South Carolina

Planning Education Advisory Committee

January 8, 2015

Joe Cronin, Planning Director
Town of Fort Mill
112 Confederate Street
Fort Mill, SC 29715

Susan Britt, Planning Manager
City of Tega Cay

Dear Mr. Cronin and Ms. Britt:

Re: Unified Sizing Criteria for Stormwater Design*: Design Criteria to Encourage LID* – 2015-01

On December 22, 2014 I received the Program Materials you submitted for accreditation of the Continuing Education Course detailed above. Upon receipt of your application, I sent an email to confirm receipt by all Committee members and set a deadline for comments.

Under the "no objection policy" adopted on July 8, 2009, your request is considered approved. Your signed "Notice of Decision" is attached. Formal, after-the-fact approval will be handled as part of a Consent Agenda at the regular quarterly meeting of the Committee, which will is scheduled for January 21, 2015 at 1:30 p.m.

Thank you for your efforts to help make this program a success.

Sincerely,

Stephen G. Riley, CM
Chairman

cc: Phillip Lindler, Cliff Ellis, Dennis Lambries and Wayne Shuler

ONE TOWN CENTER COURT • HILTON HEAD ISLAND, SC • 29928
PHONE: 843-341-4700 • FAX: 843-842-7728
www.scstatehouse.net/SCPEAC/index.htm
Stever@hiltonheadislandsc.gov

South Carolina Planning Education Advisory Committee (SCPEAC)

NOTICE OF DECISION

12. The following action has been taken by the SCPEAC on this application:

ACCEPTED WITHOUT OBJECTION Date: January 8, 2015

REVIEWED BY FULL COMMITTEE Date:

a) ___X___ ACCREDITED for _1.5_ CE credits

b) _____ DENIED ACCREDITATION

i. Reason: _____

c) _____ RETURNED for more information

13. If accredited:

a) Authorized Course No.: 2015-01

b) Date of accreditation: 01-08-2015

Signature of SCPEAC Representative: 

For further information, contact Mr. Stephen Riley, Chairman, 843-341-4701 or stever@hiltonheadislandsc.gov

South Carolina Planning Education Advisory Committee (SCPEAC)

LOCAL OFFICIAL'S CERTIFICATION OF NEED FOR CONTINUING EDUCATION PROGRAM

NOTE: The Planning Director of a jurisdiction, or the COG Director serving a jurisdiction, may certify to the SCPEAC that a particular continuing education program is appropriate to meet the needs of that jurisdiction.

This certification form, together with the required information referenced therein, shall be submitted to the Committee. **If no objections are raised** by a member of the SCPEAC within 10 working days of receipt, the continuing education program shall be considered accepted. If an objection is raised, a teleconference meeting shall be scheduled, with appropriate public notice, as soon as reasonably possible, to review the application.

1. Certifying Official's Information:

a. Name: Joe Cronin

b. Title: Planning Director

c. Jurisdiction for which certification is being made: Town of Fort Mill (Offered jointly w/ City of Tega Cay)

d. Address of Jurisdiction: 112 Confederate Street

e. City: Fort Mill, SC

Zip Code 29715

f. Telephone: 803-547-2116

g. Email: jcronin@fortmillsc.gov

h. For COG Directors:

i. Name of COG:

ii. Address of COG:

iii. City:

Zip Code:

iv. Telephone:

v. Email:

2. Information on Educational Program:

a. Title of Program: Unified Sizing Criteria for Stormwater Design: Design Criteria to Encourage LID

b. Name of Organization that is providing or sponsoring the Program:

i. Organization: Amec Foster Wheeler

ii. Street Address: 720 Gracern Road, Suite 132

iii. City: Columbia

State: SC

Zip Code: 29210

iv. Contact Person: William Lamb

v. Title: Senior Engineer / Project Manager

vi. Telephone: 803-798-1200

vii. Email: william.lamb@amecfw.com

c. Date(s) and Location(s) of Program:

Thursday, January 22, 2015 -- 7:00 pm to 8:30 pm -- The Spratt Building, 215 Main Street, Fort Mill, SC 29715

d. Briefly describe the program and why it is relevant to your jurisdiction:

Brief course on innovative stormwater design methods to encourage Low Impact Development (LID)

3. Method of presentation (check all that apply. All sessions must have a Coordinator present):

a. Presentor(s) in room with participants ☒

b. Live presentation via close circuit TV, video conferencing, or similar; Coordinator present ☐

c. Videotape or CD/DVD presentation; Facilitator present ☐

d. Webinar or similar; Coordinator present ☐

e. Other (describe)

4. Description of materials to be distributed (check/fill in all that apply):

a. Powerpoint handout:	☒	number of slides: 53
b. Other handouts:	☐	total pages:

c. CD/DVD: ☐

d. Other (describe)

e. None: ☐

5. When are materials distributed?

a. Sent before the program: ☐

b. Handed out at the program: ☒

c. Other (describe)

6. Required attachments (5 copies distributed as described below):

a. Course description and outline including estimated time per section

b. Brochure, if available

c. Course Presenter(s) and credentials (include brief resumes and qualifications)

d. Copies of all handouts and course materials

e. Evaluation Form and method of evaluation (each program must be evaluated)

7. Instruction Time:

a. Indicate the total minutes of instruction time: 1 hour and 30 minutes

Note: Breaks, meals and introductions should not be counted. A reasonable period of Q and A should be included and counted.

8. Local contact person (if other than Certifying Official):

a. Name: Same as Certifying Official

b. Title: For City of Tega Cay, contact Susan Britt, Planning Manager, at 803-548-3513 or sbritt@tegacaysc.gov

c. Jurisdiction: _____

d. Telephone: _____

e. Email: _____

9. Certification. By Submitting this application, the applicant agrees to:

a. Allow in-person observation, without charge, of the Program by the SCPEAC Committee members. Any food, travel or lodging costs will be the responsibility of the Committee member(s).

b. The Certifying Official acknowledges that its approval for this Program may be withdrawn for violations of the regulations or failure to comply with the agreements and representations contained herein and as may be required by the SCPEAC.

c. I do hereby certify that this program satisfies the current continuing education needs of this community.

i. Name: Joe Cronin

ii . Title: Planning Director

iii. Signature: _____

iv. Date: December 19, 2014

Application and all Materials may be submitted in one of the following means:

1. Electronic submission to each ofthe committee members listed below via email; or
2. Hardcopy via U. S. Mail, 1 copy each to each committee member; or
3. Electronic submission of the application via email to all committee members, and submit hardcopy supporting materials via U.S. Mail to each member, if materials not available electronically.
4. Please cc all applications to the Chairman's assistant, Vicki Pfannenschmidt at vickip@hiltonheadislandsc.gov

To access committee members email and postal addresses visit the link below:
http://www.scstatehouse.gov/scpeac/members.htm

Unified Sizing Criteria for Stormwater Design: Design Criteria to Encourage Low Impact Development in SC

William Lamb, PE

Presentation Outline

- The Need for Stormwater Management
- Current SC Stormwater Design Standards
- Unified Sizing Criteria Framework (USC)
- Example Project
- Benefits of USC

The Need for Stormwater Management

The Need for Stormwater Management

1. Changes in Stream Flow

- Disruption of natural water balance
- Increased flood peaks
- Increased stormwater runoff volume
- More frequent bankfull flows
- Lower base flow during dry weather

The Need for Stormwater Management

2. Changes in Stream Morphology

- Stream widening & down-cutting
- Fragmentation of riparian tree canopy
- Decreased streambed quality
- Degradation of habitat structure
- Decreased channel stability

The Need for Stormwater Management

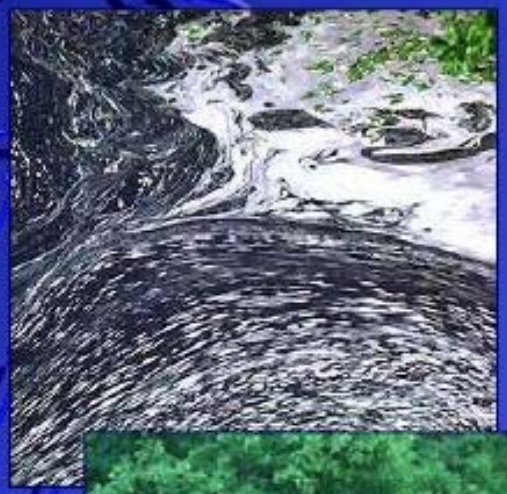
3. Changes to Aquatic Habitat

- Decline in habitat value of streams
- Loss pool-riffle sequence
- Reduced baseflow
- Increased temperature
- Decline in abundance and biodiversity

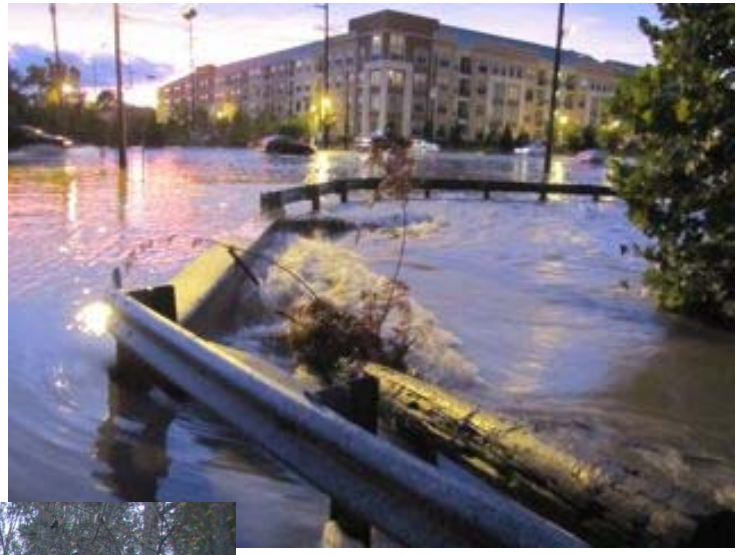
The Need for Stormwater Management

4. Changes to Water Quality

- Reduced oxygen
- Nutrient enrichment
- Microbial contamination
- Oil, grease and hydrocarbons
- Toxic substances
- Sediment
- Trash and debris

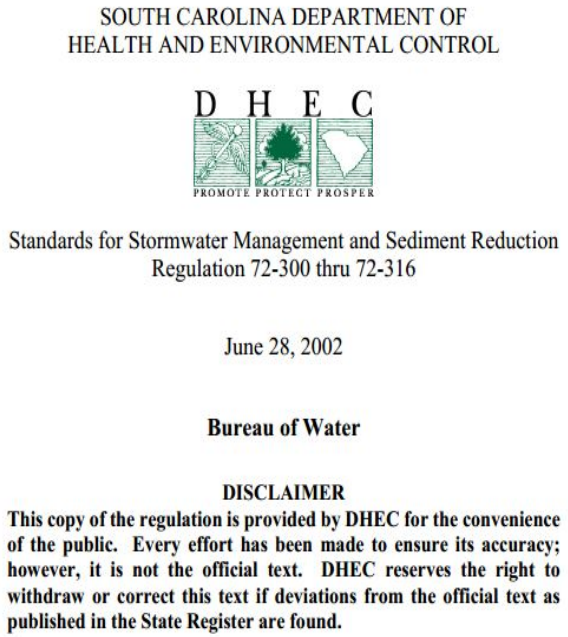


The Need for Stormwater Management



Current SC Stormwater Design Regulations
(Standards for Stormwater Management and Sediment Reduction Regulation 72-300 thru 72-316)

- General Water Quantity Control
  - Post-development peak runoff rate ≤ Pre-development peak runoff rate for 2 yr and 10 yr, 24 hr storm event. Implementing agencies may require less frequent storm event (e.g. 25 yr, 24 hr)
  - Non-erosive velocities at discharges
- General Water Quality Control
  - Stormwater runoff to a single outlet from land disturbance ≥ 10 acres to have sediment basin with 80% removal efficiency or 0.5 ML/L settable solids
  - Wet ponds to store and release first ½" of runoff over at least 24 hours
  - Dry ponds to store and release first 1" of runoff over at least 24 hours
  - Infiltration practices to accept first 1" of runoff



SOUTH CAROLINA DEPARTMENT OF
HEALTH AND ENVIRONMENTAL CONTROL

D H E C

PROMOTE PROTECT PROSPER

Standards for Stormwater Management and Sediment Reduction
Regulation 72-300 thru 72-316

June 28, 2002

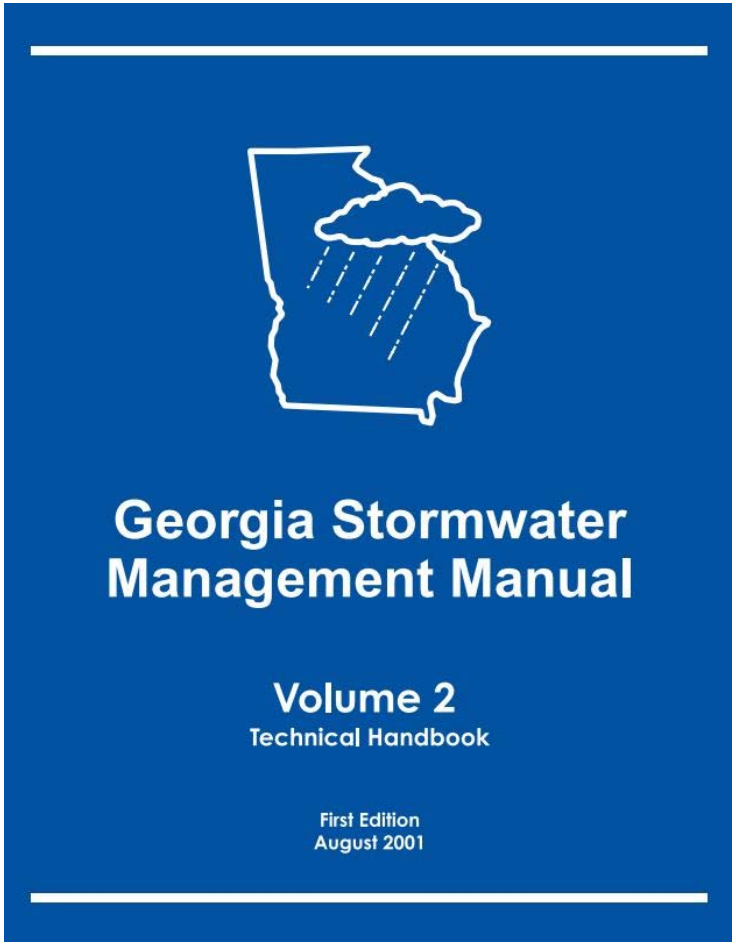
Bureau of Water

DISCLAIMER

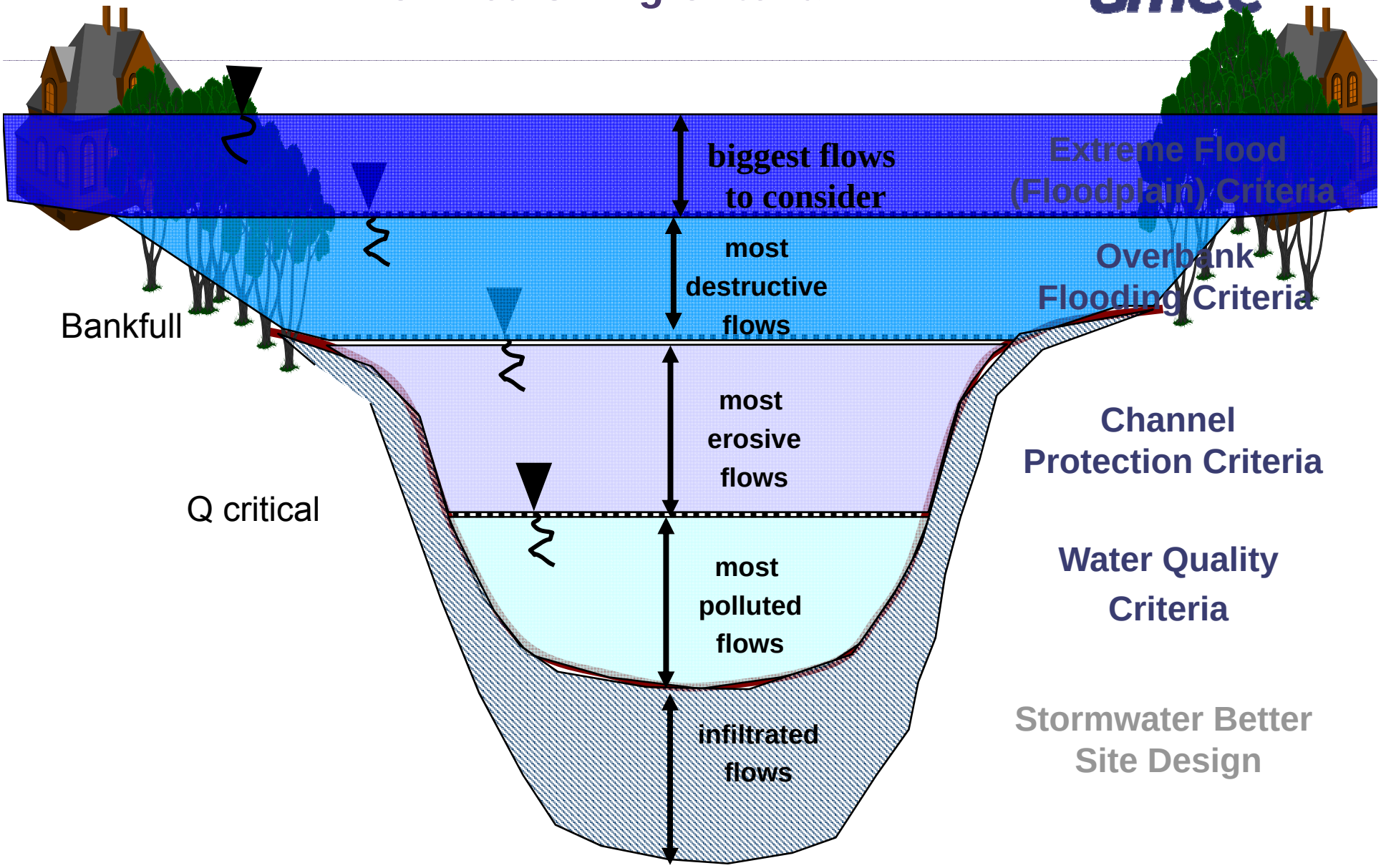
This copy of the regulation is provided by DHEC for the convenience of the public. Every effort has been made to ensure its accuracy; however, it is not the official text. DHEC reserves the right to withdraw or correct this text if deviations from the official text as published in the State Register are found.

Unified Sizing Criteria

- Currently adopted by Georgia, Maryland, New York, and others
- Completely different framework from current regs:
  - Water Quality Volume (WQ_V)
  - Channel Protection Volume (CP_V)
  - Overbank Flood Protection
  - Extreme Flood Protection
  - Credit System

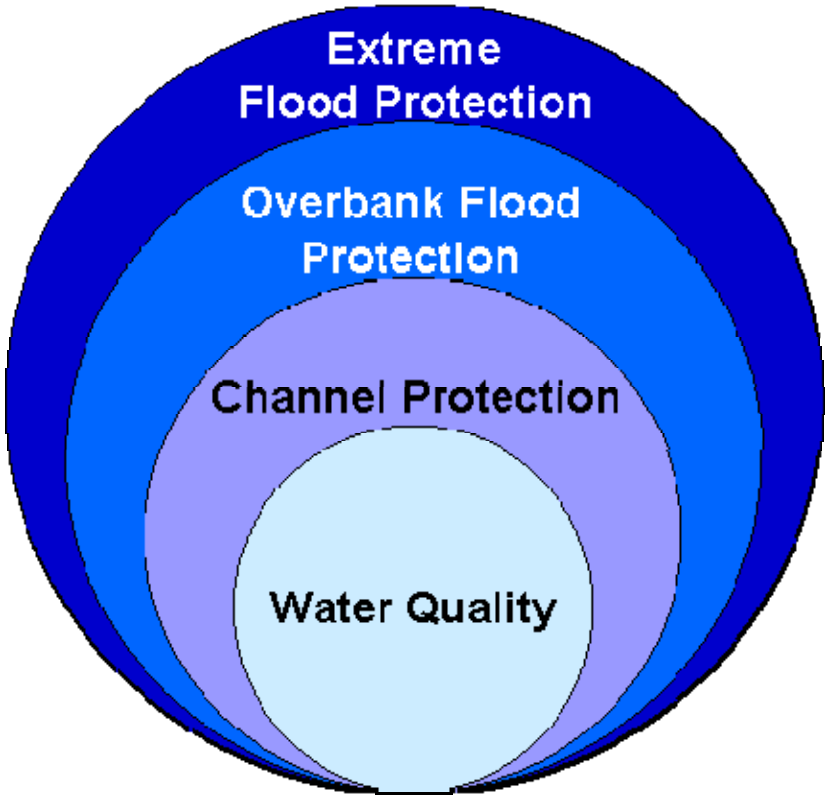


Unified Sizing Criteria



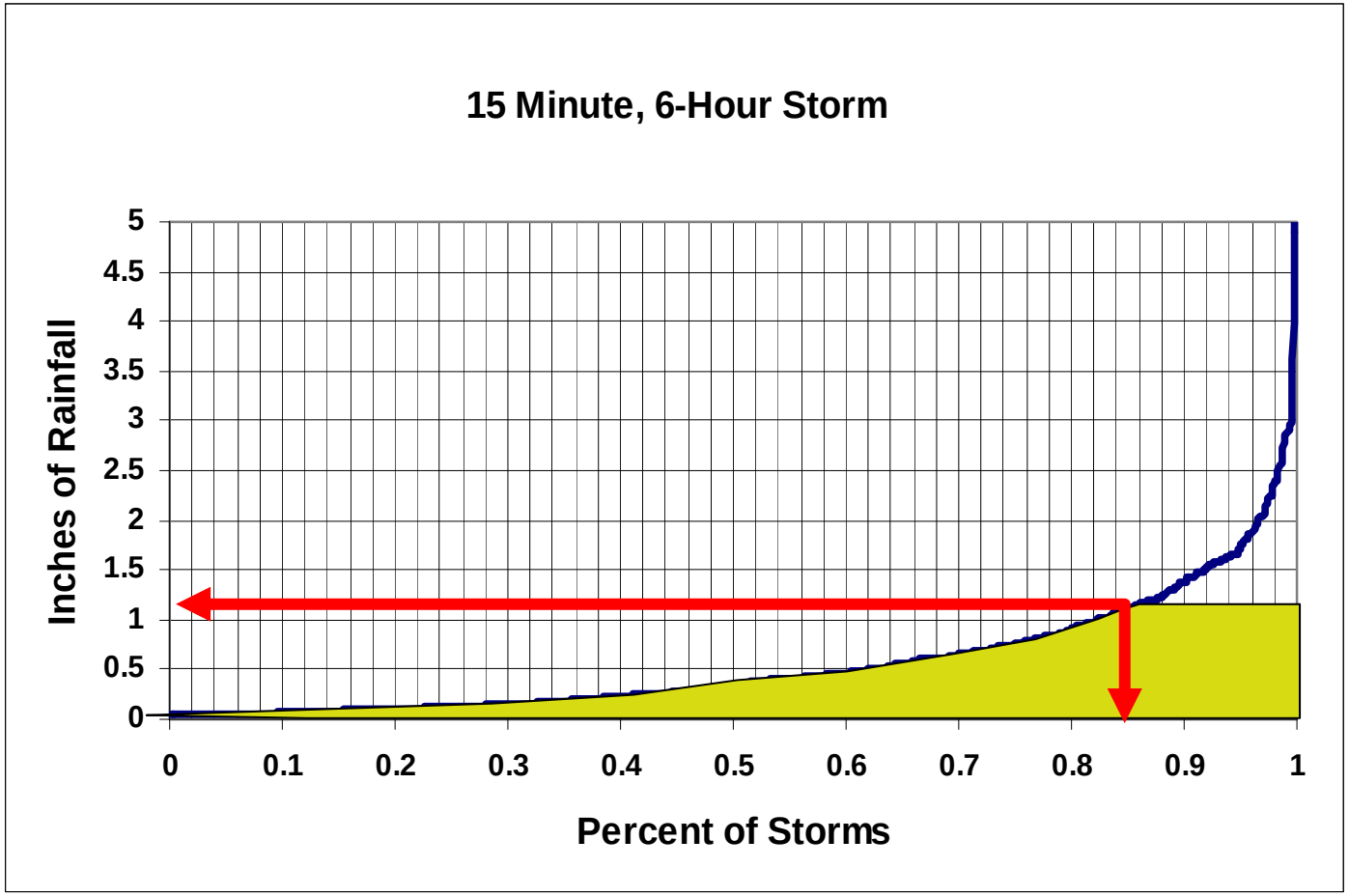
Unified Sizing Criteria

- NEW! Water Quality: Capture & treat runoff from first 1.2 inches of rainfall
- NEW! Channel Protection: Provide extended detention of 1-yr, 24-hr storm over 24 hours
- Overbank Flood Protection: Provide peak flow attenuation of 2-yr, 10-yr, (25-yr for sites over 40 acres) 24-hr storm
- Extreme Flood Protection: Manage 100-yr storm through detention or floodplain mgmt



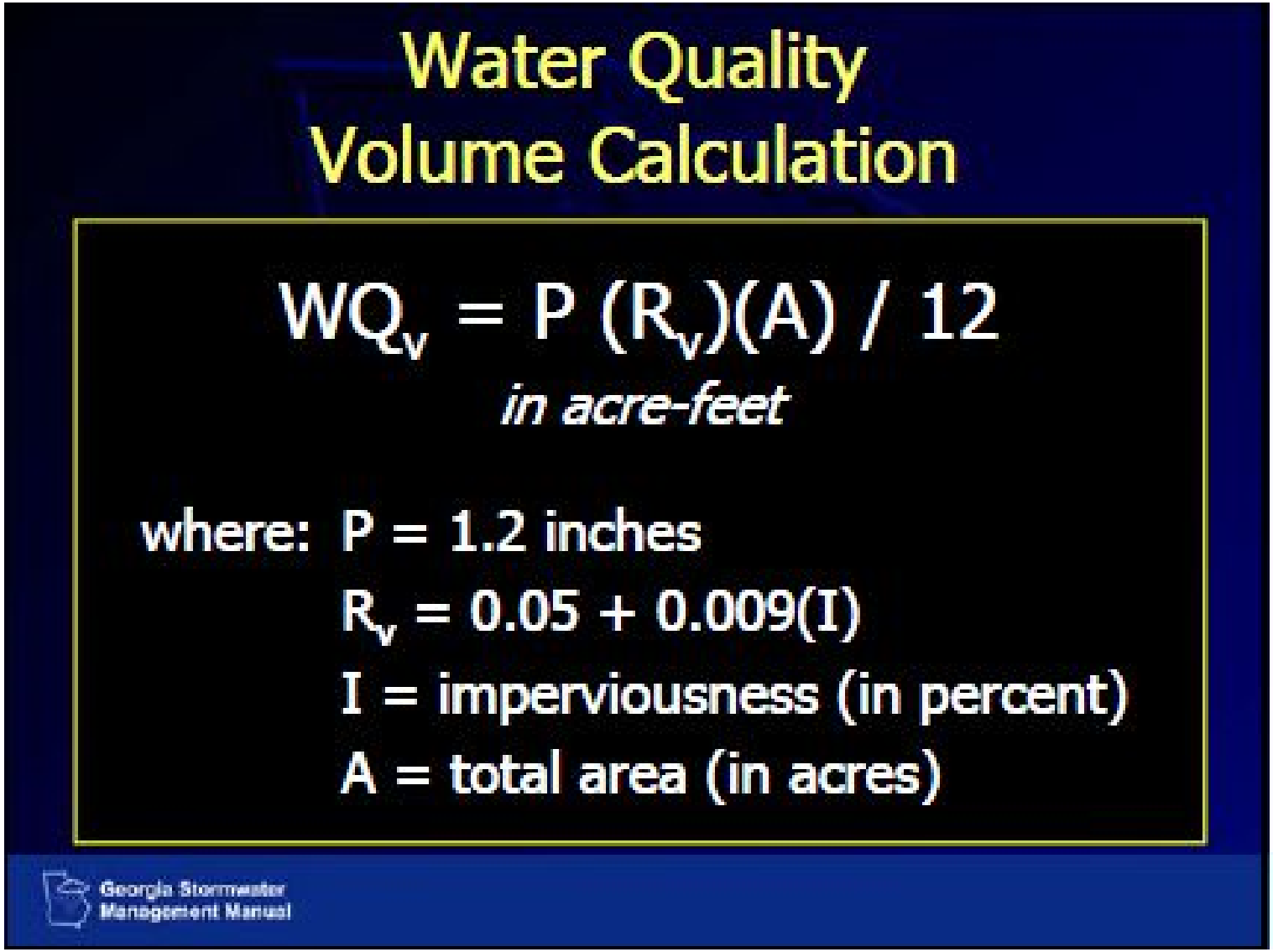
Unified Sizing Criteria

- Water Quality: capture and treat runoff from 85th percentile storm ~ 1.2” of rain



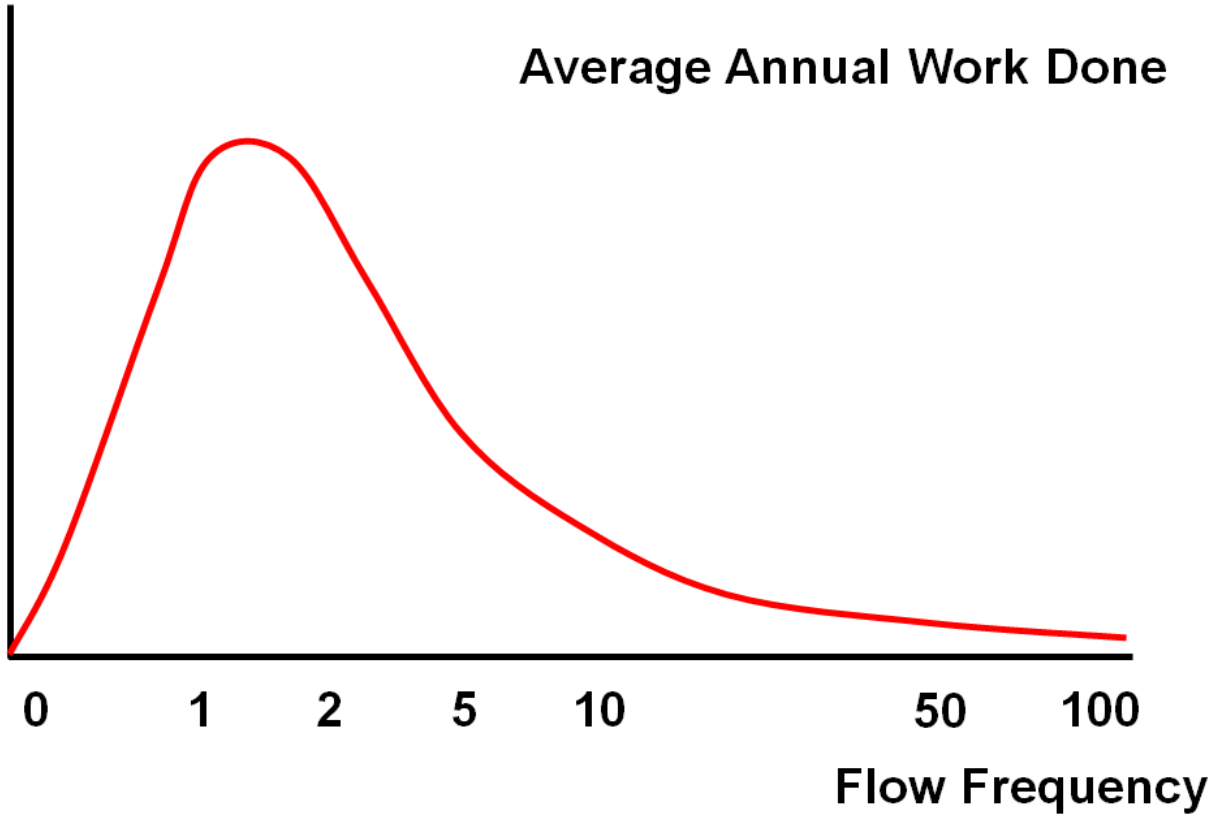
Water Quality

Water Quality Volume (WQ_V)



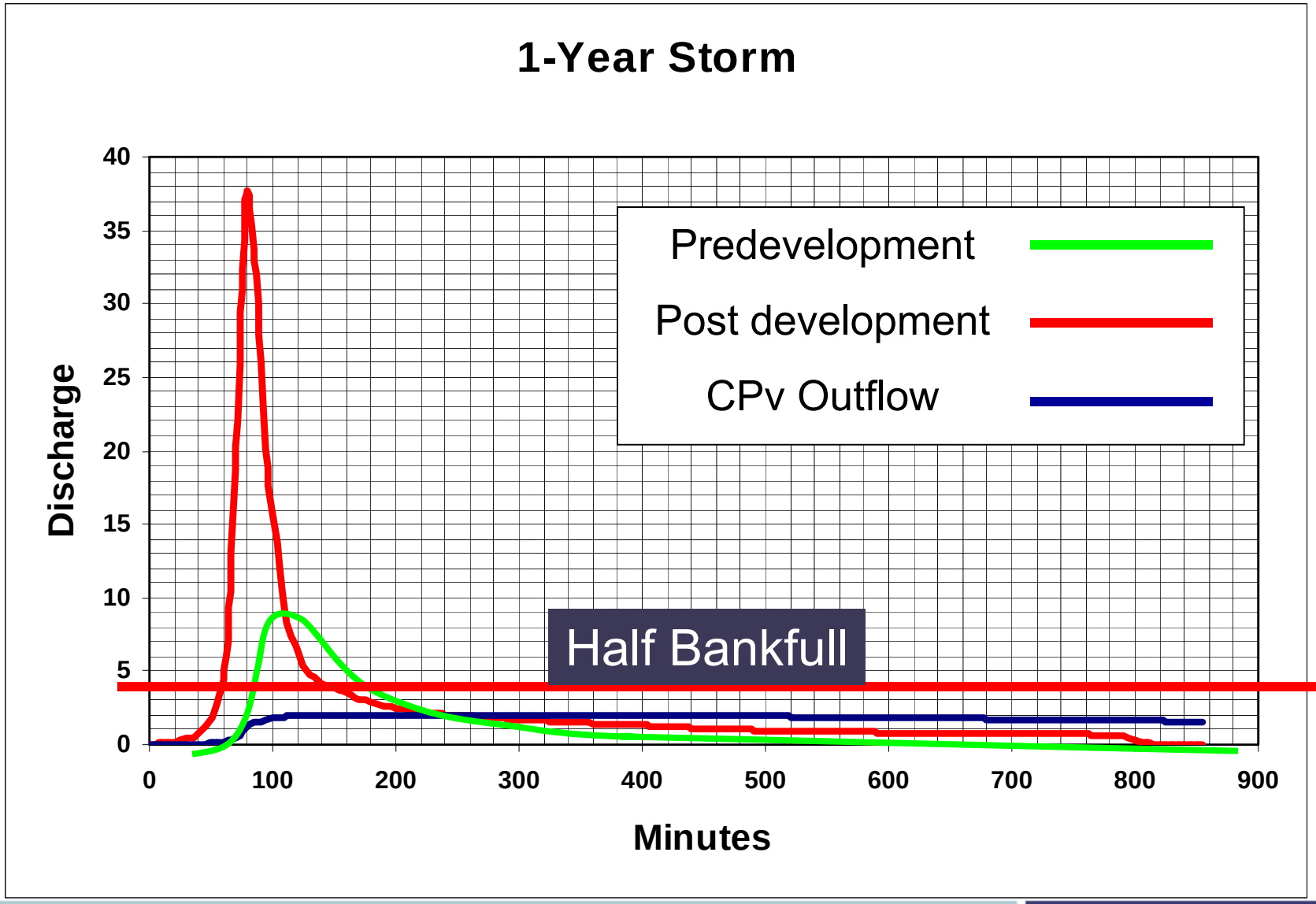
Unified Sizing Criteria

- Channel Protection: provide extended detention of 1-year storm over 24 hours to protect stream channels from erosive velocities

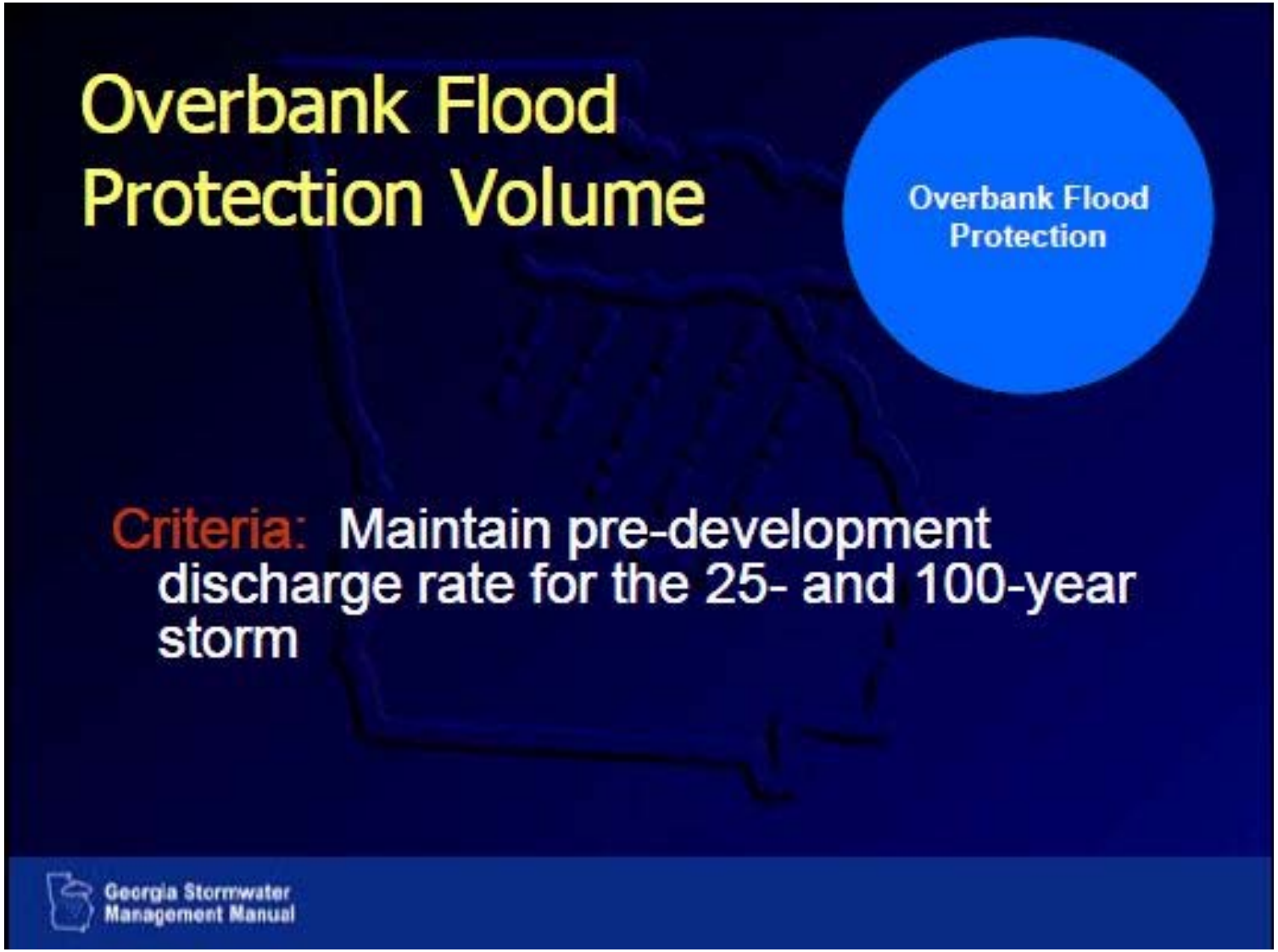


Channel Protection

Less Bank-full Flow…



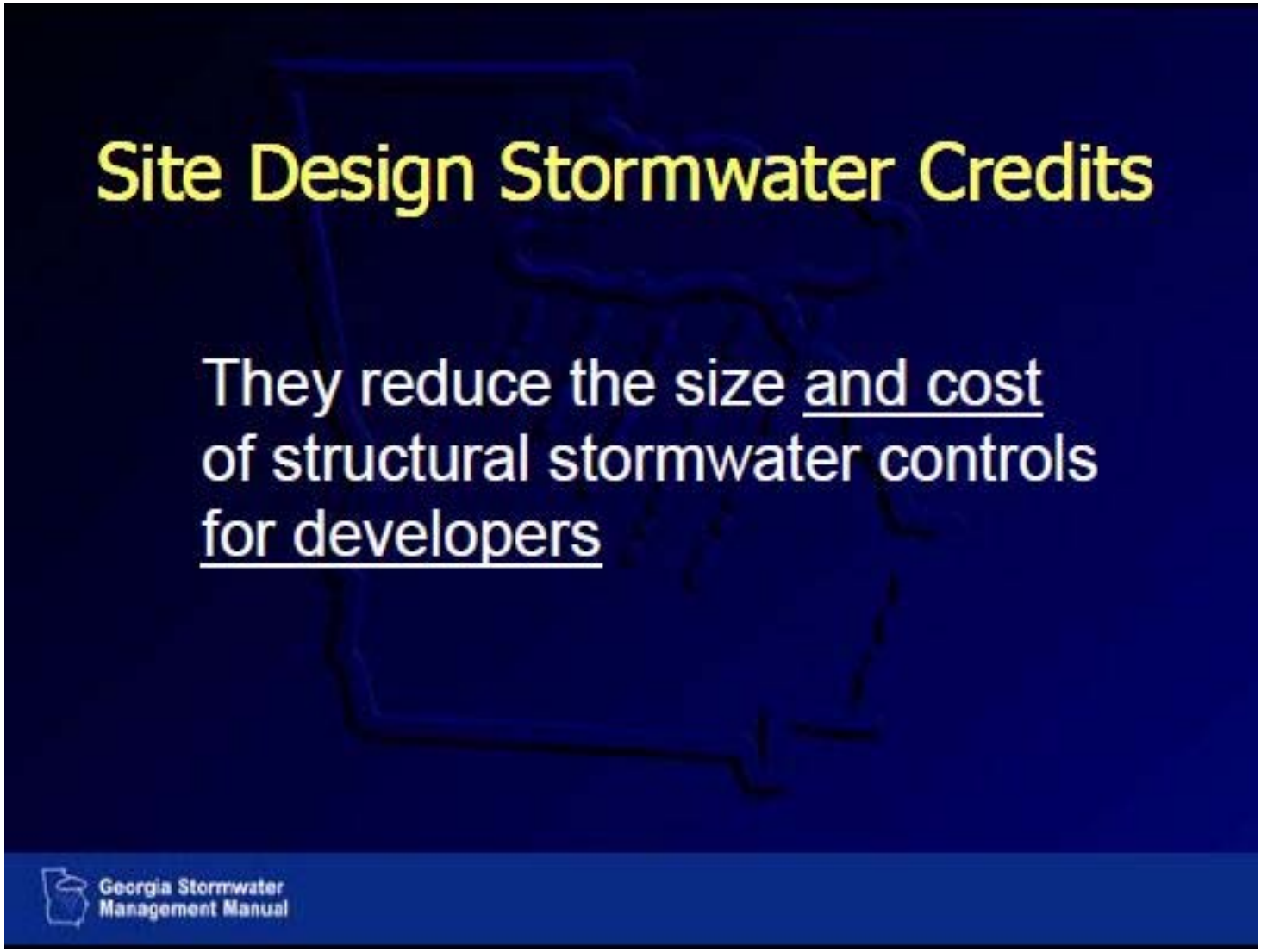
Overbank/Extreme Flood Protection



Stormwater Better Site Design

Stormwater Better Site Design

Stormwater Site Design Credits



Stormwater Site Design Credits

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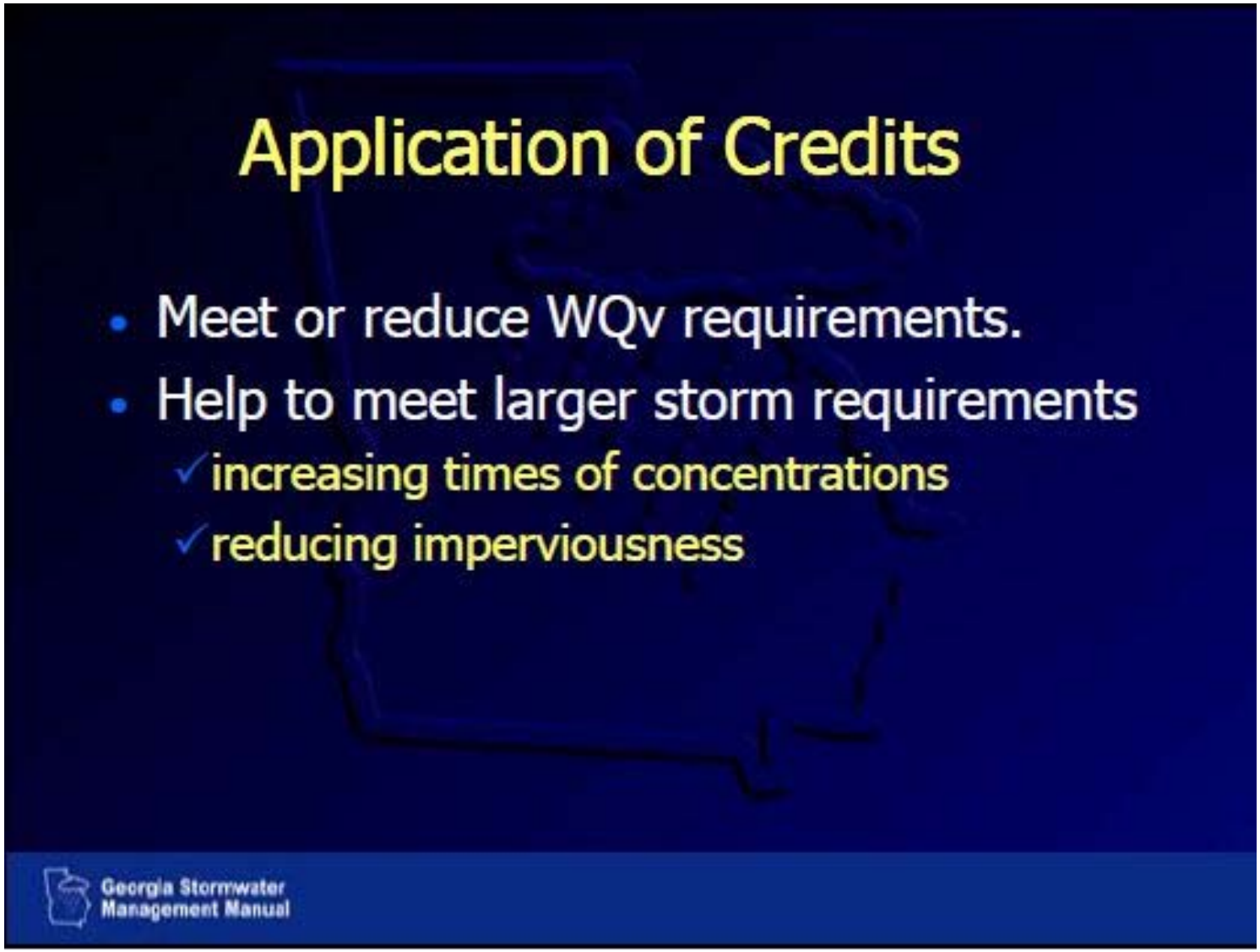
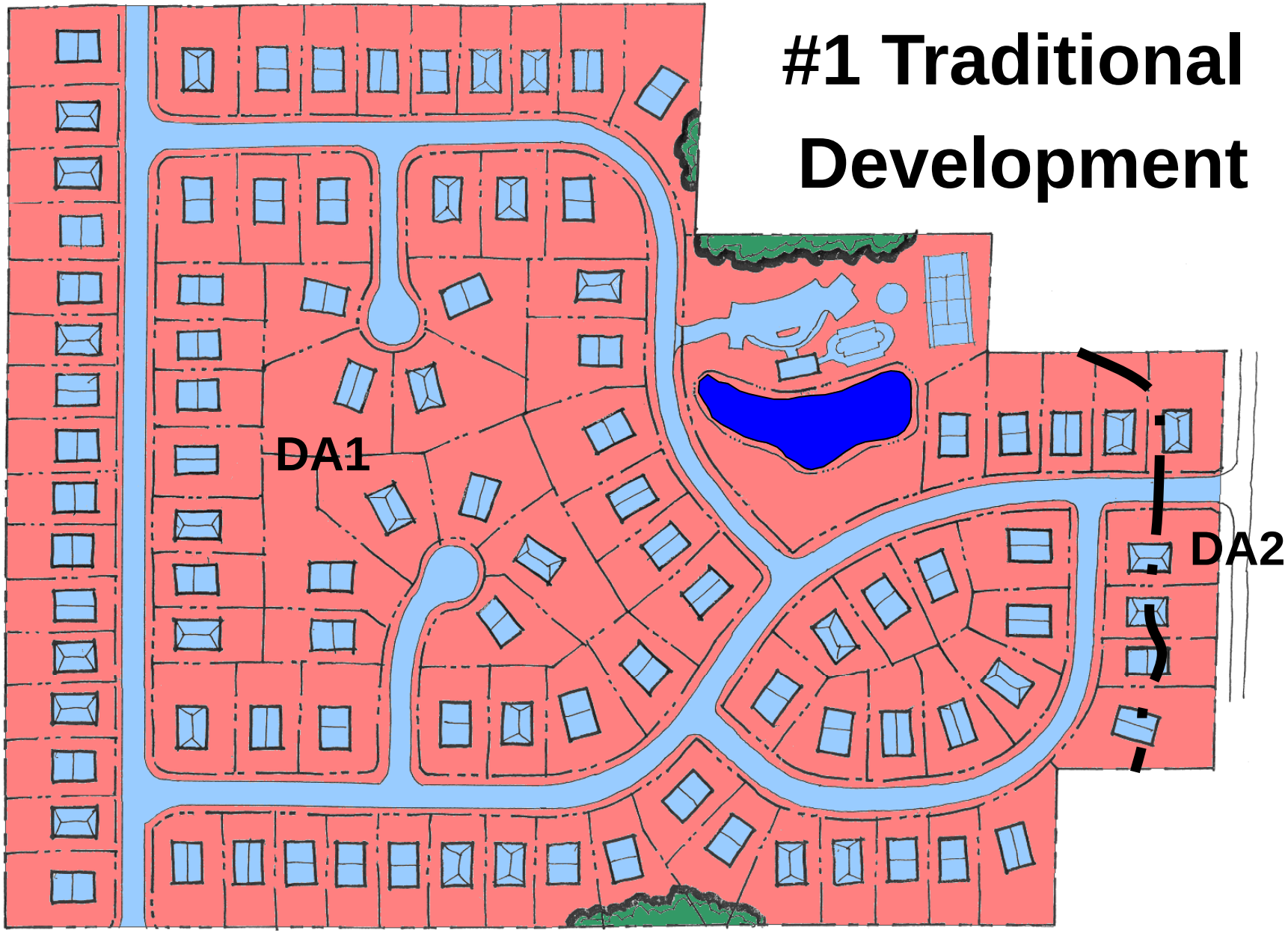


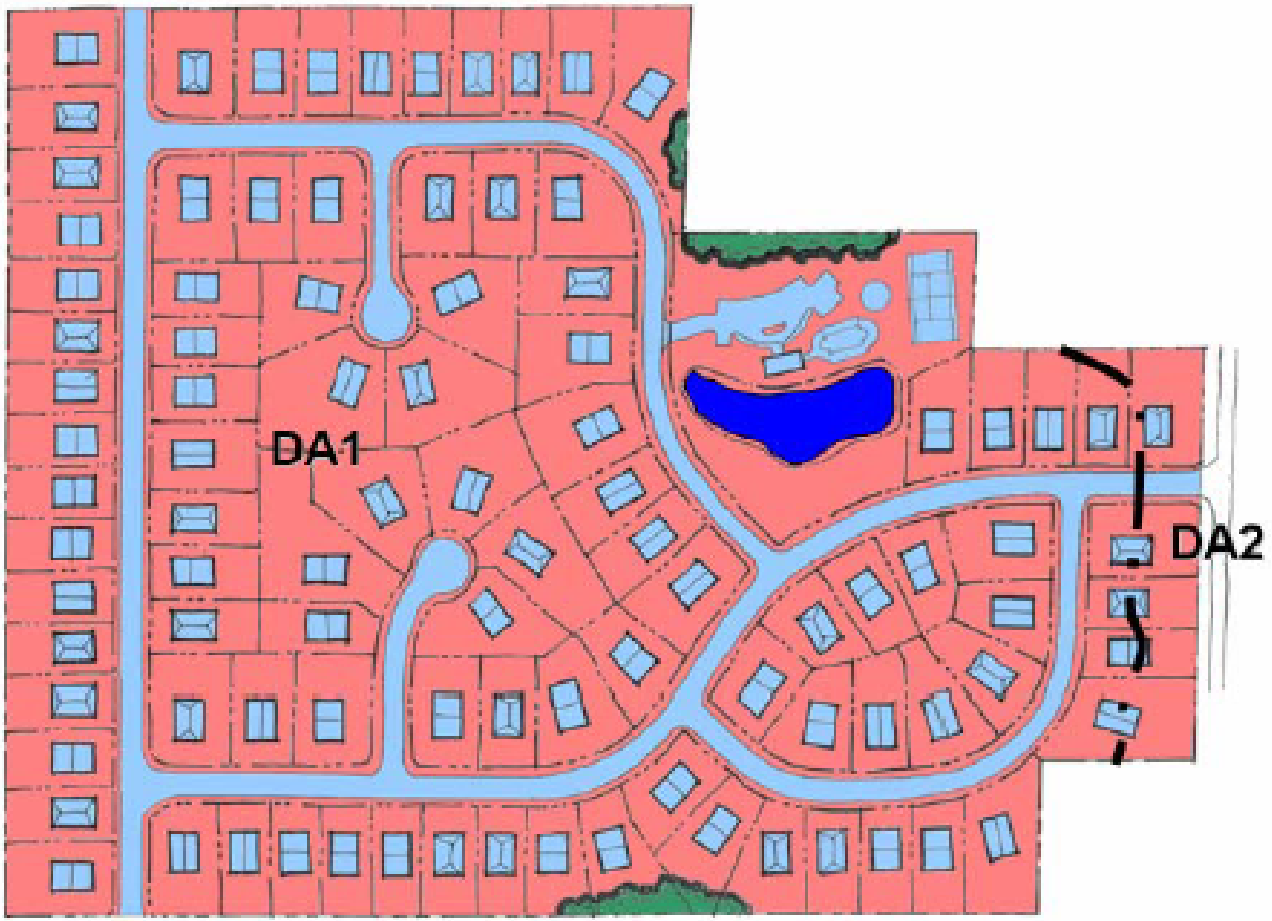
Example Project!

#1 Traditional Development



RESIDENTIAL SUBDIVISION -- CONVENTIONAL DESIGN

Description: A medium-density residential subdivision designed with a conventional layout. The proposed site design has 96 single-family lots along with an amenity area, which includes the clubhouse, pool and tennis court. The entire site will be cleared and mass-graded.



RESIDENTIAL SUBDIVISION -- CONVENTIONAL DESIGN

Planned Site Design:

Total Size = 83.41 acres

Number of Lots = 96

Total Impervious Cover = 20.75 acres

- Rooftops/Driveways/Decks = 10.33 acres
- Streets (1.10 linear miles – 34’ width) = 9.00 acres
- Amenity Area (Clubhouse, Pool, Tennis Court, Parking) = 1.42 acres

Percent Impervious Cover = 25%

Natural Conservation Area = 1.16 acres

Drainage Area 1 (DA1) = 80.60 acres

Impervious Area = 20.52 acres

Percent Impervious Cover = 25.5%

Natural Conservation Area = 1.16 acres

Structural Control: Stormwater Pond

Drainage Area 2 (DA2) = 2.81 acres

Impervious Area = 0.23 acres

Percent Impervious Cover = 8.2%

Natural Conservation Area = 0

Structural Control: None

Volume Calculation Tool:

Volume Calculation Executive Summary

Project Name: Residential Example: #1 Standard
Project Number: -
Date: 7/24/2013
Site Location: City of Columbia, SC
Drainage Area: DA1

data input cells

Site Hydrology

	Drainage Area [ac]	Imperv. Area [ac]	CN	tc [min]
Pre-Development	80.6	0	74	73.1
Post-Development	80.6	20.52	84	53.7

	Qpw [cfs]	1yr [cfs]	2yr [cfs]	10yr [cfs]	25yr [cfs]	100yr [cfs]
Pre-Development	N/A	41.1	52.1	116.7	140.1	192.3
Post-Development		87.5	101.5	188.6	220.2	288.9

	WQv [cf]	CPv [cf]	2yr [cf]	10yr [cf]	25yr [cf]	100yr [cf]
Pre-Development	-	-	-	-	-	-
Post-Development	98,001	328,744	167,369	268,886	306,240	385,564

Better Site Design

Credited Practice	Area Draining to BMP [acres]	WQv Credit [cf]
Natural Area Conservation	1.16	1,411
Stream Buffer		-
Vegetated Channel		-
Overland Flow Filtration/Infiltration Zones		-
Environmentally Sensitive Large Lot		-
Total WQv stored with BSD practices [cf]		1,411

Applicable BSD Credits to Adjust Site's CN:		
Conservation Areas	1,411	cf
Stream Buffers	-	cf
Infiltration Zones	-	cf
Adjustment to Runoff Reduction Volume (BSD)	1,411	cf
Adjusted CN'_{post}	84	

* Adjusted CN'_{post} is based off runoff reduction from the 100-yr event (most conservative)

Pre vs. Post Drainage Area Summary

	Drainage Area [ac]	Imperv. Area [ac]	CN	tc [min]
Post-Development	80.6	20.52	84	53.7
Post-Dev. with BSD	80.6	20.52	84	53.7

Pre vs. Post Peak Flow Summary

	Qpw [cfs]	1yr [cfs]	2yr [cfs]	10yr [cfs]	25yr [cfs]	100yr [cfs]
Post-Development	N/A	87.5	101.5	188.6	220.2	288.9
Post-Dev. with BSD		87.5	101.5	188.6	220.2	288.9

Pre vs. Post Volume Summary

	WQv [cf]	CPv [cf]	2yr [cf]	10yr [cf]	25yr [cf]	100yr [cf]
Post-Development	98,001	328,744	167,369	268,886	306,240	385,564
Post-Dev. with BSD	96,590	328,744	167,369	268,886	306,240	385,564
% Reduction with BSD	1.44	-	-	-	-	-

Page 1

Volume Calculation Executive Summary

Structural BMPs

Credited Practices in CoC BMP Manual	WQv Credit [cf]
Bioretention Area	
Infiltration Trench	
Grass Filter Strip	
Dry Swale	
Pervious Surfaces	

***Retrieve WQ Volumes from BMP Design Aid Worksheets*

Credited Practices for Other Accepted Structural BMPs	WQv Credit [cf]
Wetlands	
Wet Swale	
Gravity Separator	
Commercial SW Controls	
Multi-Purpose Detention Area	
Underground Detention	
Rain Garden/Cistern	

***Provide Supporting Calculations for WQ Volumes*

Total WQv stored with BMPs [cf]	-

Applicable BSD Credits to Adjust Site's CN:		
Conservation Areas	1,411	cf
Stream Buffers	-	cf
Infiltration Zones	-	cf

Applicable BMP Credits to Adjust Site's CN:		
Bioretention	-	cf
Infiltration Trench	-	cf
Porous Surfaces	-	cf
Dry Swale	-	cf
Rain Garden/Cistern	-	cf
Runoff Reduction Vol. Adjustment (BSD + BMP)	1,411	cf
Adjusted CN''_{post}	84	

* Adjusted CN''_{post} is based off runoff reduction from the 100-yr event (most conservative)

Pre vs. Post Drainage Area Summary

	Total Drainage Area [acres]	Imperv. Area [acres]	CN	tc [min]
Post-Development	80.6	20.52	84	53.7
Post-Dev. with BSD	80.6	20.52	84	53.7
Post-Dev. with BSD & BMPs	80.6	20.52	84	53.7

Pre vs. Post Peak Flow Summary

	Qpw [cfs]	1yr [cfs]	2yr [cfs]	10yr [cfs]	25yr [cfs]	100yr [cfs]
Post-Development	N/A	87.5	101.5	188.6	220.2	288.9
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Post-Dev. with BSD & BMPs		87.5	101.5	188.6	220.2	288.9

Pre vs. Post Volume Summary

	WQv [cf]	CPv [cf]	2yr [cf]	10yr [cf]	25yr [cf]	100yr [cf]
Post-Development	98,001	328,744	167,369	268,886	306,240	385,564
Post-Dev. with BSD	96,590	328,744	167,369	268,886	306,240	385,564
Post-Dev. with BSD & BMPs	96,590	328,744	167,369	268,886	306,240	385,564
% Reduction w. BSD & BMPs	1.44	-	-	-	-	-

Page 2

#1 Standard ‘DA1’

Project Name:	Residential Example: #1 Standard
Project Number:	-
Date:	7/24/2013
Site Location:	City of Columbia, SC
Drainage Area:	DA1

data input cells

Site Hydrology

	Drainage Area [ac]	Imperv. Area [ac]	CN	tc [min]
Pre-Development	80.6	0	74	73.1
Post-Development	80.6	20.52	84	53.7

	Qpw [cfs]	1yr [cfs]	2yr [cfs]	10yr	25yr [cfs]	100yr
Pre-Development	N/A	41.1	52.1	116.7	140.1	192.3
Post-Development		87.5	101.5	188.6	220.2	288.9

	WQv [cf]	CPv [cf]	2yr [cf]	10yr [cf]	25yr [cf]	100yr [cf]
Pre-Development	-	-	-	-	-	-
Post-Development	98,001	328,744	167,369	268,886	306,240	385,564

Better Site Design

Credited Practice	Area Draining to BMP [acres]	WQv Credit [cf]
Natural Area Conservation	1.16	1,411
Stream Buffer		-
Vegetated Channel		-
Overland Flow Filtration/Infiltration Zones		-
Environmentally Sensitive Large Lot		-
Total WQv stored with BSD practices [cf]		1,411

Applicable BSD Credits to Adjust Site's CN:		
Conservation Areas	1,411	cf
Stream Buffers	-	cf
Infiltration Zones	-	cf
Adjustment to Runoff Reduction Volume (BSD)	1,411	cf
Adjusted CN'_{post}	84	

* Adjusted CN'post is based off runoff reduction from the 100-yr event (most conservative)

Pre vs. Post Drainage Area Summary

	Drainage Area [ac]	Imperv. Area [ac]	CN	tc [min]
Post-Development	80.6	20.52	84	53.7
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Pre vs. Post Peak Flow Summary

	Qpw [cfs]	1yr [cfs]	2yr [cfs]	10yr	25yr [cfs]	100yr
Post-Development	N/A	87.5	101.5	188.6	220.2	288.9
Post-Dev. with BSD		87.5	101.5	188.6	220.2	288.9

Pre vs. Post Volume Summary

	WQv [cf]	CPv [cf]	2yr [cf]	10yr [cf]	25yr [cf]	100yr [cf]
Post-Development	98,001	328,744	167,369	268,886	306,240	385,564
Post-Dev. with BSD	96,590	328,744	167,369	268,886	306,240	385,564
% Reduction with BSD	1.44	-	-	-	-	-

Instructions | Input_Output | Pre | Post | BSD_Credits | BSD_Credits (format 2) | Post_BS

Input Pre-Development parameters

Input Post-Development parameters

Input DA1’s Natural Conservation Area

Not enough infiltration from cons. area to change site’s CN

Summary of Pre Dev vs. Post Dev with BSD:

- Peak Flows
- Storage Volumes

% Volume Reduction Utilizing BSD Practices:

	WQv	CPv	2yr	10yr	25yr	100yr
% Red. w. BSD	1.44	-	-	-	-	-

#1 Standard ‘DA2’

Project Name:	Residential Example: #1 Standard
Project Number:	-
Date:	7/24/2013
Site Location:	City of Columbia, SC
Drainage Area:	DA2

Site Hydrology (data input cells)

	Drainage Area [ac]	Imperv. Area [ac]	CN	tc [min]
Pre-Development	2.81	0	74	32.1
Post-Development	2.81	0.23	81	26.0

	Qpw [cfs]	1yr [cfs]	2yr [cfs]	10yr	25yr [cfs]	100yr
Pre-Development	N/A	2.3	3.0	6.6	7.9	10.8
Post-Development		4.0	4.7	9.0	10.6	14.1

	WQv [cf]	CPv [cf]	2yr [cf]	10yr [cf]	25yr [cf]	100yr [cf]
Pre-Development	-	-	-	-	-	-
Post-Development	1,513	10,435	4,402	7,346	8,435	10,749

Better Site Design

Credited Practice	Area Draining to BMP [acres]	WQv Credit [cf]
Natural Area Conservation		-
Stream Buffer		-
Vegetated Channel		-
Overland Flow Filtration/Infiltration Zones		-
Environmentally Sensitive Large Lot		-
Total WQv stored with BSD practices [cf]		-

Applicable BSD Credits to Adjust Site's CN:		
Conservation Areas	-	cf
Stream Buffers	-	cf
Infiltration Zones	-	cf
Adjustment to Runoff Reduction Volume (BSD)	-	cf
Adjusted CN'_{post}	81	

* Adjusted CN'post is based off runoff reduction from the 100-yr event (most conservative)

Pre vs. Post Drainage Area Summary

	Drainage Area [ac]	Imperv. Area [ac]	CN	tc [min]
Post-Development	2.81	0.23	81	26
Post-Dev. with BSD	2.81	0.23	81	26

Pre vs. Post Peak Flow Summary

	Qpw [cfs]	1yr [cfs]	2yr [cfs]	10yr	25yr [cfs]	100yr
Post-Development	N/A	4.0	4.7	9.0	10.6	14.1
Post-Dev. with BSD		4.0	4.7	9.0	10.6	14.1

Pre vs. Post Volume Summary

	WQv [cf]	CPv [cf]	2yr [cf]	10yr [cf]	25yr [cf]	100yr [cf]
Post-Development	1,513	10,435	4,402	7,346	8,435	10,749
Post-Dev. with BSD	1,513	10,435	4,402	7,346	8,435	10,749
% Reduction with BSD	-	-	-	-	-	-

Instructions | Input_Output | Pre | Post | BSD_Credits | BSD_Credits (format 2) | Post_

Input Pre-Development parameters

Input Post-Development parameters

DA2 did not conserve any natural features

No infiltration BSD practices were preserved on DA2, hence same CN

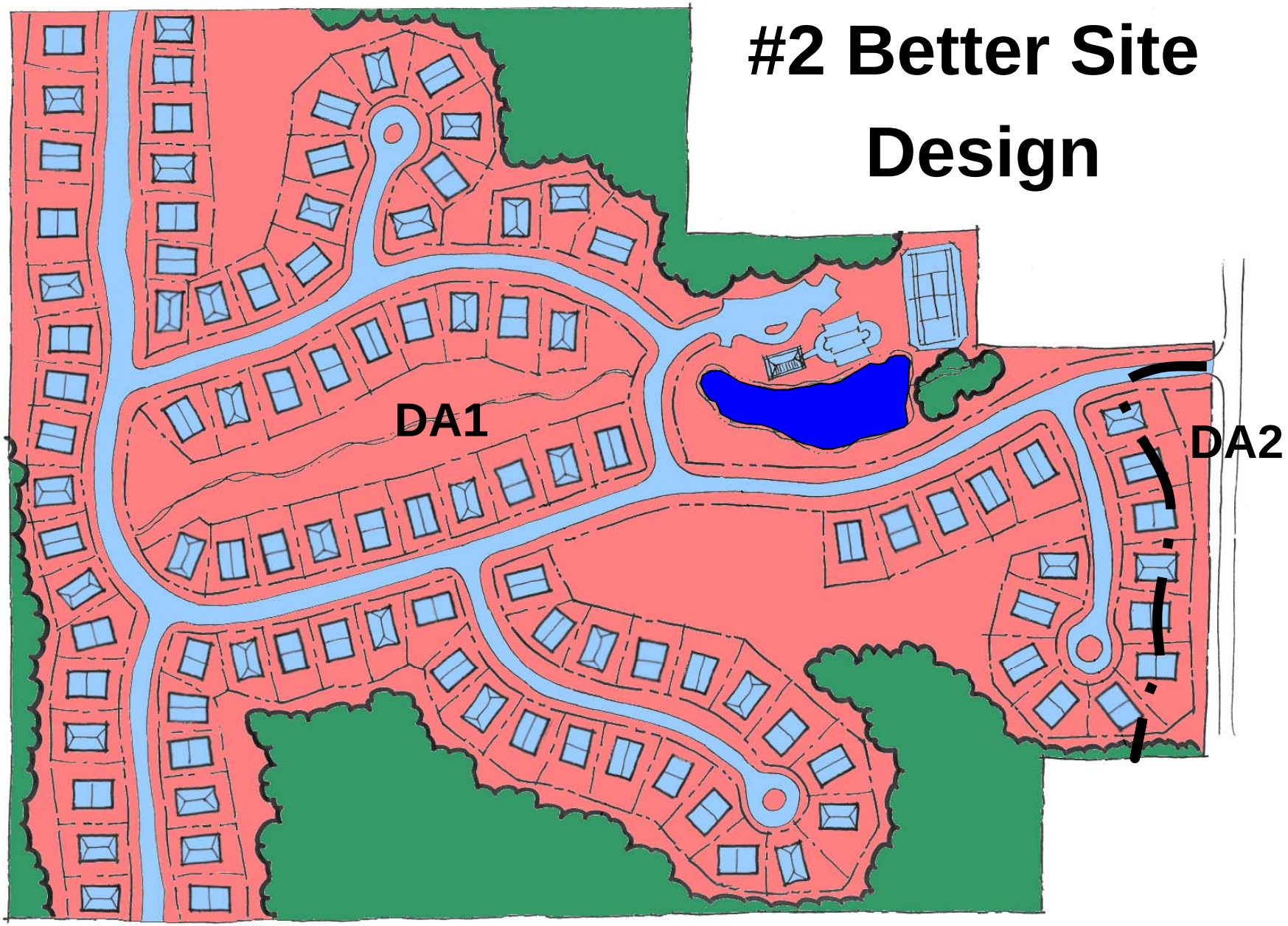
Summary of Pre Dev vs. Post Dev with BSD:

- Peak Flows
- Storage Volumes

% Volume Reduction Utilizing BSD Practices:

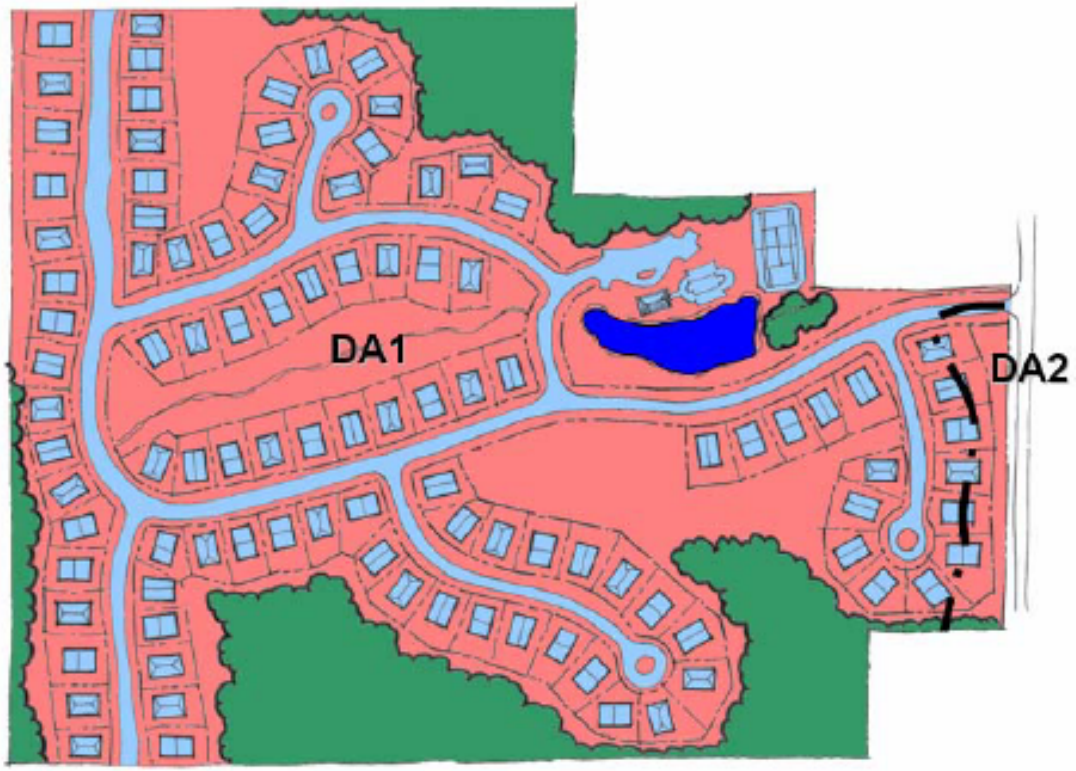
	WQv	CPv	2yr	10yr	25yr	100yr
% Red. w. BSD	-	-	-	-	-	-

#2 Better Site Design



RESIDENTIAL SUBDIVISION -- BETTER SITE DESIGN

Description: A medium-density residential subdivision designed using stormwater "better site design" principals and techniques. The proposed site design has 102 single-family lots along with an amenity area, which includes the clubhouse, pool and tennis court. Almost one-fifth of the original site has been left in its undisturbed natural state in protected natural conservation areas. In addition, the subdivision layout was designed around the natural drainage patterns of the site in order to reduce the need for a storm drainage pipe system. Only the building envelopes and minor areas of each home site will be graded. Street width has been minimized and pervious vegetated "islands" are designed for each cul-de-sac.



RESIDENTIAL SUBDIVISION -- BETTER SITE DESIGN

Propose Stormwater Management: The subdivision will utilize the natural drainage patterns of the site as much as possible to carry runoff through the subdivision. A stormwater wet pond (located within the amenity area) is the proposed stormwater management facility for both quality and quantity control.

Total Size = 83.41 acres

Number of Lots = 102 (+6)

Total Impervious Cover = 16.81 acres

- Rooftops/Driveways/Decks = 9.11 acres
- Streets (1.10 linear miles – 34' width) = 6.28 acres
- Amenity Area (Clubhouse, Pool, Tennis Court, Parking) = 1.42 acres

Percent Impervious Cover = 20% (-5%)

Natural Conservation Area = 14.21 acres

Drainage Area 1 (DA1) = 80.84 acres

- Impervious Area = 16.71 acres (- 3.81 acres)
- Percent Impervious Cover = 20.7% (- 4.8%)
- Natural Conservation Area = 14.14 acres (+ 12.98 acres)
- Structural Control: Stormwater Pond

Drainage Area 2 (DA2) = 2.57 acres

- Impervious Area = 0.10 acres (- 0.13 acres)
- Percent Impervious Cover = 3.9% (- 4.3%)
- Natural Conservation Area = 0.07 (+ 0.07)
- Structural Control: None

#2 BSD

‘DA1’

2	Project Name:	Residential Example: #2 BSD						
3	Project Number:	-						
4	Date:	7/24/2013						
5	Site Location:	City of Columbia, SC						
6	Drainage Area:	DA1						
7								
8	Site Hydrology						data input cells	
9		Drainage Area [ac]	Imperv. Area [ac]	CN	tc [min]			
10	Pre-Development	80.84	0	74	73.1			
11	Post-Development	80.84	16.71	82	57.4			
12								
13		Qpw [cfs]	1yr [cfs]	2yr [cfs]	10yr	25yr [cfs]	100yr	
14	Pre-Development	N/A	41.2	52.3	117.0	140.5	192.9	
15	Post-Development		77.4	90.4	172.2	202.1	267.4	
16								
17		WQv [cf]	CPv [cf]	2yr [cf]	10yr [cf]	25yr [cf]	100yr [cf]	
18	Pre-Development	-	-	-	-	-	-	
19	Post-Development	83,116	301,350	141,814	234,530	268,871	341,933	
20								
21								
22								
23	Better Site Design							
24	Credited Practice	Area Draining to BMP [acres]	WQv Credit [cf]		Applicable BSD Credits to Adjust Site's CN:			
25	Natural Area Conservation	14.14	14,538		Conservation Areas	14,538	cf	
26	Stream Buffer		-		Stream Buffers	-	cf	
27	Vegetated Channel		-		Infiltration Zones	-	cf	
28	Overland Flow Filtration/Infiltration Zones		-		Adjustment to Runoff Reduction Volume (BSD)	14,538	cf	
29	Environmentally Sensitive Large Lot		-					
30	Total WQv stored with BSD practices [cf]		14,538		Adjusted CN'$_{post}$	81		
31								
32					* Adjusted CN'post is based off runoff reduction from the 100-yr event (most conservative)			
33								
34	Pre vs. Post Drainage Area Summary							
35		Drainage Area [ac]	Imperv. Area [ac]	CN	tc [min]			
36	Post-Development	80.84	16.71	82	57.4			
37	Post-Dev. with BSD	80.84	16.71	81	57.4			
38								
39	Pre vs. Post Peak Flow Summary							
40		Qpw [cfs]	1yr [cfs]	2yr [cfs]	10yr	25yr [cfs]	100yr	
41	Post-Development	N/A	77.4	90.4	172.2	202.1	267.4	
42	Post-Dev. with BSD		74.0	86.8	167.5	197.2	262.0	
43								
44	Pre vs. Post Volume Summary							
45		WQv [cf]	CPv [cf]	2yr [cf]	10yr [cf]	25yr [cf]	100yr [cf]	
46	Post-Development	83,116	301,350	141,814	234,530	268,871	341,933	
47	Post-Dev. with BSD	68,578	288,379	131,822	221,839	255,404	327,069	
48	% Reduction with BSD	17.49	4.30	7.05	5.41	5.01	4.35	

Instructions | Input_Output | Pre | Post | BSD_Credits | BSD_Credits (format 2) | Post_BS

Input Pre-Development parameters

Input Post-Development parameters

Input DA1’s Natural Conservation Area

Enough infiltration from cons. areas to lower site’s CN

Summary of Pre Dev vs. Post Dev with BSD:

- Peak Flows
- Storage Volumes

% Volume Reduction Utilizing BSD Practices:

	WQv	CPv	2yr	10yr	25yr	100yr
% Red. w. BSD	17.49	4.30	7.05	5.41	5.01	4.35

#2 BSD 'DA2'

Project Name:	Residential Example: #2 BSD
Project Number:	-
Date:	7/24/2013
Site Location:	City of Columbia, SC
Drainage Area:	DA2

Site Hydrology

data input cells

	Drainage Area [ac]	Imperv. Area [ac]	CN	tc [min]
Pre-Development	2.57	0	74	32.1
Post-Development	2.57	0.1	80	26.9

	Qpw [cfs]	1yr [cfs]	2yr [cfs]	10yr	25yr [cfs]	100yr
Pre-Development	N/A	2.1	2.7	6.0	7.2	9.9
Post-Development		3.4	4.0	7.9	9.3	12.4

	WQv [cf]	CPv [cf]	2yr [cf]	10yr [cf]	25yr [cf]	100yr [cf]
Pre-Development	-	-	-	-	-	-
Post-Development	951	9,119	3,664	6,175	7,112	9,106

Better Site Design

Credited Practice	Area Draining to BMP [acres]	WQv Credit [cf]
Natural Area Conservation	0.07	26
Stream Buffer		-
Vegetated Channel		-
Overland Flow Filtration/Infiltration Zones		-
Environmentally Sensitive Large Lot		-
Total WQv stored with BSD practices [cf]		26

Applicable BSD Credits to Adjust Site's CN:		
Conservation Areas	26	cf
Stream Buffers	-	cf
Infiltration Zones	-	cf
Adjustment to Runoff Reduction Volume (BSD)	26	cf
Adjusted CN'_{post}	80	

* Adjusted CN'post is based off runoff reduction from the 100-yr event (most conservative)

Pre vs. Post Drainage Area Summary

	Drainage Area [ac]	Imperv. Area [ac]	CN	tc [min]
Post-Development	2.57	0.1	80	26.9
Post-Dev. with BSD	2.57	0.1	80	26.9

Pre vs. Post Peak Flow Summary

	Qpw [cfs]	1yr [cfs]	2yr [cfs]	10yr	25yr [cfs]	100yr
Post-Development	N/A	3.4	4.0	7.9	9.3	12.4
Post-Dev. with BSD		3.4	4.0	7.9	9.3	12.4

Pre vs. Post Volume Summary

	WQv [cf]	CPv [cf]	2yr [cf]	10yr [cf]	25yr [cf]	100yr [cf]
Post-Development	951	9,119	3,664	6,175	7,112	9,106
Post-Dev. with BSD	925	9,119	3,664	6,175	7,112	9,106
% Reduction with BSD	2.73	-	-	-	-	-

Instructions | Input_Output | Pre | Post | BSD_Credits | BSD_Credits (format 2) | Post_BSD

Input Pre-Development parameters

Input Post-Development parameters

Input DA2's Natural Conservation Area

Not enough infiltration from cons. area to change site's CN

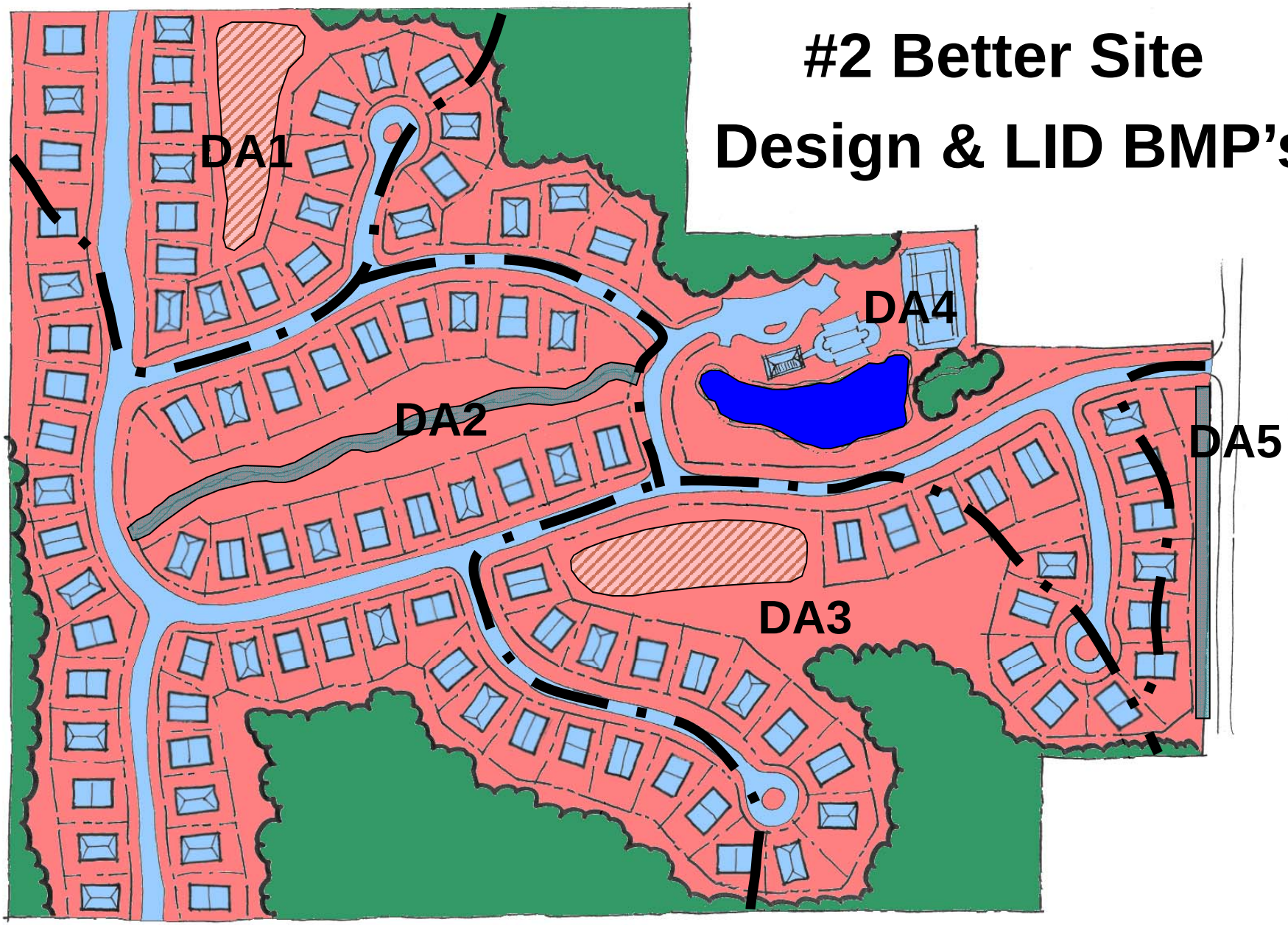
Summary of Pre Dev vs. Post Dev with BSD:

- Peak Flows
- Storage Volumes

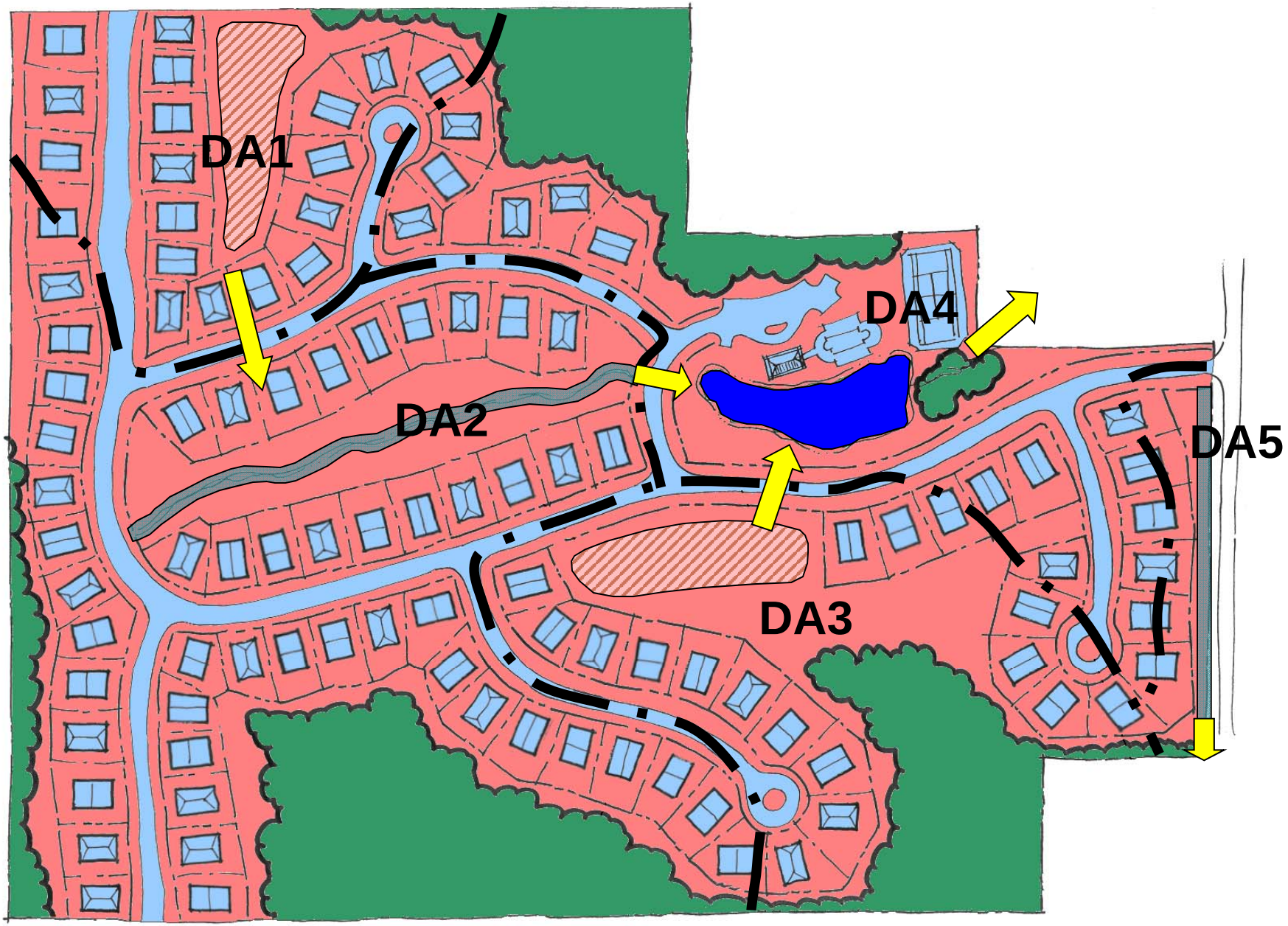
% Volume Reduction Utilizing BSD Practices:

	WQv	CPv	2yr	10yr	25yr	100yr
% Red. w. BSD	2.73	-	-	-	-	-

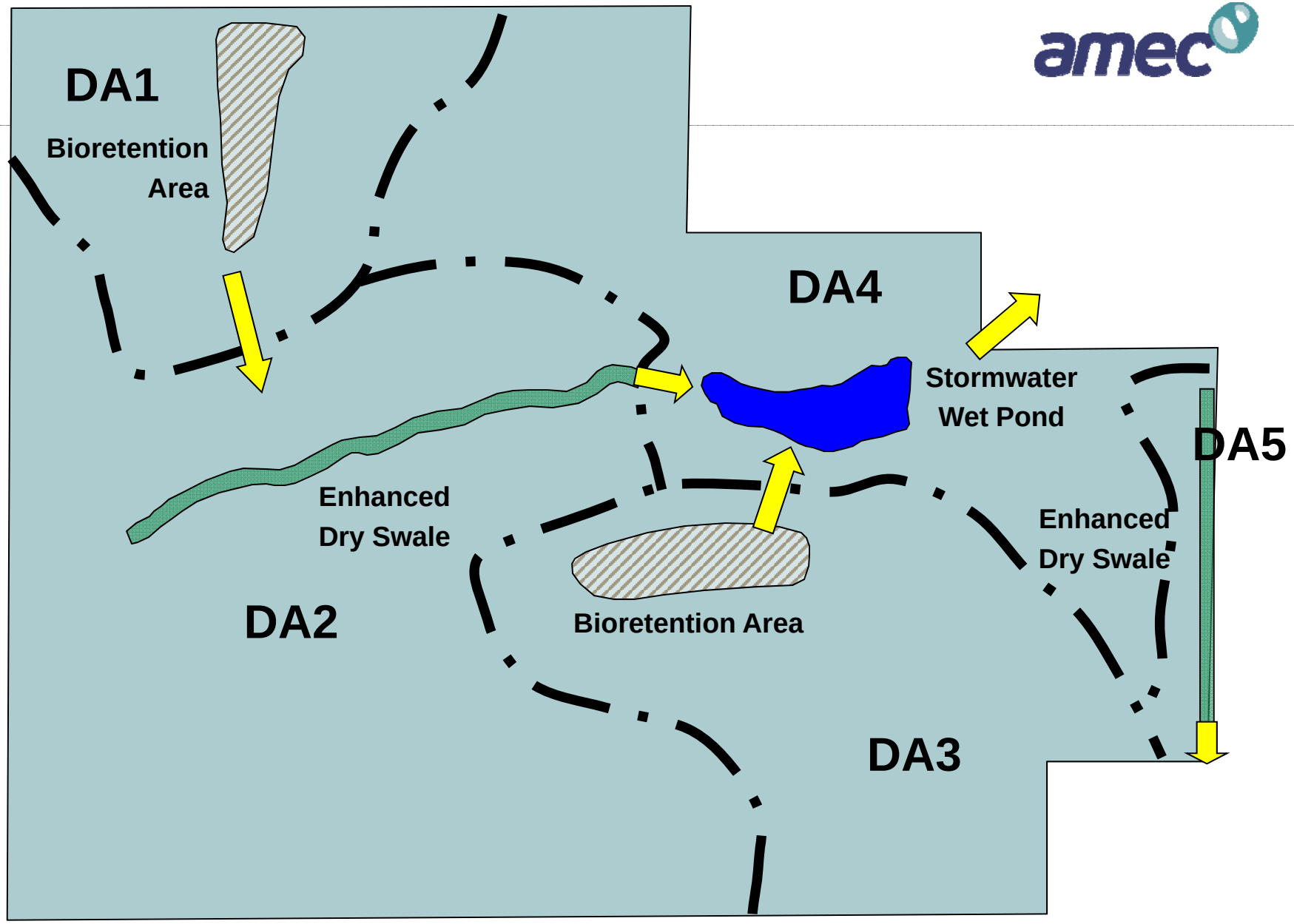
#2 Better Site Design & LID BMP's



RESIDENTIAL SUBDIVISION -- BETTER SITE DESIGN



RESIDENTIAL SUBDIVISION -- BETTER SITE DESIGN


DA1
Bioretention
Area
DA4
Stormwater
Wet Pond
DA5
Enhanced
Dry Swale
Enhanced
Dry Swale
DA2
Bioretention Area
DA3

Same as last time…

Site Info:

Total Size = 83.41 acres

Number of Lots = 102 (+6)

Total Impervious Cover = 16.81 acres

- Rooftops/Driveways/Decks = 9.11 acres
- Streets (1.10 linear miles – 34’ width) = 6.28 acres
- Amenity Area (Clubhouse, Pool, Tennis Court, Parking) = 1.42 acres

Percent Impervious Cover = 20% (-5%)

Natural Conservation Area = 14.21 acres

Drainage Area 1 (DA1) = 10.07 acres

Impervious Area = 2.66 acres

Percent Impervious Cover = 26.4%

Natural Conservation Area = 0.33 acres

Structural Control: Bioretention Area

Drainage Area 2 (DA2) = 38.22 acres

Impervious Area = 7.98 acres

Percent Impervious Cover = 20.9%

Natural Conservation Area = 5.28 acres

Structural Control: Enhanced Dry Swale

Drainage Area 3 (DA3) = 14.47 acres

Impervious Area = 2.21 acres

Percent Impervious Cover = 15.2%

Natural Conservation Area = 3.88 acres

Structural Control: Bioretention Area

Drainage Area 4 (DA4) = 18.08 acres

Impervious Area = 3.86 acres

Percent Impervious Cover = 21.3%

Natural Conservation Area = 4.65 acres

Structural Control: Stormwater Pond

Drainage Area 5 (DA5) = 2.57 acres [previously DA2]

Impervious Area = 0.10 acres

Percent Impervious Cover = 3.9%

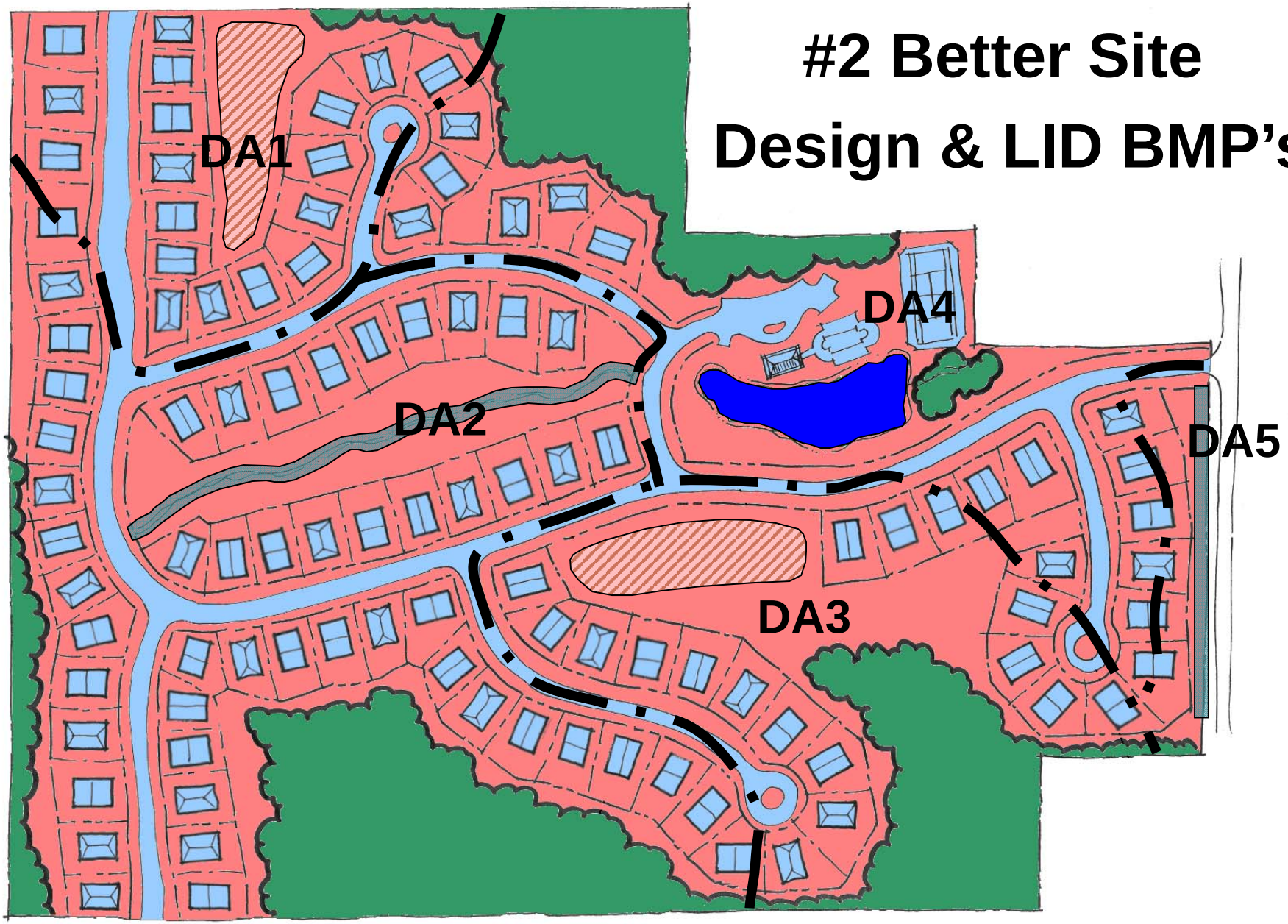
Natural Conservation Area = 0.07

Structural Control: Enhanced Dry Swale

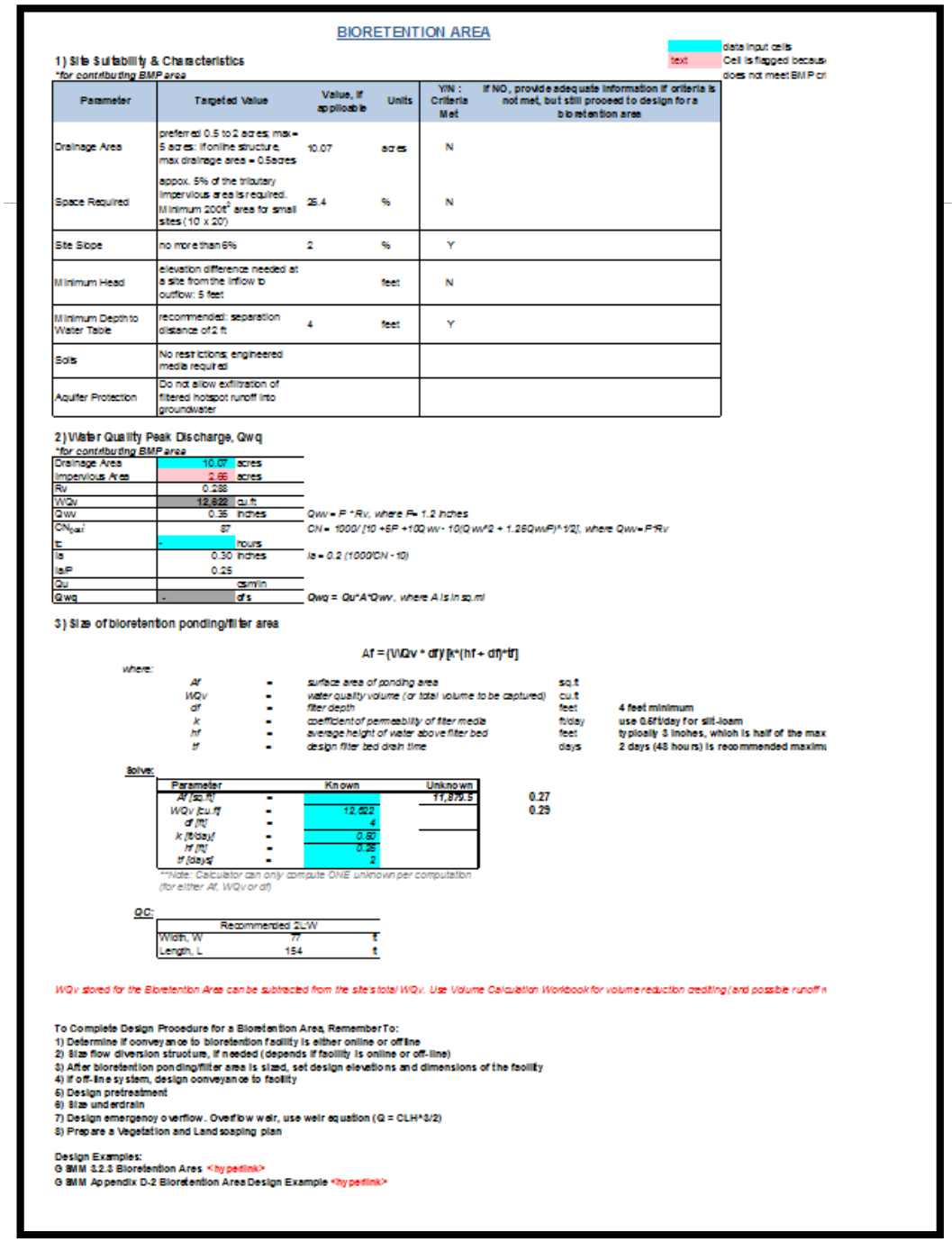
*Bioretention Areas were sized to treat each DA's (DA1 and DA3) WQv (procedure on following slide)

*Enhanced Dry Swale sized for 1660 linear feet in DA2 and for 1200 linear feet in DA5 (procedure on following slide)

#2 Better Site Design & LID BMP's



RESIDENTIAL SUBDIVISION -- BETTER SITE DESIGN



BIORETENTION AREA

data input cells
text Cell is flagged becaus
does not meet BMP cri

1) Site Suitability & Characteristics

*for contributing BMP area

Parameter	Targeted Value	Value, if applicable	Units	Y/N : Criteria Met	If NO, provide adequate information if criteria is not met, but still proceed to design for a bioretention area
Drainage Area	preferred 0.5 to 2 acres; max = 5 acres: if online structure, max drainage area = 0.5acres	10.07	acres	N	
Space Required	approx. 5% of the tributary impervious area is required. Minimum 200ft² area for small sites (10' x 20')	26.4	%	N	
Site Slope	no more than 6%	2	%	Y	
Minimum Head	elevation difference needed at a site from the inflow to outflow: 5 feet		feet	N	
Minimum Depth to Water Table	recommended: separation distance of 2 ft	4	feet	Y	
Soils	No restrictions; engineered media required				
Aquifer Protection	Do not allow exfiltration of filtered hotspot runoff into groundwater				

2) Water Quality Peak Discharge, Qwq

*for contributing BMP area

Drainage Area	10.07	acres	
Impervious Area	2.66	acres	
Rv	0.288		
WQv	12,822	cu.ft	
Qww	0.35	inches	Qww = P *Rv, where P= 1.2 inches
CN[pat]	87		CN = 1000/ [10 +5P +10Qww- 10(Qww^2 + 1.25QwwP)^1/2], where Qww=P*Rv
tc	-	hours	
Ia	0.30	inches	Ia = 0.2 (1000/CN - 10)
Ia/P	0.25		
Qu		csm/in	
Qwq	-	cfs	Qwq = Qu*A*Qww, where A is in sq.mi

3) Size of bioretention ponding/filter area

$$Af = (WQv * df) / [k*(hf + df)*tf]$$

where:

Af	=	surface area of ponding area	sq.ft	
WQv	=	water quality volume (or total volume to be captured)	cu.ft	
df	=	filter depth	feet	4 feet minimum
k	=	coefficient of permeability of filter media	ft/day	use 0.5ft/day for silt-loam
hf	=	average height of water above filter bed	feet	typically 3 inches, which is half of the max
tf	=	design filter bed drain time	days	2 days (48 hours) is recommended maximu

Solve:

Parameter		Known	Unknown	
Af [sq.ft]	=		11,879.5	0.27
WQv [cu.ft]	=	12,822		0.29
df [ft]	=	4		
k [ft/day]	=	0.50		
hf [ft]	=	0.25		
tf [days]	=	2		

*Note: Calculator can only compute ONE unknown per computation (for either Af, WQv or df)

QC:

	Recommended L:W	
Width, W	77	ft
Length, L	154	ft

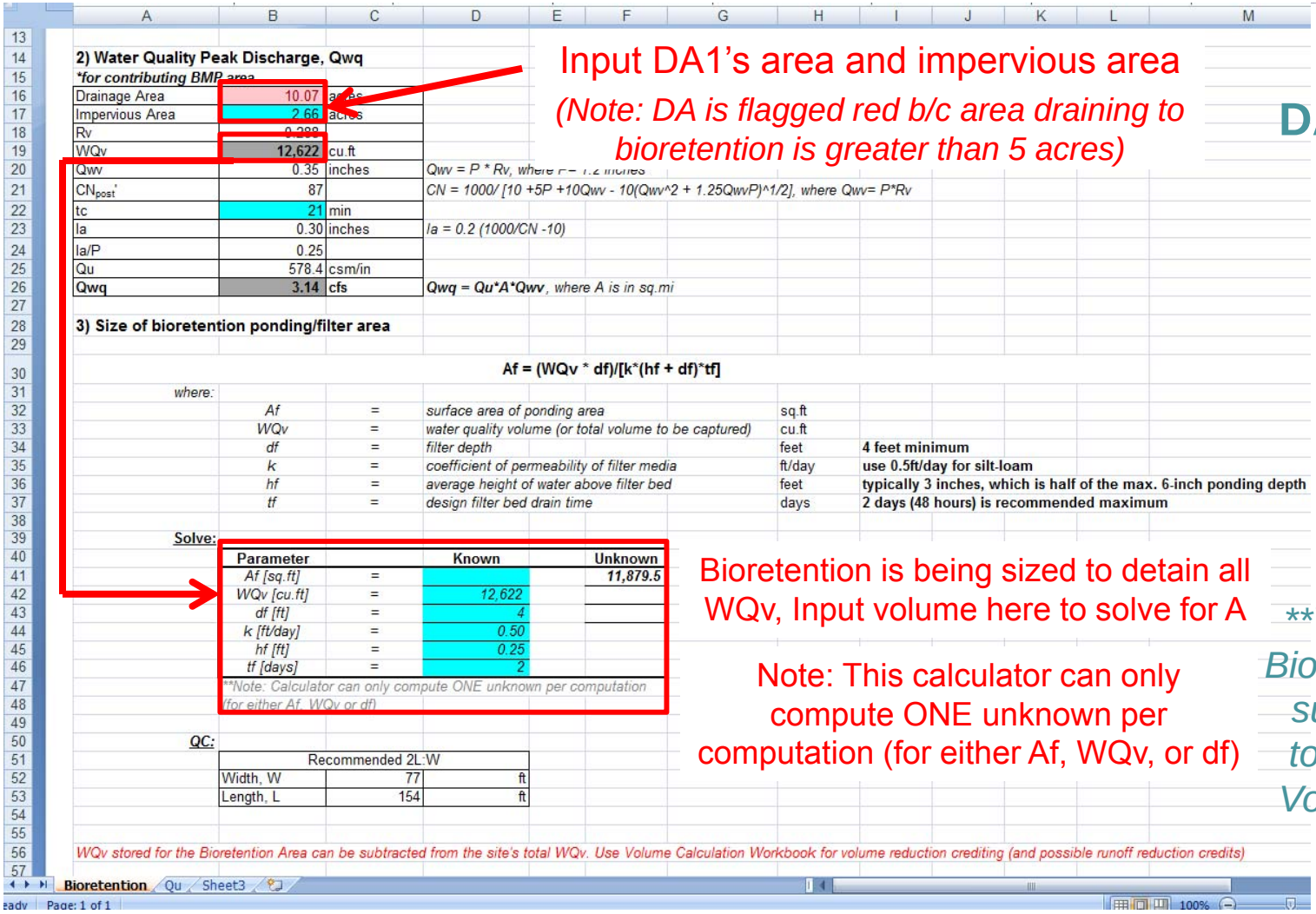
WQv stored for the Bioretention Area can be subtracted from the site's total WQv. Use Volume Calculation Workbook for volume reduction crediting (and possible runoff r

To Complete Design Procedure for a Bioretention Area, Remember To:
1) Determine if conveyance to bioretention facility is either online or offline
2) Size flow diversion structure, if needed (depends if facility is online or off-line)
3) After bioretention ponding/filter area is sized, set design elevations and dimensions of the facility
4) If off-line system, design conveyance to facility
5) Design pretreatment
6) Size underdrain
7) Design emergency overflow. Overflow weir, use weir equation (Q = CLH^3/2)
8) Prepare a Vegetation and Land scaping plan

Design Examples:
G BMM 3.2.3 Bioretention Area <hyperlink>
G BMM Appendix D-2 Bioretention Area Design Example <hyperlink>

Bioretention Area Sizing Tool

Sizing DA1's Bioretention Cell



2) Water Quality Peak Discharge, Qwq

**for contributing BMP area*

Drainage Area	10.07	acres	
Impervious Area	2.66	acres	
Rv	0.288		
WQv	12,622	cu.ft	
Qwv	0.35	inches	Qwv = P * Rv, where P = 1.2 inches
CN_{post}	87		CN = 1000/ [10 +5P +10Qwv - 10(Qwv^2 + 1.25QwvP)^1/2], where Qwv= P*Rv
tc	21	min	
Ia	0.30	inches	Ia = 0.2 (1000/CN -10)
Ia/P	0.25		
Qu	578.4	csm/in	
Qwq	**3.14**	**cfs**	***Qwq = Qu*A*Qwv***, *where A is in sq.mi*

3) Size of bioretention ponding/filter area

Af = (WQv * df)/[k*(hf + df)*tf]

where:

Af	=	*surface area of ponding area*	sq.ft	
WQv	=	*water quality volume (or total volume to be captured)*	cu.ft	
df	=	*filter depth*	feet	**4 feet minimum**
k	=	*coefficient of permeability of filter media*	ft/day	**use 0.5ft/day for silt-loam**
hf	=	*average height of water above filter bed*	feet	**typically 3 inches, which is half of the max. 6-inch ponding depth**
tf	=	*design filter bed drain time*	days	**2 days (48 hours) is recommended maximum**

Solve:

Parameter		Known	Unknown
Af [sq.ft]	=		***11,879.5***
WQv [cu.ft]	=	*12,622*	
df [ft]	=	*4*	
k [ft/day]	=	*0.50*	
hf [ft]	=	*0.25*	
tf [days]	=	*2*	

***Note: Calculator can only compute ONE unknown per computation (for either Af, WQv or df)*

QC:

Recommended 2L:W		
Width, W	77	ft
Length, L	154	ft

WQv stored for the Bioretention Area can be subtracted from the site's total WQv. Use Volume Calculation Workbook for volume reduction crediting (and possible runoff reduction credits)

Bioretention Qu Sheet3

Ready Page: 1 of 1 100%

Input DA1's area and impervious area

(Note: DA is flagged red b/c area draining to bioretention is greater than 5 acres)

Bioretention is being sized to detain all WQv, Input volume here to solve for A

Note: This calculator can only compute ONE unknown per computation (for either Af, WQv, or df)

DA1 Bioretention Cell Area:

= 11,880 sq.ft

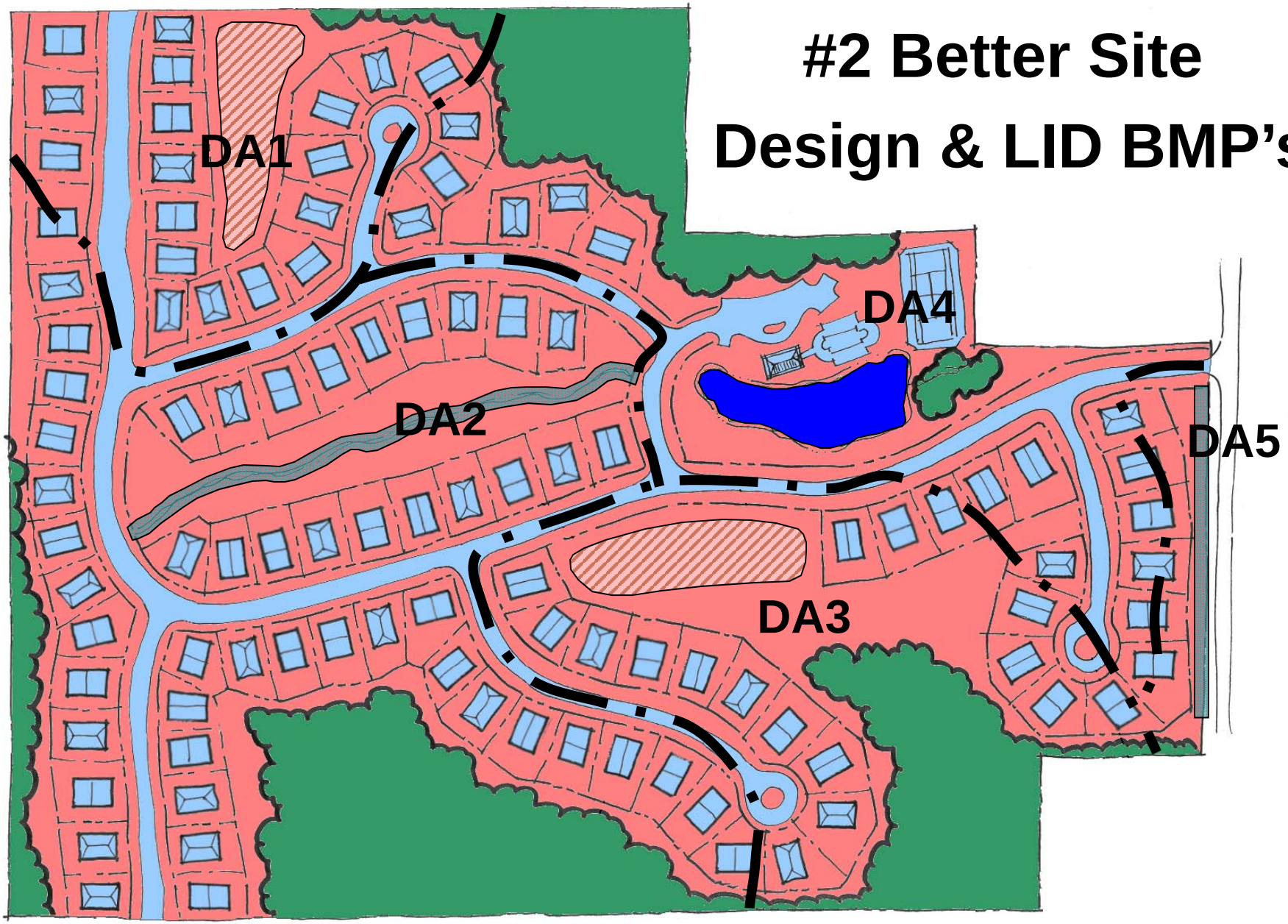
= 0.27 acres

Cell Volume:

= 12,622 cu.ft

***Volume stored in the Bioretention Area can be subtracted from site's total WQv. Use CoC's Vol. Calc. Spreadsheet*

#2 Better Site Design & LID BMP's



RESIDENTIAL SUBDIVISION -- BETTER SITE DESIGN

#2 BSD & BMPs

'DA1 thru DA4'

Project Name:	Residential Example: #2 BSD & BMPs
Project Number:	-
Date:	7/24/2013
Site Location:	City of Columbia, SC
Drainage Area:	DA1, DA2, DA3 & DA4

Site Hydrology

data input cells

	Drainage Area [ac]	Imperv. Area [ac]	CN	tc [min]
Pre-Development	80.84	0	74	73.1
Post-Development	80.84	16.71	82	57.4

	Qpw [cfs]	1yr [cfs]	2yr [cfs]	10yr	25yr [cfs]	100yr
Pre-Development	N/A	41.2	52.3	117.0	140.5	192.9
Post-Development		77.4	90.4	172.2	202.1	267.4

	WQv [cf]	CPv [cf]	2yr [cf]	10yr [cf]	25yr [cf]	100yr [cf]
Pre-Development	-	-	-	-	-	-
Post-Development	83,116	301,350	141,814	234,530	268,871	341,933

Input Pre-Development parameters

Input Post-Development parameters

Better Site Design

Credited Practice	Area Draining to BMP [acres]	WQv Credit [cf]
Natural Area Conservation	14.14	14,538
Stream Buffer		-
Vegetated Channel		-
Overland Flow Filtration/Infiltration Zones		-
Environmentally Sensitive Large Lot		-
Total WQv stored with BSD practices [cf]		14,538

Input Natural Conservation Areas for DA1 thru DA4

Applicable BSD Credits to Adjust Site's CN:		
Conservation Areas	14,538	cf
Stream Buffers	-	cf
Infiltration Zones	-	cf
Adjustment to Runoff Reduction Volume (BSD)	14,538	cf
Adjusted CN'_{post}	81	

* Adjusted CN'post is based off runoff reduction from the 100-yr event (most conservative)

Enough infiltration from cons. areas to lower site's CN

Pre vs. Post Drainage Area Summary

	Drainage Area [ac]	Imperv. Area [ac]	CN	tc [min]
Post-Development	80.84	16.71	82	57.4
Post-Dev. with BSD	80.84	16.71	81	57.4

Pre vs. Post Peak Flow Summary

	Qpw [cfs]	1yr [cfs]	2yr [cfs]	10yr	25yr [cfs]	100yr
Post-Development	N/A	77.4	90.4	172.2	202.1	267.4
Post-Dev. with BSD		74.0	86.8	167.5	197.2	262.0

Pre vs. Post Volume Summary

	WQv [cf]	CPv [cf]	2yr [cf]	10yr [cf]	25yr [cf]	100yr [cf]
Post-Development	83,116	301,350	141,814	234,530	268,871	341,933
Post-Dev. with BSD	68,578	288,379	131,822	221,839	255,404	327,069
% Reduction with BSD	17.49	4.30	7.05	5.41	5.01	4.35

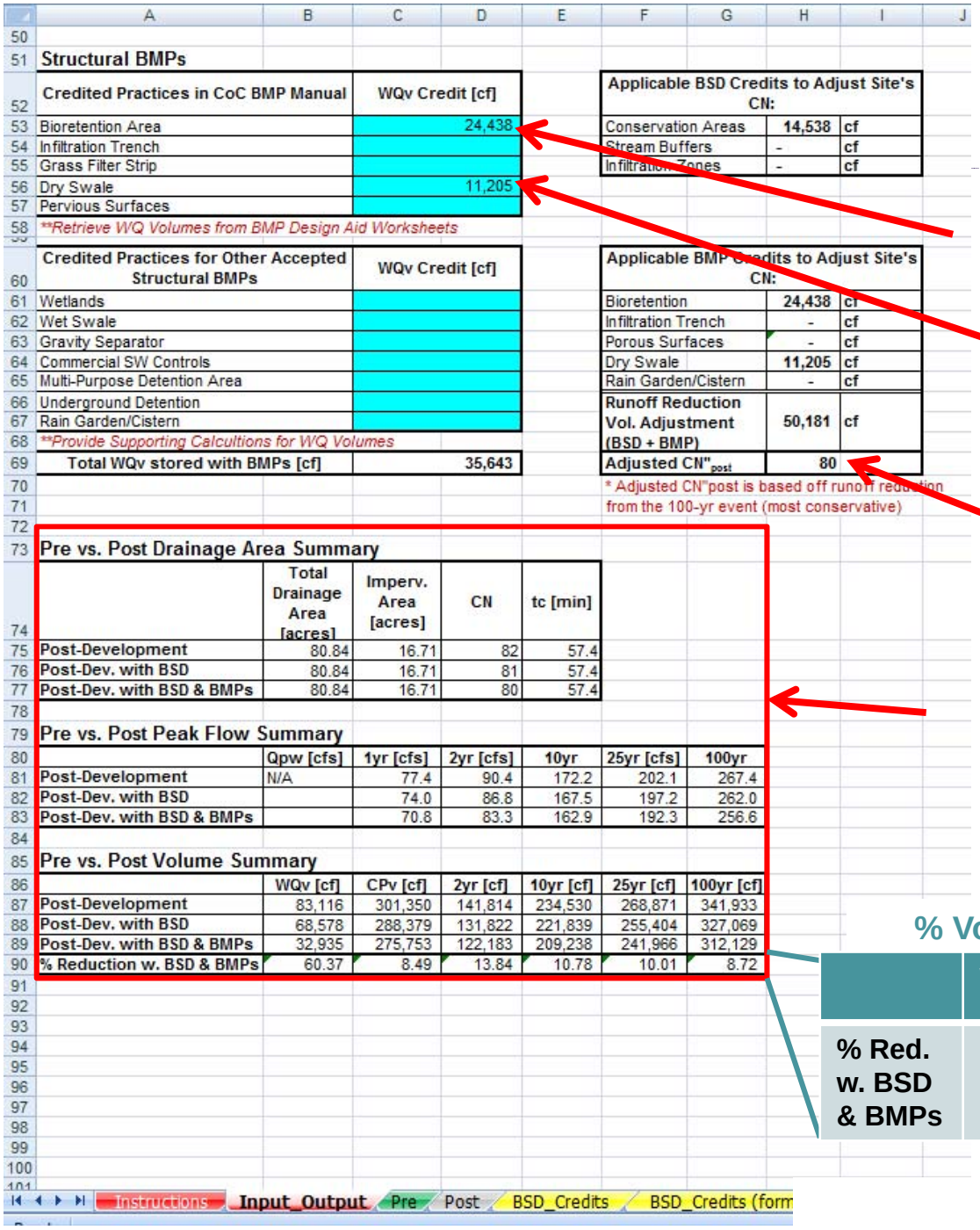
Instructions | Input_Output | Pre | Post | BSD_Credits | BSD_Credits (form

Summary of Pre Dev vs. Post Dev with BSD:

- Peak Flows
- Storage Volumes

% Volume Reduction Utilizing BSD Practices:

	WQv	CPv	2yr	10yr	25yr	100yr
% Red. w. BSD	17.49	4.30	7.05	5.41	5.01	4.35



Structural BMPs

Credited Practices in CoC BMP Manual	WQv Credit [cf]
Bioretention Area	24,438
Infiltration Trench	
Grass Filter Strip	
Dry Swale	11,205
Pervious Surfaces	

***Retrieve WQ Volumes from BMP Design Aid Worksheets*

Applicable BSD Credits to Adjust Site's CN:		
Conservation Areas	14,538	cf
Stream Buffers	-	cf
Infiltration Zones	-	cf

Credited Practices for Other Accepted Structural BMPs	WQv Credit [cf]
Wetlands	
Wet Swale	
Gravity Separator	
Commercial SW Controls	
Multi-Purpose Detention Area	
Underground Detention	
Rain Garden/Cistern	
***Provide Supporting Calcultions for WQ Volumes*	
Total WQv stored with BMPs [cf]	**35,643**

Applicable BMP Credits to Adjust Site's CN:		
Bioretention	24,438	cf
Infiltration Trench	-	cf
Porous Surfaces	-	cf
Dry Swale	11,205	cf
Rain Garden/Cistern	-	cf
Runoff Reduction Vol. Adjustment (BSD + BMP)	50,181	cf
Adjusted CN"$_{post}$	80	

* Adjusted CN"post is based off runoff reduction from the 100-yr event (most conservative)

Pre vs. Post Drainage Area Summary

	Total Drainage Area [acres]	Imperv. Area [acres]	CN	tc [min]
Post-Development	80.84	16.71	82	57.4
Post-Dev. with BSD	80.84	16.71	81	57.4
Post-Dev. with BSD & BMPs	80.84	16.71	80	57.4

Pre vs. Post Peak Flow Summary

	Qpw [cfs]	1yr [cfs]	2yr [cfs]	10yr	25yr [cfs]	100yr
Post-Development	N/A	77.4	90.4	172.2	202.1	267.4
Post-Dev. with BSD		74.0	86.8	167.5	197.2	262.0
Post-Dev. with BSD & BMPs		70.8	83.3	162.9	192.3	256.6

Pre vs. Post Volume Summary

	WQv [cf]	CPv [cf]	2yr [cf]	10yr [cf]	25yr [cf]	100yr [cf]
Post-Development	83,116	301,350	141,814	234,530	268,871	341,933
Post-Dev. with BSD	68,578	288,379	131,822	221,839	255,404	327,069
Post-Dev. with BSD & BMPs	32,935	275,753	122,183	209,238	241,966	312,129
% Reduction w. BSD & BMPs	60.37	8.49	13.84	10.78	10.01	8.72

Instructions | Input_Output | Pre | Post | BSD_Credits | BSD_Credits (form

#2 BSD & BMPs

'DA1 thru DA4'

Input DA1 and DA3's Bioretenion Cells' Storage Volumes (from CoC's Sizing Tools

Input DA2's Dry Enhanced Swale Storage Volume (from CoC's Sizing Tools)

Enough infiltration from bioretention cell to lower site's CN from 82 to 80

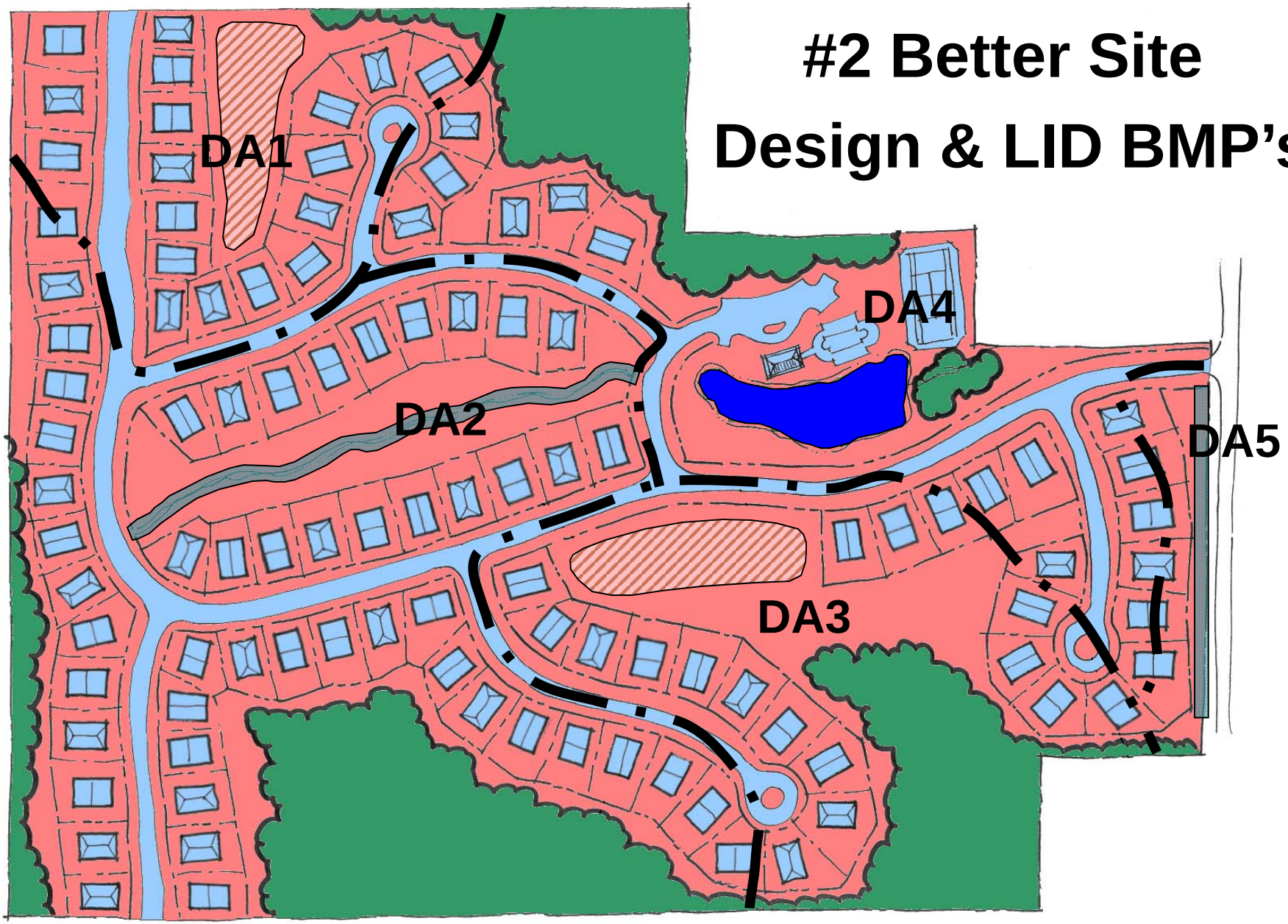
Summary of Pre Dev vs. Post Dev with BSD vs. Post Dev with BSD & BMPs:

- Peak Flows
- Storage Volumes

% Volume Reduction Utilizing BSD & BMPs:

	WQv	CPv	2yr	10yr	25yr	100yr
% Red. w. BSD & BMPs	**60.37**	**8.5**	**13.8**	**10.8**	**10.0**	**8.7**

#2 Better Site Design & LID BMP's



RESIDENTIAL SUBDIVISION -- BETTER SITE DESIGN

#2 BSD & BMPs ‘DA5’

Project Name:	Residential Example: #2 BSD & BMPs
Project Number:	-
Date:	7/24/2013
Site Location:	City of Columbia, SC
Drainage Area:	DA5

data input cells

Site Hydrology

	Drainage Area [ac]	Imperv. Area [ac]	CN	tc [min]
Pre-Development	2.57	0	74	32.1
Post-Development	2.57	0.1	79	27.7

	Qpw [cfs]	1yr [cfs]	2yr [cfs]	10yr	25yr [cfs]	100yr
Pre-Development	N/A	2.1	2.7	6.0	7.2	9.9
Post-Development		3.1	3.8	7.6	8.9	12.0

	WQv [cf]	CPv [cf]	2yr [cf]	10yr [cf]	25yr [cf]	100yr [cf]
Pre-Development	-	-	-	-	-	-
Post-Development	951	8,659	3,316	5,637	6,514	8,385

Input Pre-Development parameters

Input Post-Development parameters

Input Natural Conservation Area for DA5

Better Site Design

Credited Practice	Area Draining to BMP [acres]	WQv Credit [cf]
Natural Area Conservation	0.07	26
Stream Buffer		-
Vegetated Channel		-
Overland Flow Filtration/Infiltration Zones		-
Environmentally Sensitive Large Lot		-
Total WQv stored with BSD practices [cf]		26

Applicable BSD Credits to Adjust Site's CN:		
Conservation Areas	26	cf
Stream Buffers	-	cf
Infiltration Zones	-	cf
Adjustment to Runoff Reduction Volume (BSD)	26	cf
Adjusted CN'$_{post}$	79	

* Adjusted CN'post is based off runoff reduction from the 100-yr event (most conservative)

Not enough infiltration from cons. areas to lower site’s CN

Pre vs. Post Drainage Area Summary

	Drainage Area [ac]	Imperv. Area [ac]	CN	tc [min]
Post-Development	2.57	0.1	79	27.7
Post-Dev. with BSD	2.57	0.1	79	27.7

Pre vs. Post Peak Flow Summary

	Qpw [cfs]	1yr [cfs]	2yr [cfs]	10yr	25yr [cfs]	100yr
Post-Development	N/A	3.1	3.8	7.6	8.9	12.0
Post-Dev. with BSD		3.1	3.8	7.6	8.9	12.0

Pre vs. Post Volume Summary

	WQv [cf]	CPv [cf]	2yr [cf]	10yr [cf]	25yr [cf]	100yr [cf]
Post-Development	951	8,659	3,316	5,637	6,514	8,385
Post-Dev. with BSD	925	8,659	3,316	5,637	6,514	8,385
% Reduction with BSD	2.73	-	-	-	-	-

Instructions | Input_Output | Pre | Post | BSD_Credits | BSD_Credits (format 2) | Post_BSD

Summary of Pre Dev vs. Post Dev with BSD:

- Peak flows
- Storage Volumes

% Volume Reduction Utilizing BSD Practices:

	WQv	CPv	2yr	10yr	25yr	100yr
% Red. w. BSD	2.73	-	-	-	-	-

#2 BSD & BMPs 'DA5'

Structural BMPs

Credited Practices in CoC BMP Manual	WQv Credit [cf]
Bioretention Area	
Infiltration Trench	
Grass Filter Strip	
Dry Swale	3,150
Pervious Surfaces	

***Retrieve WQ Volumes from BMP Design Aid Worksheets*

Applicable BSD Credits to Adjust Site's CN:		
Conservation Areas	26	cf
Stream Buffers	-	cf
Infiltration Zones	-	cf

Credited Practices for Other Accepted Structural BMPs	WQv Credit [cf]
Wetlands	
Wet Swale	
Gravity Separator	
Commercial SW Controls	
Multi-Purpose Detention Area	
Underground Detention	
Rain Garden/Cistern	
***Provide Supporting Calcultions for WQ Volumes*	
Total WQv stored with BMPs [cf]	3,150

Applicable BMP Credits to Adjust Site's CN:		
Bioretention	-	cf
Infiltration Trench	-	cf
Porous Surfaces	-	cf
Dry Swale	3,150	cf
Rain Garden/Cistern	-	cf
Runoff Reduction Vol. Adjustment (BSD + BMP)	3,176	cf
Adjusted $CN"_{post}$	76	

* Adjusted CN"post is based off runoff reduction from the 100-yr event (most conservative)

Pre vs. Post Drainage Area Summary

	Total Drainage Area [acres]	Imperv. Area [acres]	CN	tc [min]
Post-Development	2.57	0.1	79	27.7
Post-Dev. with BSD	2.57	0.1	79	27.7
Post-Dev. with BSD & BMPs	2.57	0.1	76	27.7

Pre vs. Post Peak Flow Summary

	Qpw [cfs]	1yr [cfs]	2yr [cfs]	10yr	25yr [cfs]	100yr
Post-Development	N/A	3.1	3.8	7.6	8.9	12.0
Post-Dev. with BSD		3.1	3.8	7.6	8.9	12.0
Post-Dev. with BSD & BMPs		2.7	3.2	6.9	8.2	11.2

Pre vs. Post Volume Summary

	WQv [cf]	CPv [cf]	2yr [cf]	10yr [cf]	25yr [cf]	100yr [cf]
Post-Development	951	8,659	3,316	5,637	6,514	8,385
Post-Dev. with BSD	925	8,659	3,316	5,637	6,514	8,385
Post-Dev. with BSD & BMPs	0	7,510	2,253	4,353	5,121	6,797
% Reduction w. BSD & BMPs	100.00	13.26	32.06	22.78	21.38	18.94

Input DA5's Dry Enhanced Swale Storage Volume (from CoC's Sizing Tools)

Enough infiltration from bioretention cell to lower site's CN from 79 to 76

Summary of Pre Dev vs. Post Dev with BSD vs. Post Dev with BSD & BMPs:

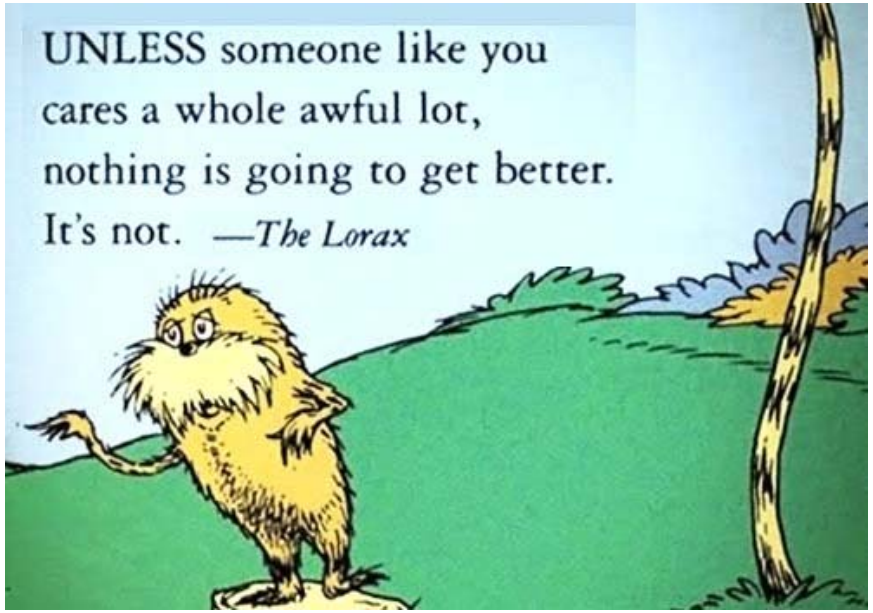
- Peak flows
- Storage Volumes

% Volume Reduction Utilizing BSD & BMPs:

	WQv	CPv	2yr	10yr	25yr	100yr
% Red. w. BSD & BMPs	100	13.26	32.1	22.8	21.4	18.9

Benefits that USC can bring to South Carolina

- Proactively addresses current and future Federal and State storm water regulations without burdening development
- Provides engineers and developers with an effective method for comprehensive storm water quantity and quality management
- Provide economic incentives for using Low Impact Development BMP's and Better Site Design practices
- Protects our natural resources and environment for the benefit or our community, our health, our economy, and future development



Questions?

William F. Lamb, PE

Senior Engineer / Project Manager

Professional qualifications/registration(s)
Professional Engineer, SC, 27791, 2009

Education
Bachelor of Science, Biosystems Engineering, Clemson University, 2005

Certifications and training
Competent Person Excavation, expires - 12/50

Publications and presentations
Unified Sizing Criteria for Stormwater Design: Design Criteria to Encourage Low Impact Development in South Carolina, 2012 S.C. Water Resources Conference, Columbia, SC.

Professional Summary

Mr. Lamb is a licensed Professional Engineer with a broad range of experience in a variety of water-related disciplines. Currently serving as a Senior Engineer and Project Manager, he provides a high level of technical expertise and leadership on numerous complex projects. Mr. Lamb's specialty is providing client-focused consulting on a variety of stormwater program support, civil design, and stream and wetland restoration projects for many local and state agencies, as well as private industry clients.

Since 2005, Mr. Lamb has served a variety of roles on hundreds of large and small projects throughout the Carolinas. He has successfully designed and permitted numerous stormwater facilities, stream and wetland restoration projects, utility projects, stream bank stabilization projects, and watershed plans. He has worked for numerous government, industrial, commercial, energy, transportation, and mining clients. Mr. Lamb is proficient in a variety of drafting and modelling programs, including AutoCAD Civil 3D, HEC-RAS, HydroCAD, PondPack, SedCAD, and WaterCAD.

His specific areas of expertise include:

- Managing Multi-Disciplinary Projects
- Stormwater Program Support
- Stormwater Regulations and Design Manuals
- Stormwater Design and Sediment and Erosion Control Training
- Stormwater System Design
- Hydrologic and Hydraulic Modelling
- Water Quality Modelling
- Watershed Planning
- Sediment and Erosion Control Design
- Grading Plans
- 401/404 Permitting
- Stream and Wetland Mitigation Plans
- Stream and Wetland Restoration Design
- Stream Bank Stabilization
- Sanitary Sewer Collection Design
- Water Distribution Design
- Floodplain Modelling
- Construction Oversight and Inspections
- CAD

CERTIFICATE OF ATTENDANCE

PLANNING TRAINING FOR LOCAL GOVERNMENT OFFICIALS

TRAINING PROGRAM INFORMATION

Sponsor:	Town of Fort Mill (Offered Jointly with the City of Tega Cay)
Activity Title:	Unified Sizing Criteria for Stormwater Design: Design Criteria to Encourage LID
Date of Attendance:	January 22, 2015
Location:	The Spratt Building, 215 Main Street, Fort Mill, SC 29715
Orientation Program or Course Number:	To be provided by SCPEAC
Total Credit Hours:	1.5 CE credit hours (based on a 60-minute hour)

TO BE COMPLETED BY ATTENDING OFFICIAL OR EMPLOYEE

By signing below, I certify that I attended the activity describe above and am entitled to claim:

__ Orientation Program Hours

1.5 Continuing Education (CE) Credit Hours

I am also certifying that I attended the session with faculty and/or a professional planner as a discussant in person.

_____
Name of Appointed Official or Employee (Please Print)

_____
Signature

_____
Date

Jurisdiction:
___ Town of Fort Mill
___ City of Tega Cay

Position:
___ Planning Commission
___ Board of Zoning Appeals
___ Historic Review Board
___ Employee/Other: _____

TO BE COMPLETED BY CERTIFYING OFFICER

I certify that the above named individual attended the activity described herein and is entitled to claim 1.5 Continuing Education Credit Hours toward his/her statutory training requirement for Calendar Year 2015.

Certifying Officer: _____ _____

Joe Cronin, Planning Director
Town of Fort Mill

Date

SESSION EVALUATION FORM

PLANNING TRAINING FOR LOCAL GOVERNMENT OFFICIALS

TRAINING PROGRAM INFORMATION

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TO BE COMPLETED BY ATTENDING OFFICIAL OR EMPLOYEE

	Poor	Fair	Good	Very Good	Excellent
Quality of content presented					
Quality of visual aids/handouts					
Usefulness/relevance of the topic					
Presenter's knowledge of the topic					
Participant involvement/engagement					
Quality of the training location					
What did you find most useful about today's presentation?					
Do you have any additional comments regarding today's training program?					
Do you have any additional comments regarding the training facility?					
Would you like to suggest a future training topic or presenter?					

Position:
___ Planning Commission Member
___ Board of Zoning Appeals Member
___ Historic Review Board Member
___ Employee/Other: _____

Jurisdiction:
___ Town of Fort Mill
___ City of Tega Cay