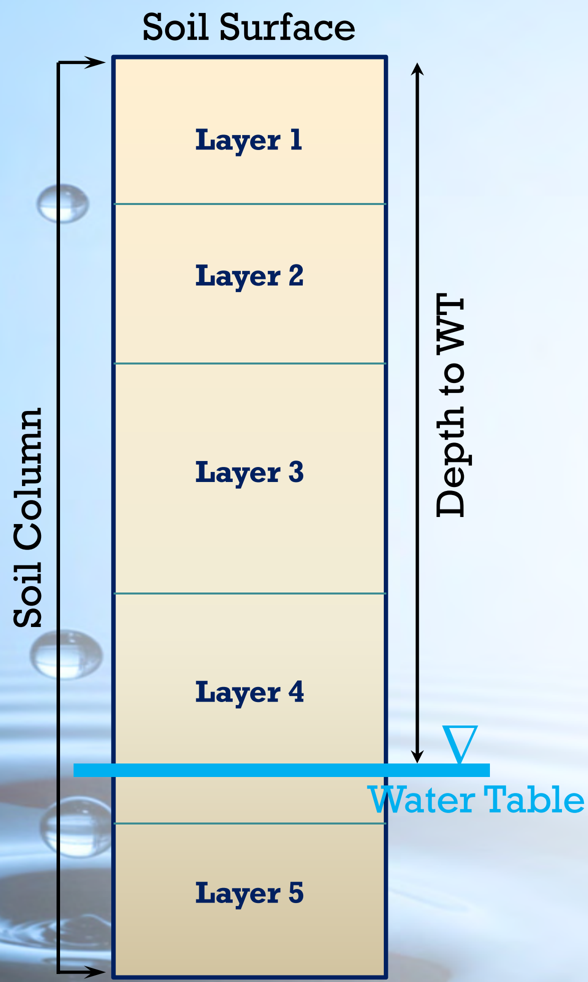
Background

- Change from ICPR3 to ICPR4
- Layered soil data needs
- Mechanism for consistent and up-to-date soil parameterization
- Determination of initial moisture content based on initial water table depth
- Use soil moisture retention curve to decide soil storage



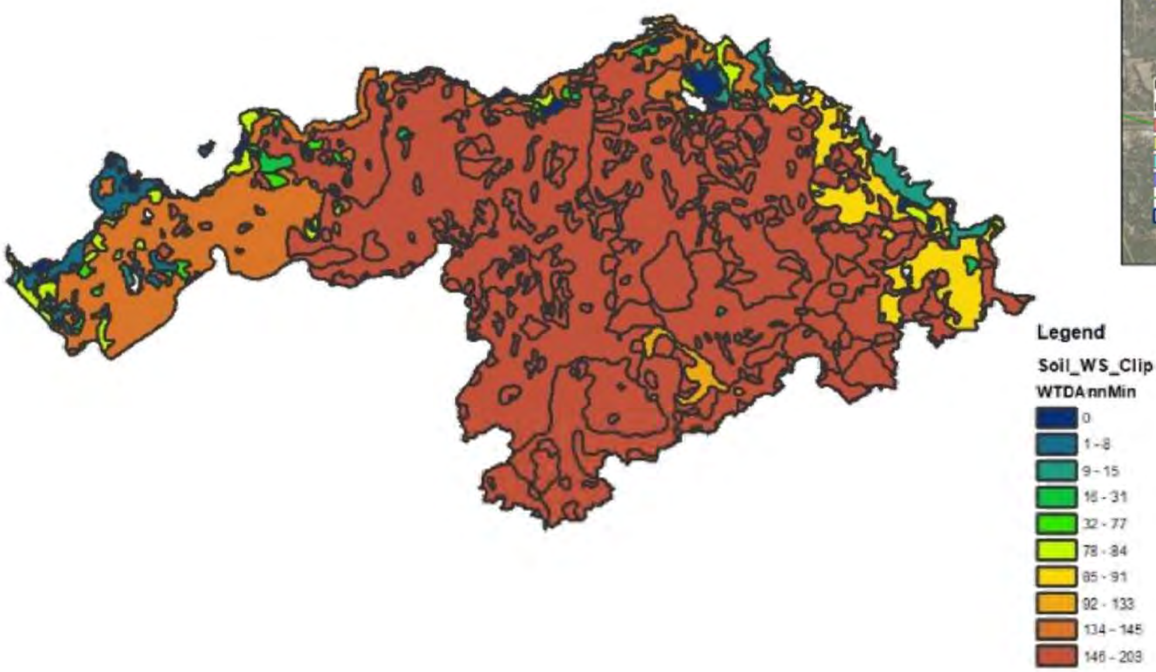


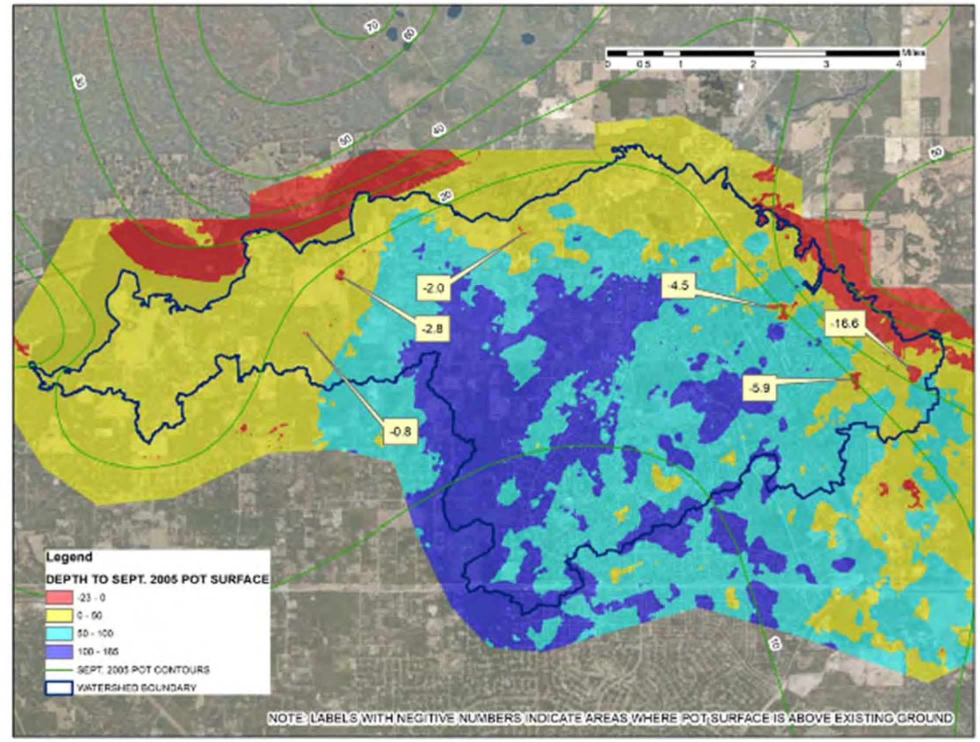
SoilDataRetrieval&Processing_v8 - Excel
SWFWMD Soil Data Retrieval and Processing (Ver. 2.0)
Soil Input Parameters
ICPR4 Green-Ampt
Soil MUKEY(s)
Already have a tab containing a list of MUKEYs
Field Capacity Option
Use one-tenth bar for field capacity estimation
User Reference
What soil data should I retrieve?
Execute
Read Me
To retrieve/process soil data, select appropriate options on the above drop-down lists and then click on Execute. The texts near each drop-down list on the left self-explain the settings.
If you only need to retrieve data for one soil, consider providing MUKEY directly, otherwise load MUKEYs in a file or create a tab to hold MUKEYs (Column A only) may be more convenient and avoid errors.
If you desire to replace default initial water table depth, you can specify water table depth to associated soils in column B in the loaded file or tab.
Simply close the program and restart when you don't know how to deal with certain issues, or feel free contact the program developer.
The last and most important thing is DO NOT alter the GUI and other hidden tabs. You are free to delete any tabs generated during processing.
Acronym: MUKEY = Map Unit Key
ReadMe
t_GreenAmptSoilData
GUI
mk
SoilInfo
SoilTab



Soil Parameters	Source or Method
Soil Zone	SSURGO
Initial Water Table Depth	NRCS or user specified
Kv Saturated	IFAS or SSURGO
MC Saturated	Calculated as function of bulk density
MC Residual	Regression equation
MC Initial	Calculated based on soil moisture retention curve
MC Field	Water content at 1/3 or 1/10 bar
MC Wilting	Water content at 15 bar
Pore Size Index	Regression equation
Bubble Pressure	Regression equation
Layer Thickness	IFAS

Water Table Information from SSURGO





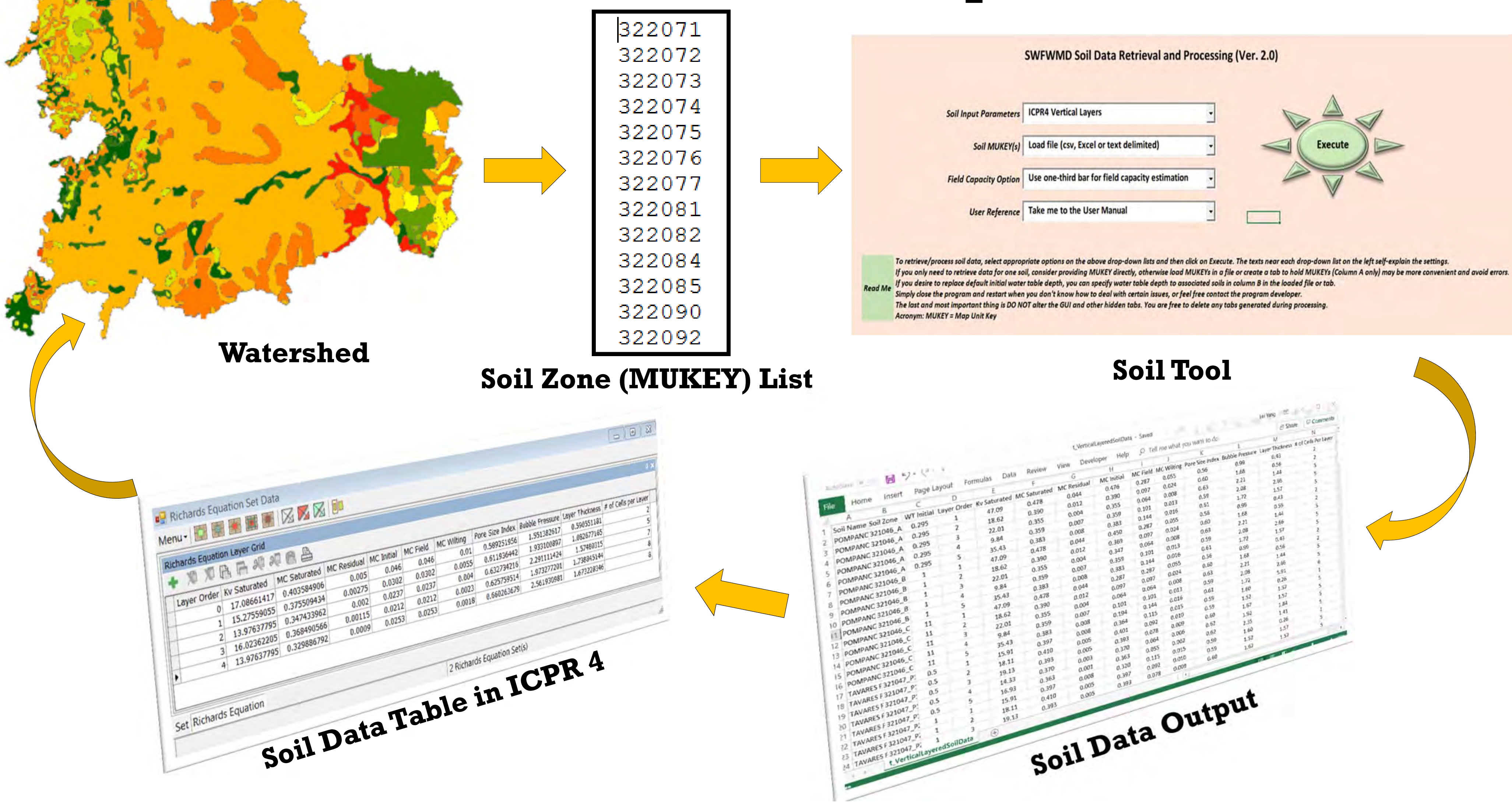
Depth to Water Table based on Potentiometric Surface

Column A	Mukey
Column B	Initial water table depth
Column C	User customized mukey

	A	B	C
1	321046	1.5	321046_A
2	321046	1	321046_B
3	321046	6	321046_C
4	321047	0	321047_P1
5	321047	1	321047_P2
6	321047	5	321047_P3
7	321048		321048
8	321049		321049
9	321050		321050
10	321051		321051
11	321052		321052
12	321053		321053
13	321054		321054

Soil Input Information Regarding Depth to Water Table

Process for Soil Data Preparation



- Physically based rainfall excess approaches better represent soil water dynamics in Florida sandy soils.
- Availability of the soil data retrieval and processing program expedite modeling process.
- Mechanism to stay current when source soil data updates happen.
- Users need professional judgment for reasonable soil parameters.

Ending Remarks

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Lei Yang, PhD, PE, Chief Professional Engineer, SWFWMD

Lei.Yang@watermatters.org

Q & A

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the following slides just for potential questions

Vertical Layered Soil Data Generated by Soil Tool

Soil Name	Soil Zone	WT Initial	Layer Order	Kv Saturated	MC Saturated	MC Residual	MC Initial	MC Field	MC Wilting	Pore Size Index	Bubble Pressure	Layer Thickness	# of Cells Per Layer
POMPANO FINE SAND, DEPRESSIONAL	321046_A	0.295	1	47.09	0.478	0.044	0.476	0.287	0.055	0.56	0.99	0.43	2
POMPANO FINE SAND, DEPRESSIONAL	321046_A	0.295	2	18.62	0.390	0.012	0.390	0.097	0.024	0.60	1.68	0.56	2
POMPANO FINE SAND, DEPRESSIONAL	321046_A	0.295	3	22.01	0.355	0.004	0.355	0.064	0.008	0.63	2.21	1.44	5
POMPANO FINE SAND, DEPRESSIONAL	321046_A	0.295	4	9.84	0.359	0.007	0.359	0.101	0.013	0.59	2.08	2.66	5
POMPANO FINE SAND, DEPRESSIONAL	321046_A	0.295	5	35.43	0.383	0.008	0.383	0.144	0.016	0.61	1.72	1.57	5
POMPANO FINE SAND, DEPRESSIONAL	321046_B	1	1	47.09	0.478	0.044	0.450	0.287	0.055	0.56	0.99	0.43	2
POMPANO FINE SAND, DEPRESSIONAL	321046_B	1	2	18.62	0.390	0.012	0.369	0.097	0.024	0.60	1.68	0.56	2
POMPANO FINE SAND, DEPRESSIONAL	321046_B	1	3	22.01	0.355	0.004	0.347	0.064	0.008	0.63	2.21	1.44	5
POMPANO FINE SAND, DEPRESSIONAL	321046_B	1	4	9.84	0.359	0.007	0.359	0.101	0.013	0.59	2.08	2.66	5
POMPANO FINE SAND, DEPRESSIONAL	321046_B	1	5	35.43	0.383	0.008	0.383	0.144	0.016	0.61	1.72	1.57	5
POMPANO FINE SAND, DEPRESSIONAL	321046_C	11	1	47.09	0.478	0.044	0.287	0.287	0.055	0.56	0.99	0.43	2
POMPANO FINE SAND, DEPRESSIONAL	321046_C	11	2	18.62	0.390	0.012	0.097	0.097	0.024	0.60	1.68	0.56	2
POMPANO FINE SAND, DEPRESSIONAL	321046_C	11	3	22.01	0.355	0.004	0.064	0.064	0.008	0.63	2.21	1.44	5
POMPANO FINE SAND, DEPRESSIONAL	321046_C	11	4	9.84	0.359	0.007	0.101	0.101	0.013	0.59	2.08	2.66	5
POMPANO FINE SAND, DEPRESSIONAL	321046_C	11	5	35.43	0.383	0.008	0.194	0.144	0.016	0.61	1.72	5.91	6
TAVARES FINE SAND, 0 TO 5 PERCENT SLOPES	321047_P1	0.5	1	15.91	0.397	0.008	0.364	0.115	0.015	0.59	1.60	0.26	1
TAVARES FINE SAND, 0 TO 5 PERCENT SLOPES	321047_P1	0.5	2	18.11	0.410	0.005	0.401	0.092	0.010	0.59	1.52	1.57	5
TAVARES FINE SAND, 0 TO 5 PERCENT SLOPES	321047_P1	0.5	3	19.13	0.393	0.005	0.393	0.078	0.009	0.60	1.67	1.57	5
TAVARES FINE SAND, 0 TO 5 PERCENT SLOPES	321047_P1	0.5	4	14.33	0.370	0.003	0.370	0.064	0.006	0.62	1.92	1.84	5
TAVARES FINE SAND, 0 TO 5 PERCENT SLOPES	321047_P1	0.5	5	16.93	0.363	0.001	0.363	0.055	0.002	0.62	2.35	1.41	5
TAVARES FINE SAND, 0 TO 5 PERCENT SLOPES	321047_P2	1	1	15.91	0.397	0.008	0.320	0.115	0.015	0.59	1.60	0.26	1
TAVARES FINE SAND, 0 TO 5 PERCENT SLOPES	321047_P2	1	2	18.11	0.410	0.005	0.397	0.092	0.010	0.59	1.52	1.57	5
TAVARES FINE SAND, 0 TO 5 PERCENT SLOPES	321047_P2	1	3	19.13	0.393	0.005	0.393	0.078	0.009	0.60	1.67	1.57	5
TAVARES FINE SAND, 0 TO 5 PERCENT SLOPES	321047_P2	1	4	14.33	0.370	0.003	0.370	0.064	0.006	0.62	1.92	1.84	5
TAVARES FINE SAND, 0 TO 5 PERCENT SLOPES	321047_P2	1	5	16.93	0.363	0.001	0.363	0.055	0.002	0.62	2.35	1.41	5
TAVARES FINE SAND, 0 TO 5 PERCENT SLOPES	321047_P3	10	1	15.91	0.397	0.008	0.115	0.115	0.015	0.59	1.60	0.26	1
TAVARES FINE SAND, 0 TO 5 PERCENT SLOPES	321047_P3	10	2	18.11	0.410	0.005	0.092	0.092	0.010	0.59	1.52	1.57	5
TAVARES FINE SAND, 0 TO 5 PERCENT SLOPES	321047_P3	10	3	19.13	0.393	0.005	0.078	0.078	0.009	0.60	1.67	1.57	5
TAVARES FINE SAND, 0 TO 5 PERCENT SLOPES	321047_P3	10	4	14.33	0.370	0.003	0.064	0.064	0.006	0.62	1.92	1.84	5
TAVARES FINE SAND, 0 TO 5 PERCENT SLOPES	321047_P3	10	5	16.93	0.363	0.001	0.174	0.055	0.002	0.62	2.35	4.75	5
IMMOKALEE FINE SAND	321048	0.82021	1	22.80	0.523	0.039	0.487	0.187	0.097	0.55	0.94	0.33	1
IMMOKALEE FINE SAND	321048	0.82021	2	23.82	0.398	0.004	0.394	0.055	0.008	0.60	1.66	1.02	4
IMMOKALEE FINE SAND	321048	0.82021	3	10.42	0.358	0.018	0.358	0.153	0.035	0.63	2.20	1.41	5
IMMOKALEE FINE SAND	321048	0.82021	4	13.97	0.359	0.010	0.359	0.110	0.020	0.58	2.11	0.33	1
IMMOKALEE FINE SAND	321048	0.82021	5	11.61	0.366	0.011	0.366	0.119	0.021	0.61	2.07	0.49	2

Green Ampt Soil Data Generated by Soil Tool

SoilDataRetrieval&Processing_v8 - Excel

SoilName	SoilZone	Kv Saturated	MC Saturated	MC Residual	MC Initial	MC Field	MC Wilting	Pore Size Index	Bubble Pressure	Allow Recharge	WT Initial
POMPANO FINE SAND, DEPRESSIO	321046_A	21.65	0.374	0.009	0.366	0.115	0.016	0.60	1.92	No	1.500
POMPANO FINE SAND, DEPRESSIO	321046_B	21.65	0.374	0.009	0.369	0.115	0.016	0.60	1.92	No	1.000
POMPANO FINE SAND, DEPRESSIO	321046_C	27.09	0.378	0.009	0.153	0.126	0.016	0.61	1.84	No	11.000
TAVARES FINE SAND, 0 TO 5 PERC	321047_P1	16.97	0.384	0.004	0.381	0.074	0.007	0.61	1.85	No	0.500
TAVARES FINE SAND, 0 TO 5 PERC	321047_P2	16.97	0.384	0.004	0.378	0.074	0.007	0.61	1.85	No	1.000
TAVARES FINE SAND, 0 TO 5 PERC	321047_P3	16.96	0.377	0.003	0.124	0.068	0.005	0.61	2.01	No	10.000
IMMOKALEE FINE SAND	321048	19.39	0.379	0.013	0.377	0.104	0.026	0.61	1.92	No	0.820
OKEELANTA MUCK	321049	11.53	0.449	0.027	0.449	0.217	0.046	0.54	1.26	No	0.000
LAKE FINE SAND, 0 TO 5 PERCENT	321050	18.24	0.407	0.011	0.248	0.087	0.023	0.57	1.45	No	4.757
LAKE FINE SAND, 5 TO 8 PERCENT	321051	18.24	0.407	0.011	0.248	0.087	0.023	0.57	1.45	No	4.757
ARREDONDO FINE SAND, 0 TO 5 PI	321052	7.27	0.398	0.035	0.381	0.171	0.063	0.45	1.85	No	1.936
ARREDONDO FINE SAND, 5 TO 8 PI	321053	7.27	0.398	0.035	0.381	0.171	0.063	0.45	1.85	No	1.936
KENDRICK FINE SAND, 0 TO 5 PER	321054	7.00	0.384	0.051	0.366	0.187	0.067	0.45	2.16	No	2.001
KENDRICK FINE SAND, 5 TO 8 PER	321055	3.66	0.382	0.048	0.333	0.267	0.140	0.25	5.72	No	2.854
ADAMSVILLE FINE SAND	321056	15.00	0.374	0.003	0.365	0.082	0.006	0.62	1.91	No	1.608
PITS	321057	17.95	0.379	0.004	0.379	0.066	0.008	0.61	1.82	No	0.000
QUARTZIPSAMENTS, 0 TO 5 PERCE	321058	17.95	0.379	0.004	0.378	0.066	0.008	0.61	1.82	No	0.525
WEEKIWACHEE-DURBIN MUCKS	321059	11.53	0.449	0.027	0.449	0.217	0.046	0.54	1.26	No	0.230
OKEELANTA-LAUDERHILL-TERRA C	321060	35.10	0.745	0.041	0.745	0.592	0.093	0.54	1.01	No	0.000
LOCHLOOSA FINE SAND, 0 TO 5 PE	321061	3.74	0.412	0.055	0.359	0.291	0.161	0.32	9.01	No	3.084

Notes

Parameter values are weighted by layer thickness based on Vertical Layer soil parameter values.

Kv Saturated is in units of ft/day.

MC Saturated, MC Residual, MC Initial, MC Field and MC Wilting are volumetric moisture contents.

Brooks-Corey Pore Size Index has no unit.

Bubble Pressure is in units of inches.

Allow Recharge set in default value. Users can adjust as needed.

WT Initial or Initial Water Table Depth in units of feet, adopted by default from the Sept 2018 NRCS soil data unless users specified otherwise.

Disclaimer

By accessing soil data and information contained in this spreadsheet, you hereby agree to accept the following terms and conditions:

The Southwest Florida Water Management District (or the DISTRICT) shall not be held liable for improper or incorrect use of the soil data, processes or materials described and/or contained herein. These data are not legal documents and are not intended t

The user hereby recognizes that the soil data, processes and materials are dynamic and may change over time without notice. However, the DISTRICT makes no commitment to update the soil data processes or materials contained herein.

Use of any soil data and related information is voluntary and reliance on it should only be undertaken after an independent review of its accuracy, reliability, completeness, usefulness and timeliness. Such independent review is solely the responsibility of use

ReadMe | t_GreenAmptSoilData | GUI | mk | SoilInfo | SoilTab