Performance Criteria

Section 3 (pg 5 – 6 in the Design Manual)

Goal of the Criteria

Follow the guiding principle to "Allow no further degradation of the current water quality conditions in McDowell Creek and McDowell Creek Cove" developed by Huntersville Town Board. In the simplest form, this means that existing conditions need to be maintained. Use existing conditions as a guide to site design. Mimic pre-development hydrology.

Performance Criteria 101 (more detail later...)

- 6 Basic Elements Need to be addressed:
 - /85% TSS removal
 - Using LID treat the runoff from the first 1 inch of rainfall
 - In addition (if necessary) use LID alone or in combination with conventional practices to treat the difference in runoff from pre versus post conditions for the 2 year 24 hour storm in the Rural and Transitional Zoning Districts. Everywhere else use the 1 year 24 hour storm
 - Any temporary water quality storage pools must drawdown in 48 to 120 hours.
 - Peak storm water runoff rates shall be controlled for development above 12% impervious (1 dwelling/acre) No one BMP shall receive runoff from an area greater than 5 acres.

Why?

Protect Water Quality

- Oddly, Almost all Criteria Focus on Stormwater not Water Quality
 - Very Difficult to assess and design for specific pollutant removal efficiency (wide range of values)
 - Existing engineering practice for the assessment of Stormwater
- A Package Deal…
 - If you design for this level of stormwater control desired water quality benefits are realized

What Needs to be Protected? Runoff volume from new development protect stream channel stability & biology Bankfull conditions predicted to increase 250% ->650% Sediment from construction, and post development streambank erosion protect biology and lake cove Nutrients from new development protect biology and lake cove

How? Better site design and BMPs! Four Major Types of BMPs Ø Pollution Prevention Runoff Reduction Retention Detention Two Major Functions of BMPs Water Quality Volume Control

BMPs for Use in Huntersville (Tables 6.1 and 6.2, Pages 48 and 49)							
BMP	Applicable Zoning Districts(1)	Applicable Performance Criteria (2)	Design Function(3)	Function(4) (WQ, VC, PC)			
Strategic Clearing & Grading	U, T, R	3(a)		WQ, VC, PC			
Reduce Impervious Surfaces	U, T, R	3 (a)		WQ, VC, PC			
Bioretention (Rain Garden)	U, T, R	3 (a), 3 (b)	Section 4.0	WQ, VC, PC			
Infiltration Trench	U, T, R	3 (a), 3 (b)	Section 8.0	WQ, VC, PC			
Infiltration Swale	U, T, R	3 (a), 3 (b)	Section 8.0	WQ, VC, PC			
Swales	U, T, R	3 (a)	Section 5.0	WQ, VC			
Swales with Outlet Control	T, R	3(a), 3(a)	Section 5.0	WQ, VC, PC			
Vegetative Filter Strips & Buffers	U, T, R	3 (a)	Section 7.0	WQ, PC			
Dry Well, Cistern & Rainbarrel	U, T, R	3(b)		WQ, VC, PC			
Porous Paving	U, T, R	3(b)		WQ, VC			
Curb & Gutter Elimination	R	3(b)		WQ, PC			
Rooftop Storage	U, T, R	3(b)		VC, PC			
Wet Pond	U, T, R	3(b), 3(d)	Section 1.0	WQ, VC, PC			
Extended Dry Pond	T, R	3(b), 3(d)	Section 6.0	VC, PC			
Storm Water Wetlands	Т, R	3(b)	Section 2.0	WQ, VC, PC			
Sand Filter	T, R	3 (a)	Section 3.0	WQ, VC, PC			

The surveyor

(1) Applicable Zoning Districts: These are the Zoning Districts where the BMP can be used including U = Urban; T = Transitional; R = Rural.

(2) Applicable Performance Criteria: These are the Performance Criteria Section numbers (see Section 3) that the BMP can be used to satisfy.

(3) Design Function: All BMP designs are contained in the N.C. Department of Environment & Natural Resources, Storm Water Best Management Pratices, April 1999

(4) Functions: These are the dominate functions that the BMPs perform including WQ = Water Quality; VC = Volume Control, PC = Peak Control.

Discuss Specific Criteria in Detail Present Criteria Water Quality Benefits Impact to the Site Hydrograph (if applicable) Discuss BMPs acceptable for addressing Criteria

(3a) 85% TSS Removal

85% TSS Removal

- North Carolina Requirement
- Applies to developed areas of a Site (no disincentive for open space, buffers, tree save, etc.)
- Water Quality Benefit: Vastly reduces upland sediment load
 - Preserve In-stream Habitat
 - Preserve Cove usability
 - Reduce Phosphorus

(3a) First 1 inch of Rainfall

 All sites must employ LID practices to control and treat runoff from the first inch of rainfall.
 <u>Water Quality Benefit</u>: 90% of pollutants are delivered in the runoff from the first 1" of rainfall

- Reduces Temperature
- Nutrients
- Fecal Coliform
- Protects Channel
 - Erosion
 - Habitat Destruction

Hydrograph

Post Development Conditions

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Flow

Using LID for First 1"

- Maintain Tc
- Decrease Peak
- Increase Lag
 - Increase Interflow

Pre-Development Conditions

Time

BMPs for Use in Huntersville (Tables 6.1 and 6.2, Pages 48 and 49)							
BMP	Applicable Zoning Districts(1)	Applicable Performance Criteria (2)	Design Function(3)	Function(4) (WQ, VC, PC)			
Strategic Clearing & Grading	U, T, R	3(a)		WQ, VC, PC			
Reduce Impervious Surfaces	U, T, R	3(a)		WQ, VC, PC			
Bioretention (Rain Garden)	U, T, R	3(a), 3(b)	Section 4.0	WQ, VC, PC			
Infiltration Trench	U, T, R	3(a), 3(b)	Section 8.0	WQ, VC, PC			
Infiltration Swale	U, T, R	3(a), 3(b)	Section 8.0	WQ, VC, PC			
Swales	U, T, R	3(a)	Section 5.0	WQ, VC			
Swales with Outlet Control	T, R	3(a), 3(a)	Section 5.0	WQ, VC, PC			
Vegetative Filter Strips & Buffers	U, T, R	3(a)	Section 7.0	WQ, PC			
Dry Well, Cistern & Rainbarrel	U, T, R	3(b)		WQ, VC, PC			
Porous Paving	U, T, R	3(b)		WQ, VC			
Curb & Gutter Elimination	R	3(b)		WQ, PC			
Rooftop Storage	U, T, R	3(b)		VC, PC			
Wet Pond	U, T, R	3(b), 3(d)	Section 1.0	WQ, VC, PC			
Extended Dry Pond	T, R	3(b), 3(d)	Section 6.0	VC, PC			
Storm Water Wetlands		3(b)	Section 2.0	WQ, VC, PC			
Sand Filter	T, R	3(a)	Section 3.0	WQ, VC, PC			

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(4)

1) Applicable Zoning Districts: These are the Zoning Districts where the BMP can be used including U = Urban; T = Transitional; R = Rural.

(2) Applicable Performance Criteria: These are the Performance Criteria Section numbers (see Section 3) that the BMP can be used to satisfy.

(3) Design Function: All BMP designs are contained in the N.C. Department of Environment & Natural Resources, Storm Water Best Management Pratices, April 1999

Functions: These are the dominate functions that the BMPs perform including WQ = Water Quality; VC = Volume Control, PC = Peak Control.

First Inch: Bioretention "Rain Gardens"





First Inch: Infiltration Trench



Figure 3.2.5-1 Infiltration Trench Example

First Inch: Infiltration Trench



First Inch: Infiltration Swale (Water Quality Swale)



First Inch: Water Quality Swale



- ROADWAY ----

PLAN VIEW



SECTION

First Inch: Swales

Grassed swales can be used along roadsides and parking lots to collect and treat storm water runoff

Developers can eliminate curbs and gutters to disconnect impervious surfaces and promote infiltration of storm water on vegetated areas (such as this grass-lined channel in a residential neighborhood)

First Inch: Swales With Outlet Control



First Inch: Filter Strips



Difference in Pre vs. Post (3b)
Use LID (and Conventional) to Treat the difference in Pre vs Post Runoff volume
In Rural and Transitional use the 2 Year 24 Hour Storm
Everywhere Else, use the 1 Year 24 Hour Storm

- Water Quality Benefit: Added protection for Higher Intensity Development
 - Provides additional LID treatment
 - Provides additional channel protection
 - Phase II Stormwater reg requirement (1 Year 24 Hour)

Hydrograph

Post Development Conditions

Using LID for First 1"

Flow

Control 2 Year –24 Hour1. Further Reduce Peak Flow2. Increase Infiltration

Pre-Development Conditions

Time

BMPs for Use in Huntersville (Tables 6.1 and 6.2, Pages 48 and 49)						
BMP	Applicable Zoning Districts(1)	Applicable Performance Criteria (2)	ApplicableDesignPerformance CriteriaFunction(3)(2)			
Strategic Clearing & Grading	U, T, R	3(a)		WQ, VC, PC		
Reduce Impervious Surfaces	U, T, R	3(a)		WQ, VC, PC		
Bioretention (Rain Garden)	U, T, R	3(a), 3(b)	Section 4.0	WQ, VC, PC		
Infiltration Trench	U, T, R	3(a), 3(b)	Section 8.0	WQ, VC, PC		
Infiltration Swale	U, T, R	3(a), 3(b)	Section 8.0	WQ, VC, PC		
Swales	U, T, R	3(a)	Section 5.0	WQ, VC		
Swales with Outlet Control	T, R	3(a), 3(b)	Section 5.0	WQ, VC, PC		
Vegetative Filter Strips & Buffers	U, T, R	3(a)	Section 7.0	WQ, PC		
Dry Well, Cistern & Rainbarrel	U, T, R	3(b)		WQ, VC, PC		
Porous Paving	U, T, R	3(b)		WQ, VC		
Curb & Gutter Elimination	R	3(b)		WQ, PC		
Rooftop Storage	U, T, R	3(b)		VC, PC		
Wet Pond	U, T, R	3(b), 3(d)	Section 1.0	WQ, VC, PC		
Extended Dry Pond	T, R	3(b), 3(d)	Section 6.0	VC, PC		
Storm Water Wetlands	T, R	3(b)	Section 2.0	WQ, VC, PC		
Sand Filter	T, R	3(a)	Section 3.0	WQ, VC, PC		

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Applicable Zoning Districts: These are the Zoning Districts where the BMP can be used including U = Urban; T = Transitional; R = Rural.

Applicable Performance Criteria: These are the Performance Criteria Section numbers (see Section 3) that the BMP can be used to satisfy.

(3) Design Function: All BMP designs are contained in the N.C. Department of Environment & Natural Resources, Storm Water Best Management Pratices, April 1999

Functions: These are the dominate functions that the BMPs perform including WQ = Water Quality; VC = Volume Control, PC = Peak Control.

TYPICAL DRY WELL



Pre vs Post: Dry Well

Pre vs Post: Rain Barrels



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Pre vs Post: Wet Ponds

ALL MANUES

Pre vs Post: Dry Ponds



Pre vs Post: Wetlands



Drawdown (3c)

- Temporary ponds must drawdown in 48 120 hours
 - Avoid standing water (mosquito breeding)
 - Long term standing water may damage plantings
 - Water Quality Benefit: Ensure water is released slowly
 - Channel Protection
 - Additional sediment protection (settling)

Peak Runoff Rates (3d)

Peak storm water runoff rates shall be controlled for all development above 12% imperviousness (1 dwelling per acre). Mimic the pre-development runoff rate for the 2 Year 24 Hour and 10-Year 24 Hour storms.

Water Quality Benefit: Added channel protection for larger storms. Significant channel damage will be prevented.

Hydrograph Using LID for First 1" Control 2 Year –24 Hour **Mimic Release Rates** Flow **Maintain Pre-Developed Flow Rate** •

Pre-Development Conditions

Time

BMPs for Use in Huntersville (Tables 6.1 and 6.2, Pages 48 and 49)						
BMP	Applicable Zoning Districts(1)	Applicable Performance Criteria (2)	Design Function(3)	Function(4) (WQ, VC, PC)		
Strategic Clearing & Grading	U, T, R	3(a)		WQ, VC, PC		
Reduce Impervious Surfaces	U, T, R	3(a)		WQ, VC, PC		
Bioretention (Rain Garden)	U, T, R	3(a), 3(b)	Section 4.0	WQ, VC, PC		
Infiltration Trench	U, T, R	3(a), 3(b)	Section 8.0	WQ, VC, PC		
Infiltration Swale	U, T, R	3(a), 3(b)	Section 8.0	WQ, VC, PC		
Swales	U, T, R	3(a)	Section 5.0	WQ, VC		
Swales with Outlet Control	T, R	3(a), 3(a)	Section 5.0	WQ, VC, PC		
Vegetative Filter Strips & Buffers	U, T, R	3(a)	Section 7.0	WQ, PC		
Dry Well, Cistern & Rainbarrel	U, T, R	3(b)		WQ, VC, PC		
Porous Paving	U, T, R	3(b)		WQ, VC		
Curb & Gutter Elimination	R	3(b)		WQ, PC		
Rooftop Storage	U, T, R	3(b)		VC, PC		
Wet Pond	U, T, R	3(b), 3(d)	Section 1.0	WQ, VC, PC		
Extended Dry Pond	T, R	3(b), 3(d)	Section 6.0	VC, PC		
Storm Water Wetlands	Т, R	3(b)	Section 2.0	WQ, VC, PC		
Sand Filter	T, R	3(a)	Section 3.0	WQ, VC, PC		

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(4)

Applicable Zoning Districts: These are the Zoning Districts where the BMP can be used including U = Urban; T = Transitional; R = Rural.

Applicable Performance Criteria: These are the Performance Criteria Section numbers (see Section 3) that the BMP can be used to satisfy.

(3) Design Function: All BMP designs are contained in the N.C. Department of Environment & Natural Resources, Storm Water Best Management Pratices, April 1999

Functions: These are the dominate functions that the BMPs perform including WQ = Water Quality; VC = Volume Control, PC = Peak Control.

Drainage Area

No one BMP shall receive runoff from an area greater than five (5) acres. However, the total drainage area from BMPs used in series (i.e., integrated) can exceed this five (5) acre maximum.

 Water Quality Benefit: Redundancy in Stormwater Treatment System
 Encourages LID

Questions?

Site Evaluation Tool



Just the Facts...

Simple" Water Quality and Stormwater Model Microsoft Excel Based Designed as a Planning/Scoping Level Tool Provides Plan Review Staff a Quick Assessment of the Environmental Impact of the Development Requires Developer/Engineer to Evaluate Essential Elements of a Site Early in the Process Soils Ø Drainage

The Need for a Tool

Evaluate Site Designs Provide quick, technically-valid basis for evaluating development impacts easy to use and administer • compare alternative designs Basis for determining compliance with performance criteria

Handling Dispersed BMPs





Site Data Sheet

General Information		
Name of Applicant:		
Name of Project:		
Scenario Name*:		
# Homes on Septic Systems		
Unsewered Commercial Systems (gal/yr)		
Development Site Area (acres):		
Development Site Area (calculated, ft ²):	0	

Group A	
Group B	
Group C	
Group D	

Site Data Sheet

Land Use/Cover Data

	Existing La	and Use	Proposed Land Use		
	Area (ft ²)	% of Site	Area (ft ²)	% of Site	
Pervious Areas					
Row Crops					
Pasture					
Forest					
Wetland					
Meadow					
Lawn					
Impervious Areas					
Residential & Light Industrial					
Rooftops					
Driveways & Parking Lots					
Other Impervious Area					
Road					
Sidewalk					
Commercial & Heavy Industrial				F	
Rooftops					
Parking Lot					
Other Impervious Area					
Road					
Sidewalk					
Storm Water Management Facilities					
Pond/Wetland Surface Area					
Swales/Channels/Infiltration					
Site Totals:	0	0.0%	0	0.0%	
Total Site Impervious Cover ¹					
Impervious Cover within Developed Area ²	N/A		N/A	\	

BMPs

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Proposed Land Use/ Cover Data by DA

Froposed Land Ose/ Cover Data by DA					
	Project	Unassigned	A) a		A) associa
	Areas (ft ²)	Area (ft ²)	DA1	DA2	DA3
Pervious Areas					
Row Crops	0	0			
Pasture	0	0			
Forest	0	0			
Wetland	0	0			
Meadow	0	0			
Lawn	0	0			
Impervious Areas					
Residential & Light Industrial					
Rooftops	0	0			
Driveways & Parking Lots	0	0			
Other Impervious Area	0	0			
Road	0	0			
Sidewalk	0	0			
Commercial & Heavy Industrial					
Rooftops	0	0			
Parking Lot	0	0			
Other Impervious Area	0	0			
Road	0	0			
Sidewalk	0	0			
Storm Water Management Facilities					
Pond/Wetland Surface Area	0	0			
Swales/Channels/Infiltration	0	0			
Total Area	0	0			

BMPs

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BMPs Applied to DA	DA1	DA2	DA3
Wet Pond			
Dry Pond			
Wetland			
Surface Sand Filter			
Bioretention			
Water Quality Dry Swale			
Grass Channels			
Infiltration			
User-defined BMP (Sequential with other assigned BMPs)			
Stream Buffer			
Enter Buffer Width for each DA with Stream Buffer (feet):			50
Percent of DA within treatment zone (150' + buffer width)			56.0%
Storage volume for 2 yr, 24 hr storm (acre-ft)	1.376		

Net Reductions	DA1	DA2	DA3
Flow converted to infiltration by BMPs	35.0%	0.0%	5.6%
Total Nitrogen	67.8%	25.0%	17.3%
Total Phosphorus	80.6%	19.0%	21.5%
TSS	93.1%	47.0%	34.6%
Fecal Coliform	97.8%	78.0%	2.8%

User-Defined BMPs

	Example		
	BMP Name:	Organic San	d Filter
Infiltration	Annual flow converted to infiltr	ation (percent)	0%
Removal		Total N	35%
Efficiencies		Total P	40%
(ac parcont)		TSS	95%
(as percent)		Fecal Coliform	0%

Example Documentation

Organic Sand Filters are similar to surface sand filters except they use compost or peat/sand as the filter media. The treated water filters through the media and is collected through perforated pipes in an underlying gravel bed. The runoff is directed to an outlet. A impermeable liner prevents movement of the treated water into groundwater. Source: Claytor, R.A. and T.R. Schueler. 1996. Design of Stormwater Filtering Systems. Center for Watershed Protection. Ellicott City, MD.

Model Output - Hydrology

Total Site Area (acres)	17.1
Pre-development impervious percentage	1.0%
Post-development impervious percentage	37.2%

	Annual Hydrology Summary		
	Existing	Design	Design
	Landuse	<u>without BMPs</u>	<u>with BMPs</u>
Annual Surface Runoff (inches/yr)	2.32	15.29	10.35
Annual Infiltration (inches/yr)	12.00	6.41	11.35

2-year, 24-hour Storm Event Runoff Volume Summary



Storm Event Runoff Volume (acre-ft)		
Existing Landuse	0.49	
Design without BMPs	1.77	
2-yr, 24-hr BMP Storage	1.376	
Target Storage ¹	1.27	
Meets Goal?	Yes	

Model Output – Pollutant Loading





BMPs Meet Sediment Load Reduction and Runoff Control Targets

