



# Stormwater SCM Minimum Design Criteria (MDC)



Robert D. Patterson, PE  
Town of Morrisville  
Stormwater Division

# Stakeholders represented:

Engineering/design community (8)

Home Builder's Association (1)

Construction (1)

Local government (4)

Environmental Group (2)

Landscape Architect (1)

Academia (2)

Soil Scientist (1)

DOT (1)

DWR & DEMLR (4)



**Why?**







*Thou shalt...*  
*S.L. 2013-82*

# SL 2013-82



MDC

Fast-track  
Process

<http://portal.ncdenr.org/web/lr/state-stormwater/mdc-team>

**Background**

**MDC list**

**Mtg. Minutes**

**Report**

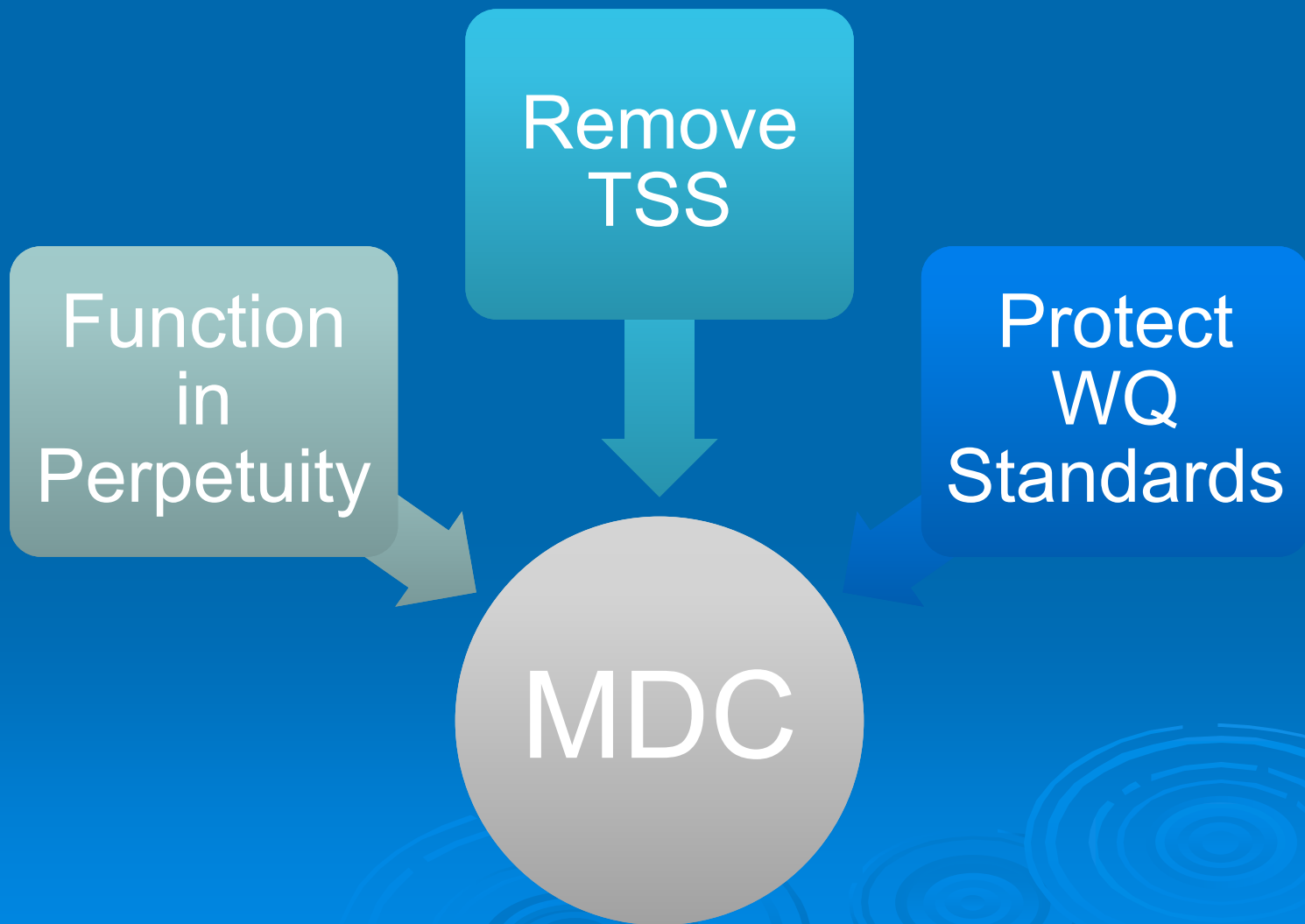
**Fast-track**

**Draft Rules**

**Process**

**Team list**

# Needed to...?







## Nutrient DC



## Bacteria DC



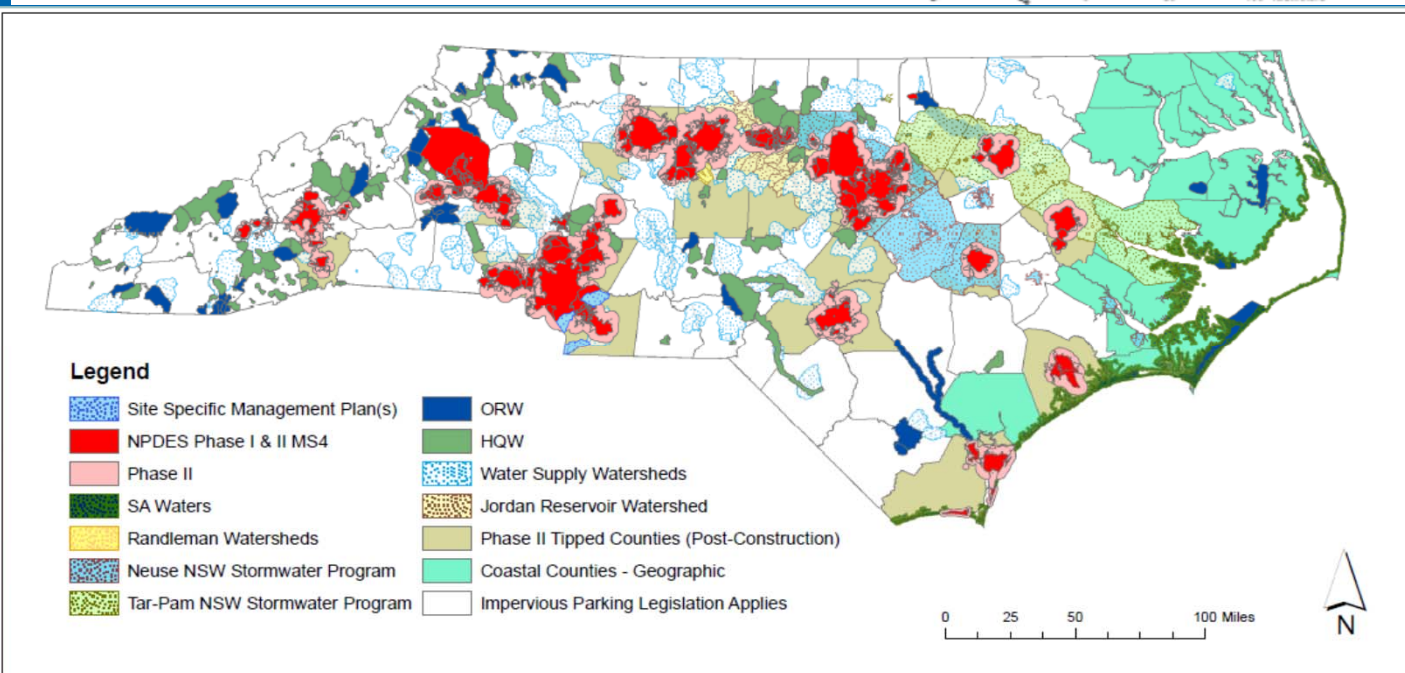
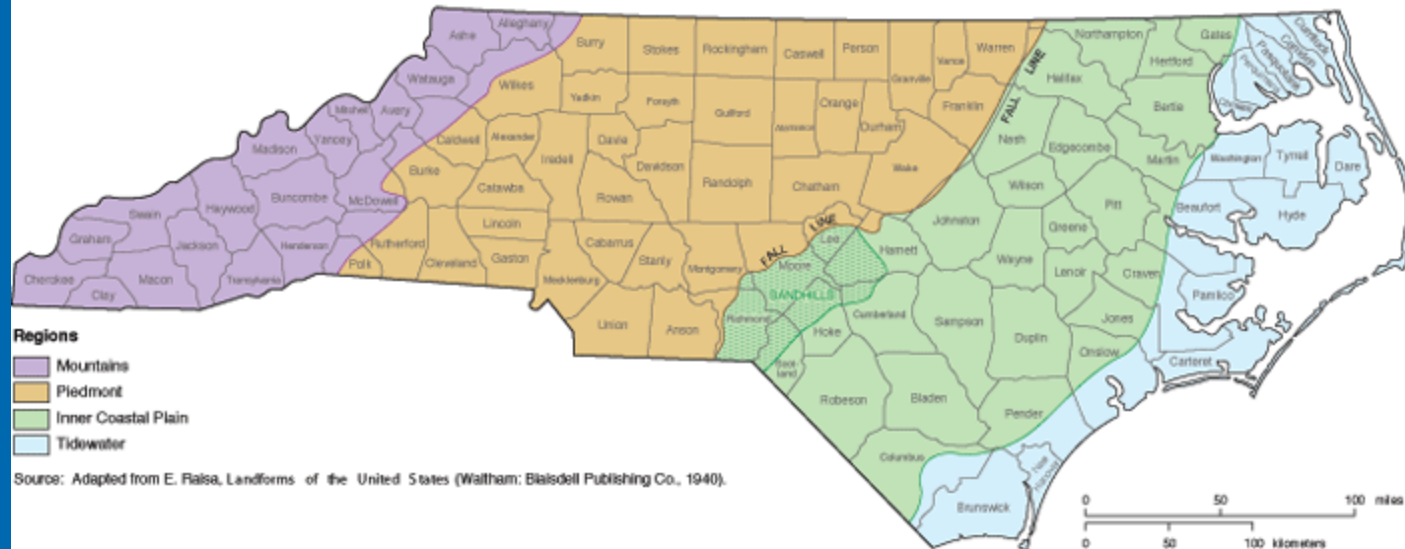
## Temperature DC



## Recommended DC

# Applies Statewide

**Figure 1a. Physical Regions**



# Different How?

- Simpler
- Updated
- More flexibility
- Less costly
- More consistent



- General MDC for ALL SCMs
- Infiltration Systems
- Bioretention
- Wet Ponds
- SW Wetlands
- LS-VFS
- Permeable Pavement
- Sand Filters
- Pollutant Removal Swales
- Green Roofs
- DIS

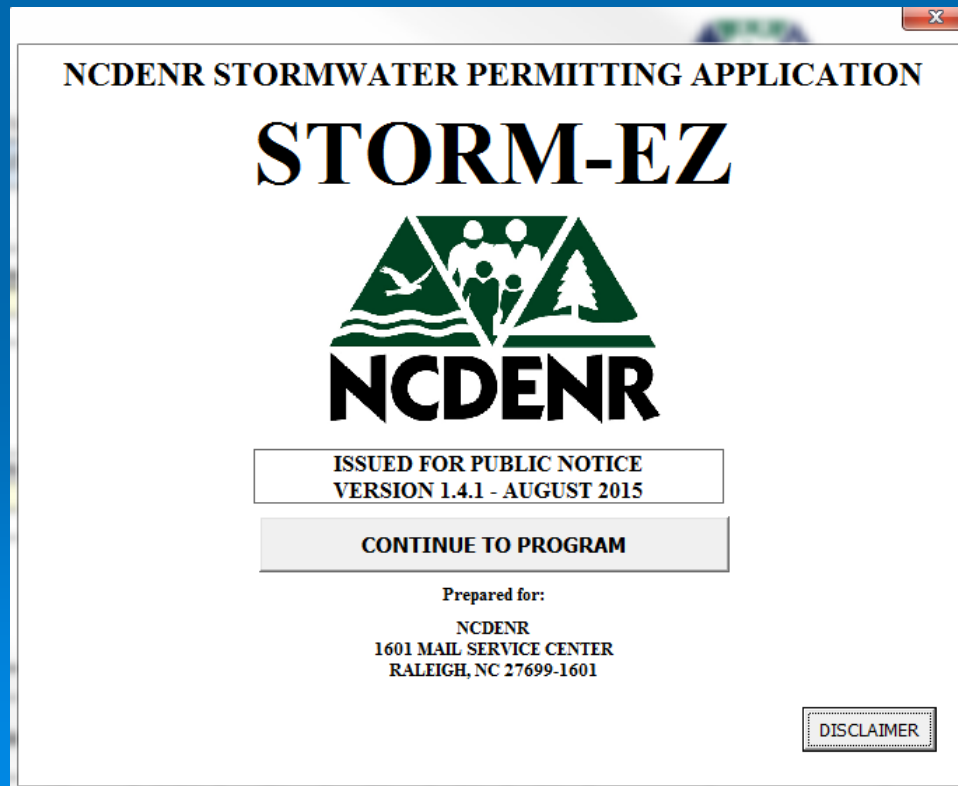




# Required Treatment Volume


NRCS Curve Number Method

SA waters: 1-yr, 24-hr storm  
All others: 90<sup>th</sup> percentile storm

The image shows a screenshot of a software application window titled "NCDENR STORMWATER PERMITTING APPLICATION". The main heading is "STORM-EZ". Below the heading is a logo for NCDENR, which features a green triangle containing white silhouettes of people, a tree, and a bird, with the text "NCDENR" in large, bold, black letters below it. Under the logo, there is a box containing the text "ISSUED FOR PUBLIC NOTICE" and "VERSION 1.4.1 - AUGUST 2015". Below this box is a button labeled "CONTINUE TO PROGRAM". At the bottom of the window, there is a section labeled "Prepared for:" followed by the text "NCDENR", "1601 MAIL SERVICE CENTER", and "RALEIGH, NC 27699-1601". In the bottom right corner, there is a button labeled "DISCLAIMER".

NCDENR STORMWATER PERMITTING APPLICATION

## STORM-EZ



ISSUED FOR PUBLIC NOTICE  
VERSION 1.4.1 - AUGUST 2015

CONTINUE TO PROGRAM

Prepared for:  
NCDENR  
1601 MAIL SERVICE CENTER  
RALEIGH, NC 27699-1601

DISCLAIMER

**Peak flow attenuation** is allowed in **ALL** SCMs



# Wet Detention Basins





## Shelf reduced to 6 ft. width





# Sizing Options

## SA/DA Tables:

Surface area of pond based on the drainage area size, % BUA and pond depth.

**Table 10-1**

Surface Area to Drainage Area Ratio for Permanent Pool Sizing to Achieve 85 Percent TSS Pollutant Removal Efficiency in the *Mountain and Piedmont* Regions, Adapted from Driscoll, 1986

Percent Impervious Cover	Permanent Pool Average Depth (ft)						
	3.0	4.0	5.0	6.0	7.0	8.0	9.0
10%	0.59	0.49	0.43	0.35	0.31	0.29	0.26
20%	0.97	0.79	0.70	0.59	0.51	0.46	0.44
30%	1.34	1.08	0.97	0.83	0.70	0.64	0.62
40%	1.73	1.43	1.25	1.05	0.90	0.82	0.77
50%	2.06	1.73	1.50	1.30	1.09	1.00	0.92
60%	2.40	2.03	1.71	1.51	1.29	1.18	1.10
70%	2.88	2.40	2.07	1.79	1.54	1.35	1.26
80%	3.36	2.78	2.38	2.10	1.86	1.60	1.42
90%	3.74	3.10	2.66	2.34	2.11	1.83	1.67

**Table 10-2**

Surface Area to Drainage Area Ratio for Permanent Pool Sizing to Achieve 85 Percent TSS Pollutant Removal Efficiency in the *Coastal* Region, Adapted from Driscoll, 1986

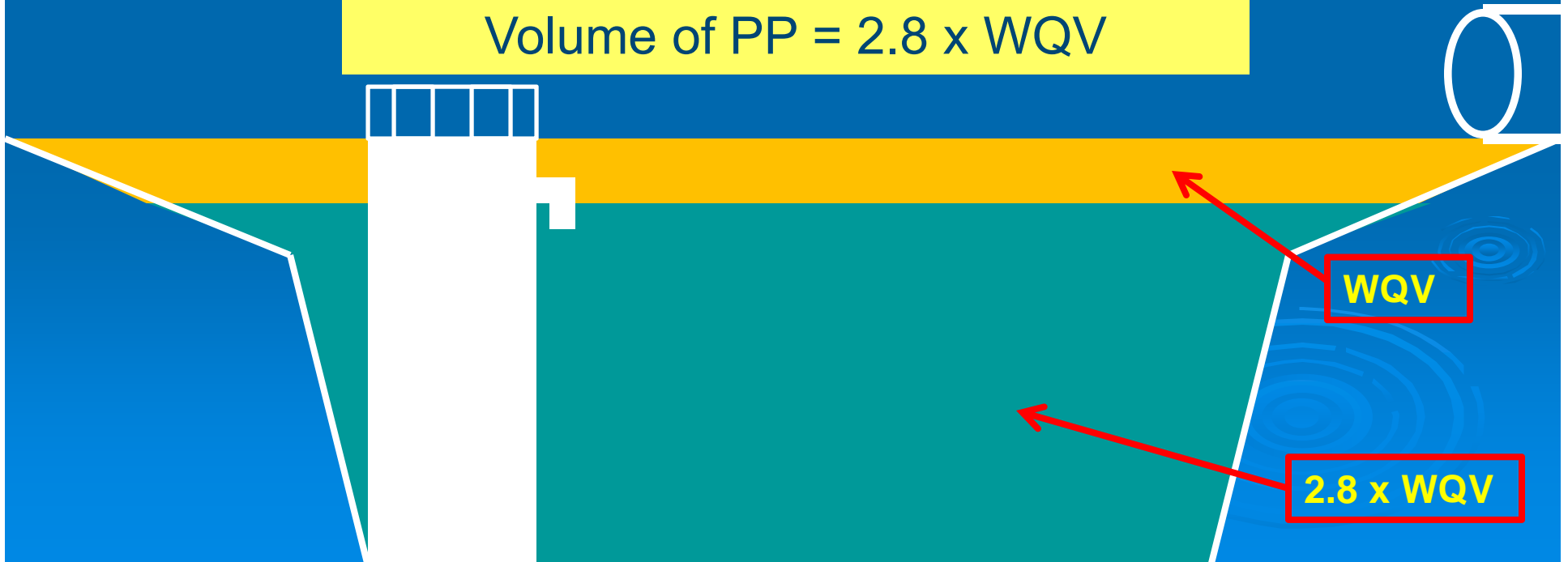
Percent Impervious Cover	Permanent Pool Average Depth (ft)									
	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5'
10%	0.9	0.8	0.7	0.6	0.5	0	0	0	0	0
20%	1.7	1.3	1.2	1.1	1.0	0.9	0.8	0.7	0.6	0.5
30%	2.5	2.2	1.9	1.8	1.6	1.5	1.3	1.2	1.0	0.9
40%	3.4	3.0	2.6	2.4	2.1	1.9	1.6	1.4	1.1	1.0
50%	4.2	3.7	3.3	3.0	2.7	2.4	2.1	1.8	1.5	1.3
60%	5.0	4.5	3.8	3.5	3.2	2.9	2.6	2.3	2.0	1.6
70%	6.0	5.2	4.5	4.1	3.7	3.3	2.9	2.5	2.1	1.8
80%	6.8	6.0	5.2	4.7	4.2	3.7	3.2	2.7	2.2	2.0
90%	7.5	6.5	5.8	5.3	4.8	4.3	3.8	3.3	2.8	2.3
100%	8.2	7.4	6.8	6.2	5.6	5.0	4.4	3.8	3.2	2.6

# Hydraulic Retention Time Method

$$V_{pp} = \frac{HRT}{5} * WQV$$

$V_{pp}$  = Permanent pool volume (cu ft)  
HRT = 14 days (hydraulic residence time)  
WQV = Water quality volume (cu ft)

$$\text{Volume of PP} = 2.8 \times WQV$$



This means 90%  
TSS removal  
ponds are no  
longer relevant.



# Infiltration Systems





## Dewater in $\leq 72$ hrs

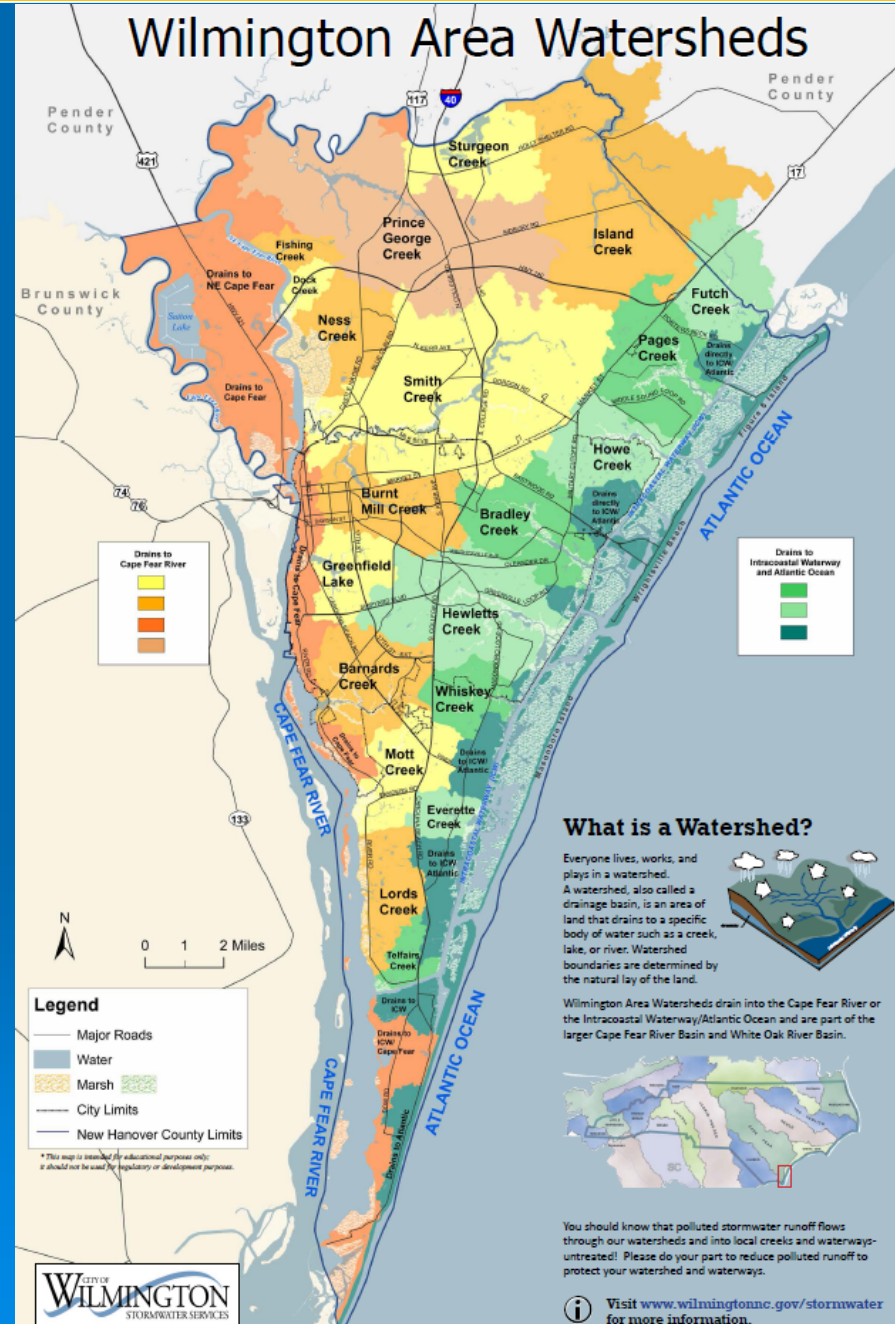


No flow splitting device required





# DA no longer limited to 2 ac-in



# SW Wetlands






Max ponding depth increased to 15"





The first 12" depth of soil shall be adjusted if necessary to promote plant growth

NCDAs Agronomic Division 4300 Reedy Creek Road Raleigh, NC 27607-6465 (919) 733-2655															Report No: 02239									
 <h1>Soil Test Report</h1>															Grower: Educational Sample-Swine Waste 4300 Reedy Creek Rd. Raleigh, NC 27607					Copies to: County Extension Director				
															Farm:									
1/26/96 SERVING N.C. CITIZENS FOR OVER 50 YEARS																								
Agronomist Comments: C - 12																								
Field Information					Applied Lime					Recommendations														
Sample No.	Last Crop	Mo	Yr	T/A	Crop or Year	Lime	N	P2O5	K2O	Mg	Cu	Zn	B	Mn	See Note									
NB1	Bahiagrass				1st Crop: Berm Hay/Pas,E	1.7T	60-80	90-110	40-60	0	0	0	0	0	12									
					2nd Crop: Berm Hay/Pas,M	0	180-220	80-100	120-140	0	0	0	0	0	12									
Test Results																								
Soil Class	HM%	W/V	CEC	BS%	Ac	pH	P-I	K-I	Ca%	Mg%	Mn-I	Mn-Al (1)	Mn-Al (2)	Zn-I	Zn-Al	Cu-I	S-I	SS-I	NQ-N	NH-N	Na			
MIN	0.41	0.84	3.8	53.0	1.8	4.5	21	44	34.0	13.0	2089	1263	1263	48	48	77	78	24			0.1			
Field Information					Applied Lime					Recommendations														
Sample No.	Last Crop	Mo	Yr	T/A	Crop or Year	Lime	N	P2O5	K2O	Mg	Cu	Zn	B	Mn	See Note									
W2	Bahiagrass				1st Crop: Berm Hay/Pas,E	1.2T	60-80	0	0-20	0	0	0	0	0	12									
					2nd Crop: Alfalfa, E	0	10-30	0	50-70	0	0	0	3	0	12									
Test Results																								
Soil Class	HM%	W/V	CEC	BS%	Ac	pH	P-I	K-I	Ca%	Mg%	Mn-I	Mn-Al (1)	Mn-Al (2)	Zn-I	Zn-Al	Cu-I	S-I	SS-I	NQ-N	NH-N	Na			
MIN	0.36	0.82	3.8	66.0	1.3	4.9	870	71	44.0	13.0	2353	1421	1421	683	683	1492	60	17			0.1			



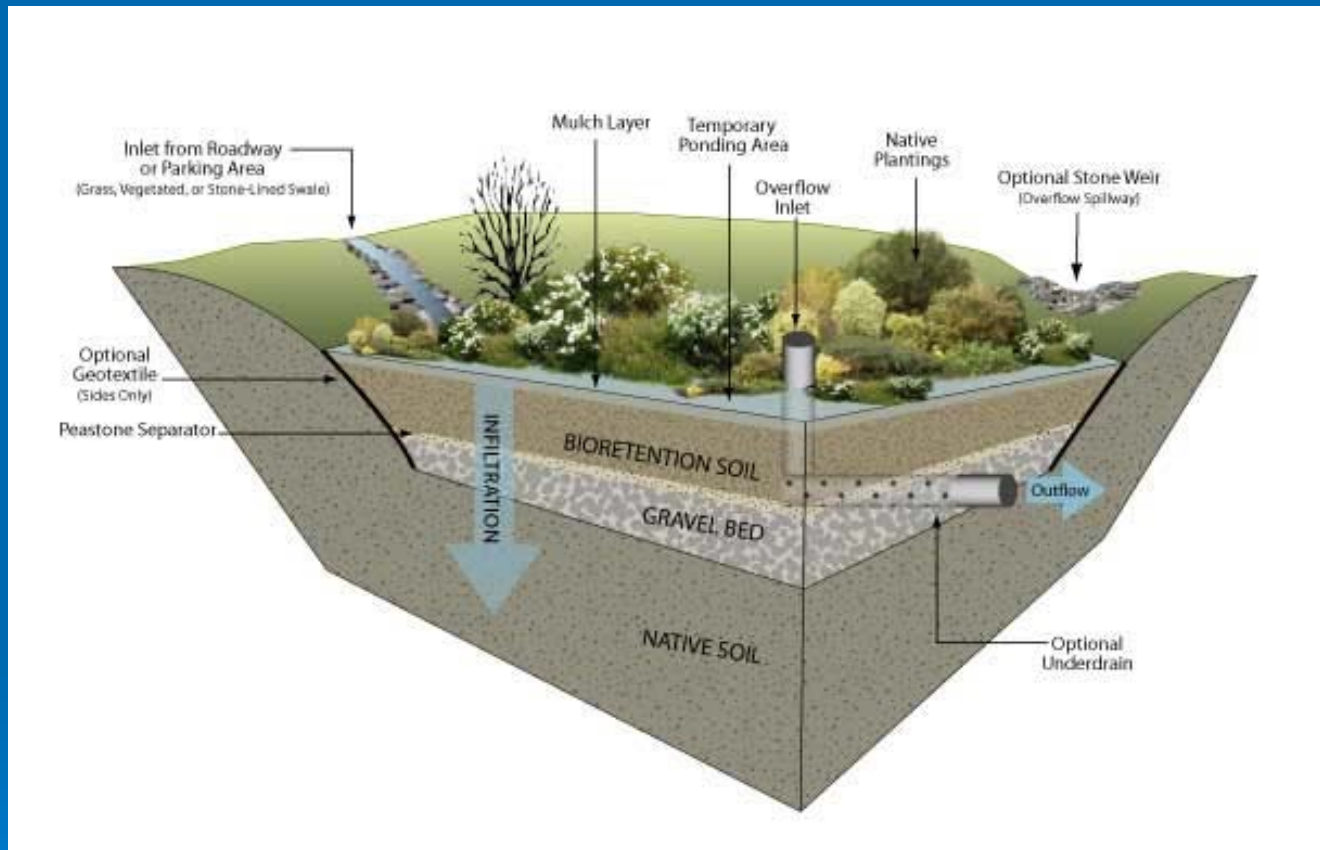


# Bioretention





# Maintain drawdown rate of 1 in/hr





75-85% medium to coarse washed sand & no  
mechanical compaction



**10% fines**



**5-15% organic**

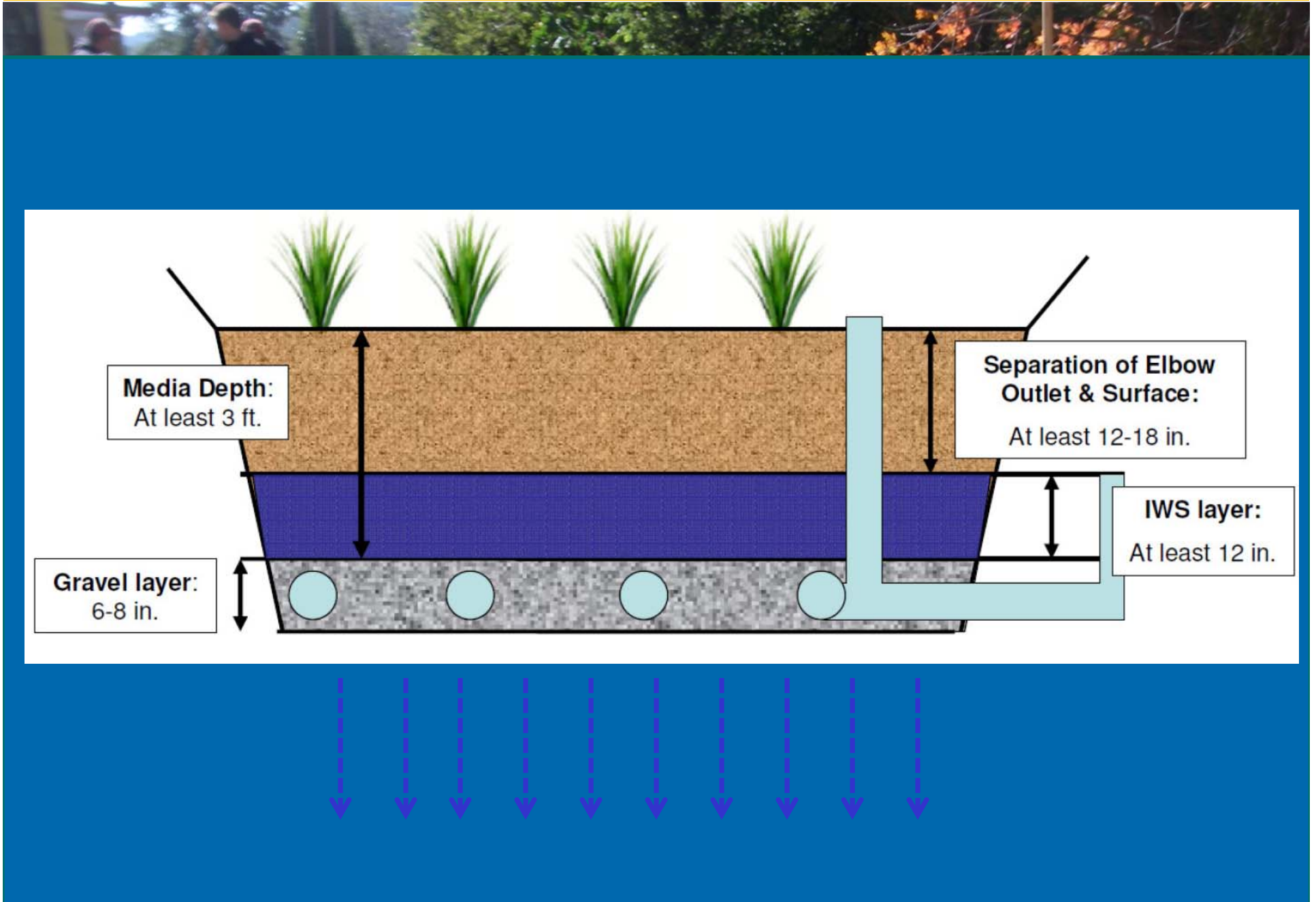


Plant to achieve 50% coverage at 5 years. Sod shall be non-clumping & deep-rooted





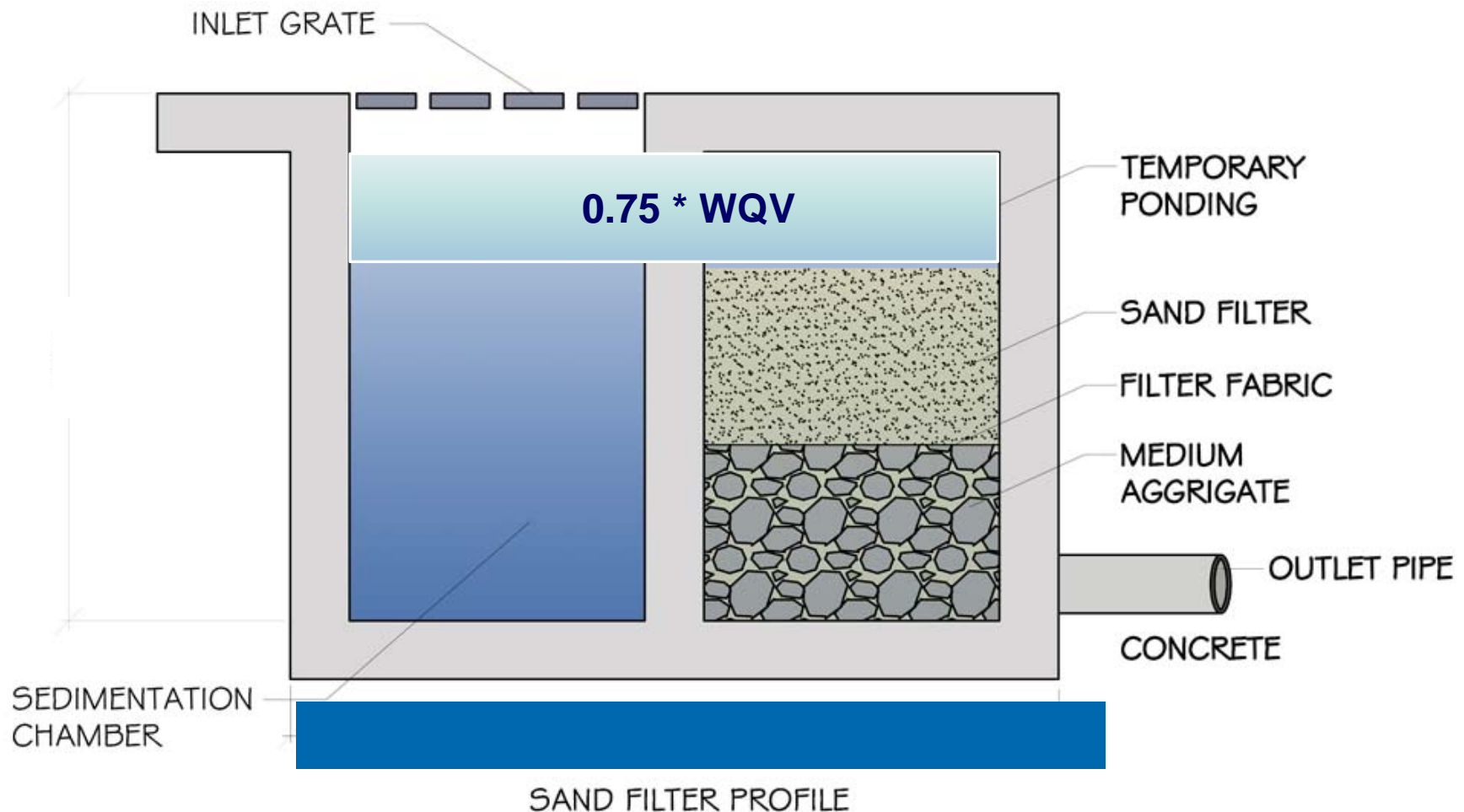
IWS required unless in-situ soil infiltration rate  $> 2$  in/hr



# Sand Filters



Size to store 0.75 x treatment volume above the sediment and sand chambers





Sand media shall meet ASTM C33





Maintain drawdown rate  $\geq 2$  in/hr at the sand surface



# NCDENR Contact for MDC Questions

<http://portal.ncdenr.org/web/lr/state-stormwater/mdc-team>

Annette Lucas, PE  
NCDENR-DEMLR  
Stormwater Program

919-807-6381

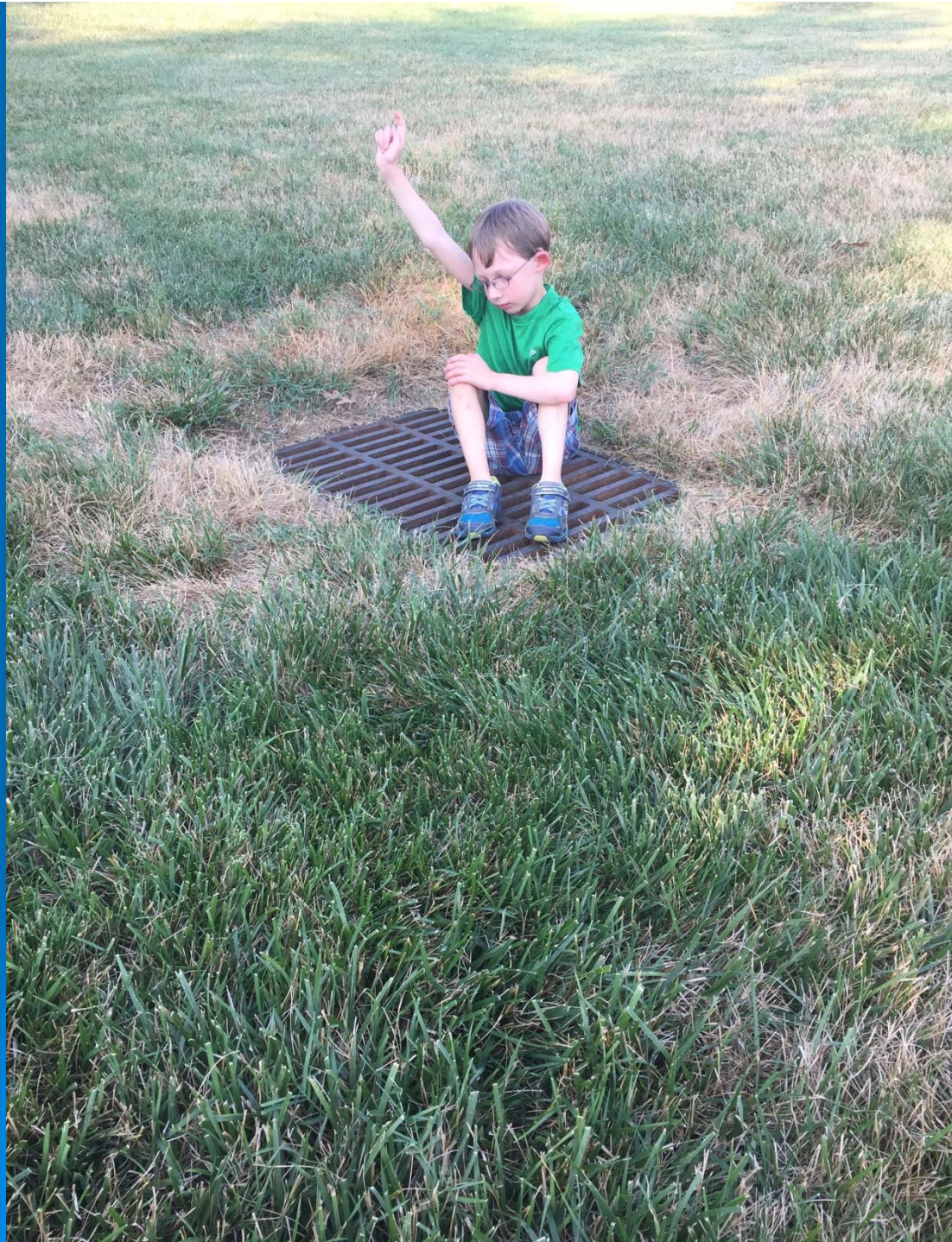
[annette.lucas@ncdenr.gov](mailto:annette.lucas@ncdenr.gov)

# Thank you to the MDC Team!

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Joe Hinton, LSS  
Boyd Devane  
Bradley Bennett  
Linda Lewis





## Possible Rule-Making Schedule

Sep-Dec 2015	DEMLR develops fiscal note
Nov 12, 2015	WQC approves rule text
Jan 14, 2016	EMC approves rule & fiscal note
Jan 15, 2016	OSBM certifies fiscal note
Jan 20, 2016	DEMLR's files rule & fiscal note in Register
Feb 17, 2016	Comment period begins
Apr 17, 2016	Comment period ends
Jul 2016	WQC adopts rule - Do we need this?
Sep 2016	EMC adopts rule