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Approaches to “Reducing” the WQv and CPv

Vermont Stormwater Management Manual Update, Meeting #3

Shelburne, Vermont Town Office

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STONE ENVIRONMENTAL INC

Horsley Witten Group
Sustainable Environmental Solutions

Adamant Accord
Meeting Facilitation and Mediation Services

Agenda

- Determining the reduction target
- Evaluating progress toward meeting the reduction target
- Where does this leave things with respect to the CPv?

Goals

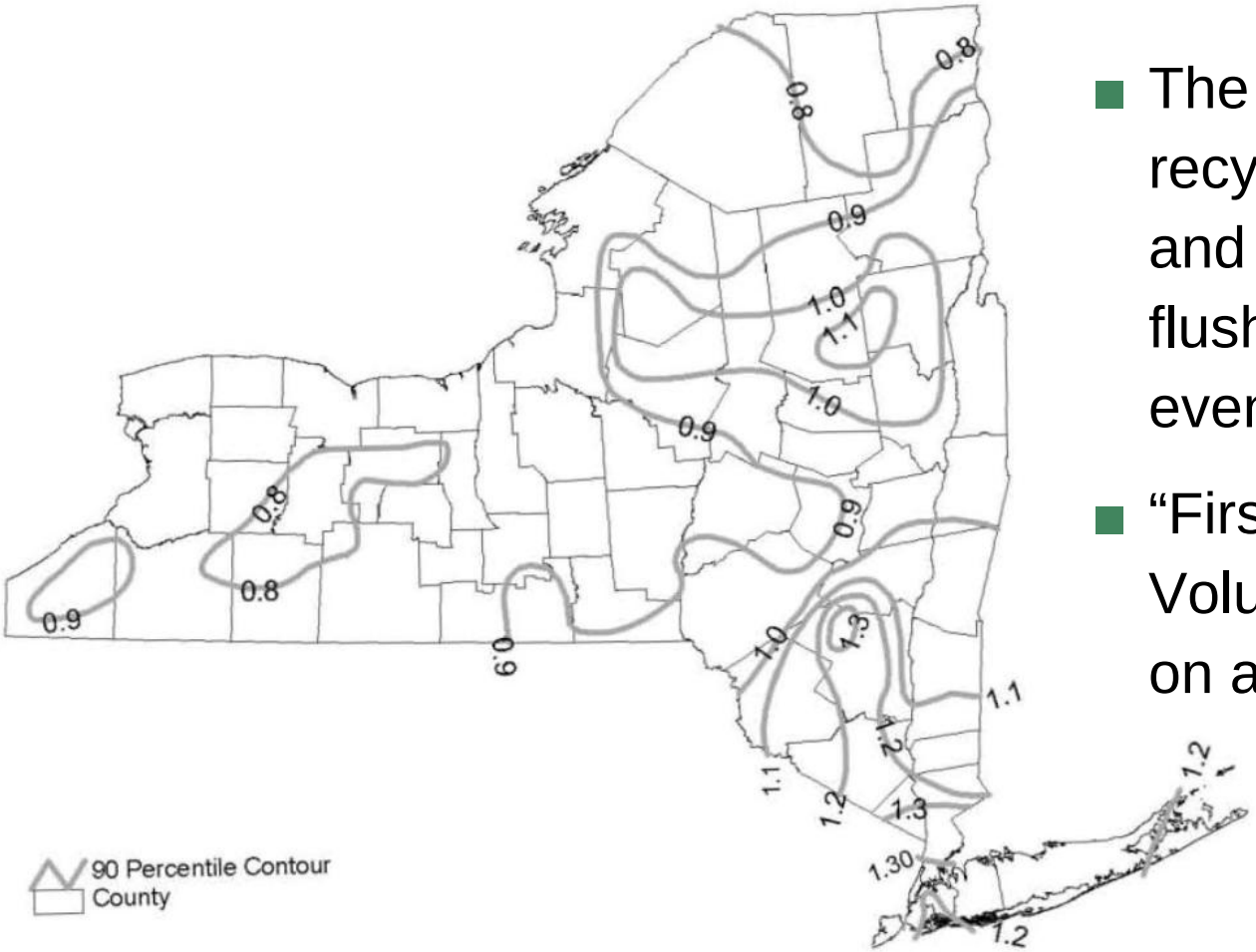
- Mimic predevelopment hydrology
- Maximize the use of non-structural practices
- Promote infiltration and evapotranspiration
- Practical and economical to apply and administer

Determining the “Reduction” Target

- New York
- Maryland
- Nashville

New York's Reduction Target

Figure 4.1 90% Rainfall in New York State (NYSDEC, 2000)



- The infiltration, reuse, recycling, evapotranspiration, and evaporation of the "first flush" of runoff during a rainfall event
- "First flush" = Water Quality Volume = 90% of all the runoff on a site = 0.8 to 1.3 inches

New York's Reduction Target, cont.

Table 4.1 New York Stormwater Sizing Criteria[1]	
Water Quality Volume (WQv)	**90% Rule:** WQ_v(acre-feet) = [(P)(Rv)(A)] /12 Rv = 0.05+0.009(I) I = Impervious Cover (Percent) Minimum Rv = 0.2 if WQv > RRv P(inch) = 90% Rainfall Event Number (See Figure 4.1)[2] A = site area in acres
Runoff Reduction Volume(RRv)	RRv (acre-feet)= Reduction of the total WQv by application of green infrastructure techniques and SMPs to replicate pre-development hydrology. The minimum required RRv is defined as the Specified Reduction Factor (S), provided objective technical justification is documented.
Channel Protection Volume(Cpv)	**Default Criterion:** Cp_v(acre-feet)= 24 hour extended detention of post-developed 1-year, 24-hour storm event; remaining after runoff reduction. Where site conditions allow, Runoff reduction of total CPv , is encouraged **Option for Sites Larger than 50 Acres:** Distributed Runoff Control - geomorphic assessment to determine the bankfull channel characteristics and thresholds for channel stability and bedload movement.
Overbank Flood (Q_p)	Q_p(cfs)=Control the peak discharge from the 10-year storm to 10-year predevelopment rates.
Extreme Storm (Q_f)	Q_f(cfs)=Control the peak discharge from the 100-year storm to 100-year predevelopment rates. Safely pass the 100-year storm event.
Alternative method (WQv):	Design, construct, and maintain systems sized to capture, reduce, reuse, treat, and manage rainfall on-site, and prevent the off-site discharge of the precipitation from all rainfall events less than or equal to the 95th percentile rainfall event, computed by an acceptable continuous simulation model.

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What Might RRv for Vermont Look Like?

- Essentially the same…
  - If we go this route, may want to use a single value (WQv = 1 inch, etc.) until NOAA Atlas 15 arrives

Maryland’s Reduction Target

- Environmental Site Design, or ESD, approach means "using small-scale stormwater management practices, nonstructural techniques, and better site planning to mimic natural hydrologic runoff characteristics and minimize the impact of land development on water resources”
- Reduction target is based on capturing and retaining enough rainfall so that the runoff leaving a site is equivalent to a wooded site in good condition
  - Site imperviousness and soil conditions are used to determine a rainfall target for sizing ESD practices
  - Calculated using TR-55
- Reduced runoff curve number (RCN) may be applied to post-development conditions when ESD practices are used

Maryland's Reduction Target

- If the rainfall target cannot be met using ESD practices, a reduced RCN for calculating additional stormwater management requirements is calculated as follows (P_E = 1 inch):

ESD Sizing Requirements:

P_E = Rainfall Target

Q_E = Runoff depth in inches that must be treated using ESD practices
= $P_E \times R_v$; R_v = the dimensionless volumetric runoff coefficient
= 0.05 + 0.009(I) where I is percent impervious cover

ESD_v = Runoff volume (in cubic feet or acre-feet) used in the design of specific ESD practices

$$= \frac{(P_E)(R_v)(A)}{12}$$ where A is the drainage area (in square feet or acres)

What Might ESD for Vermont Look Like?

- Essentially the same…

Nashville's Reduction Target

- The basis for the reduction target is a rainfall volume (1") capture goal; designed to fulfill several complimentary objectives:
  - Reflect local hydrologic and land conditions;
  - Encourage and incentivize the use of natural solutions;
  - Be consistent with the MS4-mandated TSS pollutant capture goal; and
  - Provide an approach that is simple and effective for a range of development projects.
- Target rainfall event is to be captured and treated on site through a combination of infiltration, evapotranspiration, harvest and/or reuse
- Reduction target is backed by specific volume-capture standards for structural controls and rainfall intensity scaled runoff coefficients for other land uses

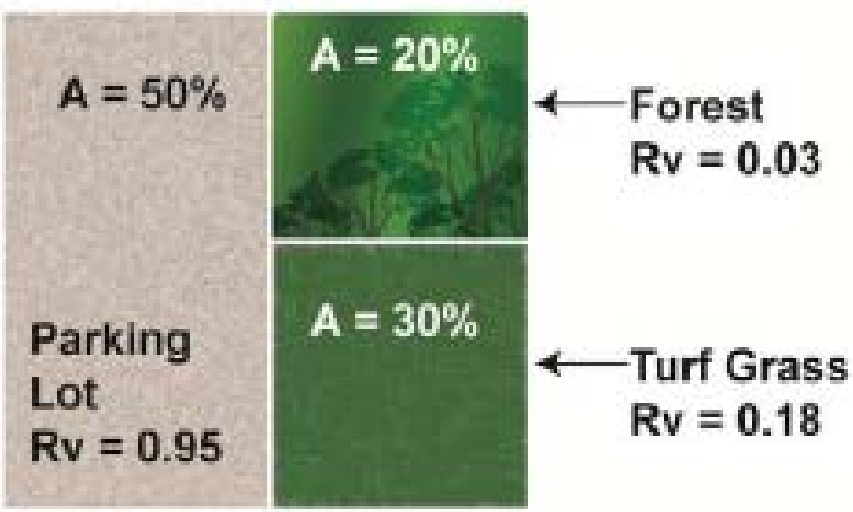
Nashville's Reduction Target

- A single volumetric runoff coefficient, Rv - which is the percentage of fallen precipitation that runs off of a specific land use area - was selected for the metro area
  - Rv is used to compare a site's post-development runoff volume for storms in the one-inch or larger range to pre-development conditions
  - In Nashville, an Rv value of 0.20 generally indicates the capture of the first inch of rainfall

Nashville's Reduction Target

- Each land use is assigned an Rv value, which is aerially-weighted in calculating the Rv for a site
  - If the weighted Rv for the whole site is 0.20 or less, the standard is met
  - If the Rv standard has not been met, Green Infrastructure Practices (GIPs) required to capture the remaining volume are added to the design.

$$\text{Weighted } R_V = [(R_{V1} * A_1) + (R_{v2} * A_2) + \cdots]/(A_1 + A_2 + \cdots)$$



  - Projects that cannot meet this standard are required to treat stormwater for 80% TSS removal

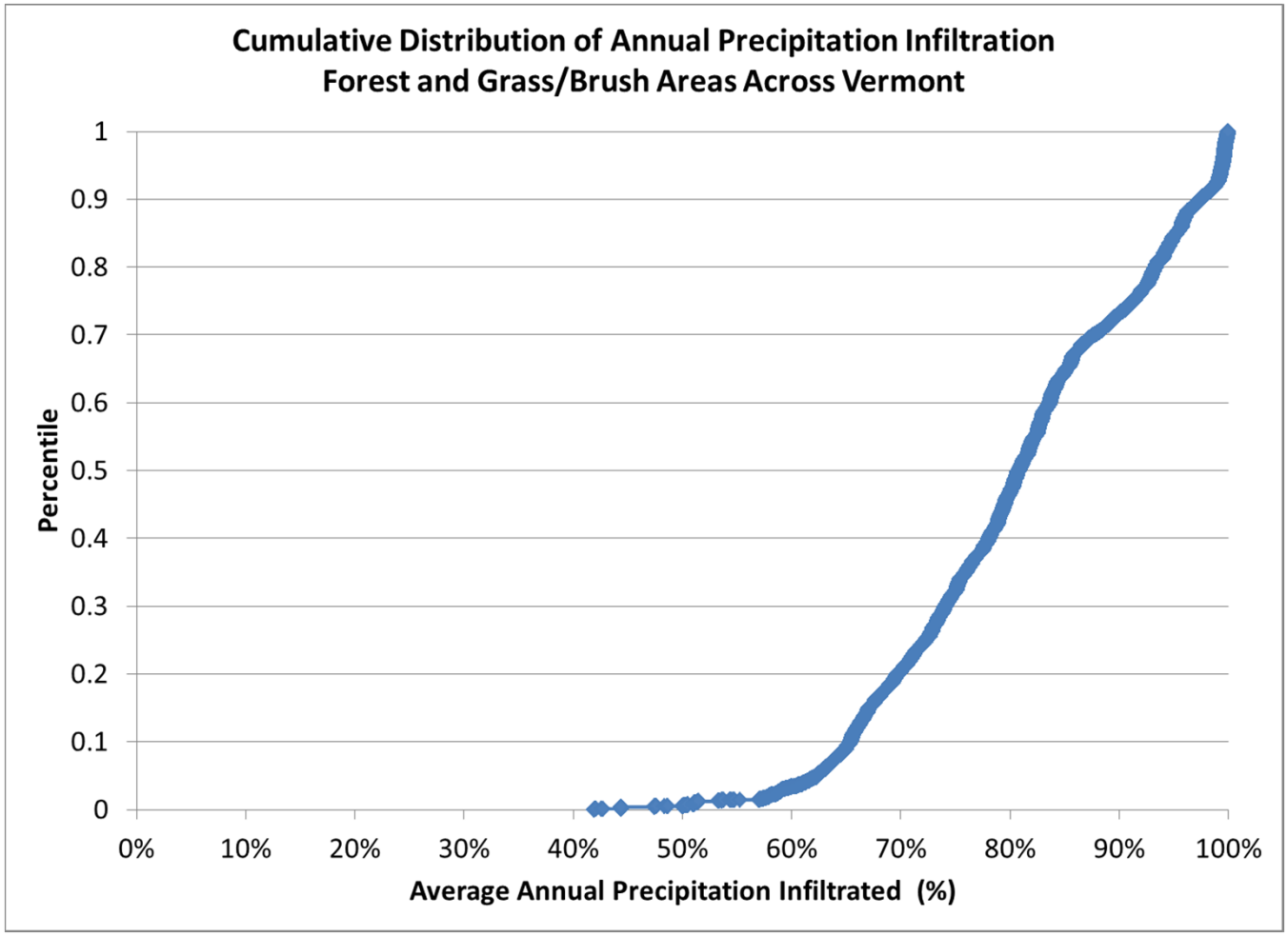
What Would Rv for Vermont Look Like?

- The SWAT Model was run for the entire state of Vermont; land use was classified based on the 2006 NLCD.
- Land use classes were simplified into:
  - Forest: (deciduous, evergreen, and mixed)
  - Grass/Brush; (shrub, grassland/herbaceous, pasture/hay, cropland)
  - Other: All other NLCD classes
- Historical weather statistics from a database of 129 different weather stations were used as precipitation inputs to the model.
- The model run was for a 10-year daily simulation using synthetic daily rainfall and temperature based on the historical statistics.
- The fraction of annual precipitation that infiltrates was calculated as:

1 – (surface runoff / precipitation)

Analysis of Results: Variability in Infiltration Fraction Results

- The infiltration fraction of total annual precipitation, averaged over the 10-year simulation over all Forest and Grassland, was found to be 81%
- However, over all the Forest and Grassland land units evaluated, the infiltration fraction varied from 42% to 100%



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Analysis of Results: Potential Grouping of Expected Infiltration Fractions

- The expected infiltration fractions can be categorized based on land use, soil, or annual precipitation.
- When grouped according to land use only, forest shows slightly higher infiltration:

Land use	Infiltration (%)
Forest	85.5%
Grass/Brush	75.6%

- When further grouped according to soil (hydrologic group), the dependence of infiltration on soil type is evident:

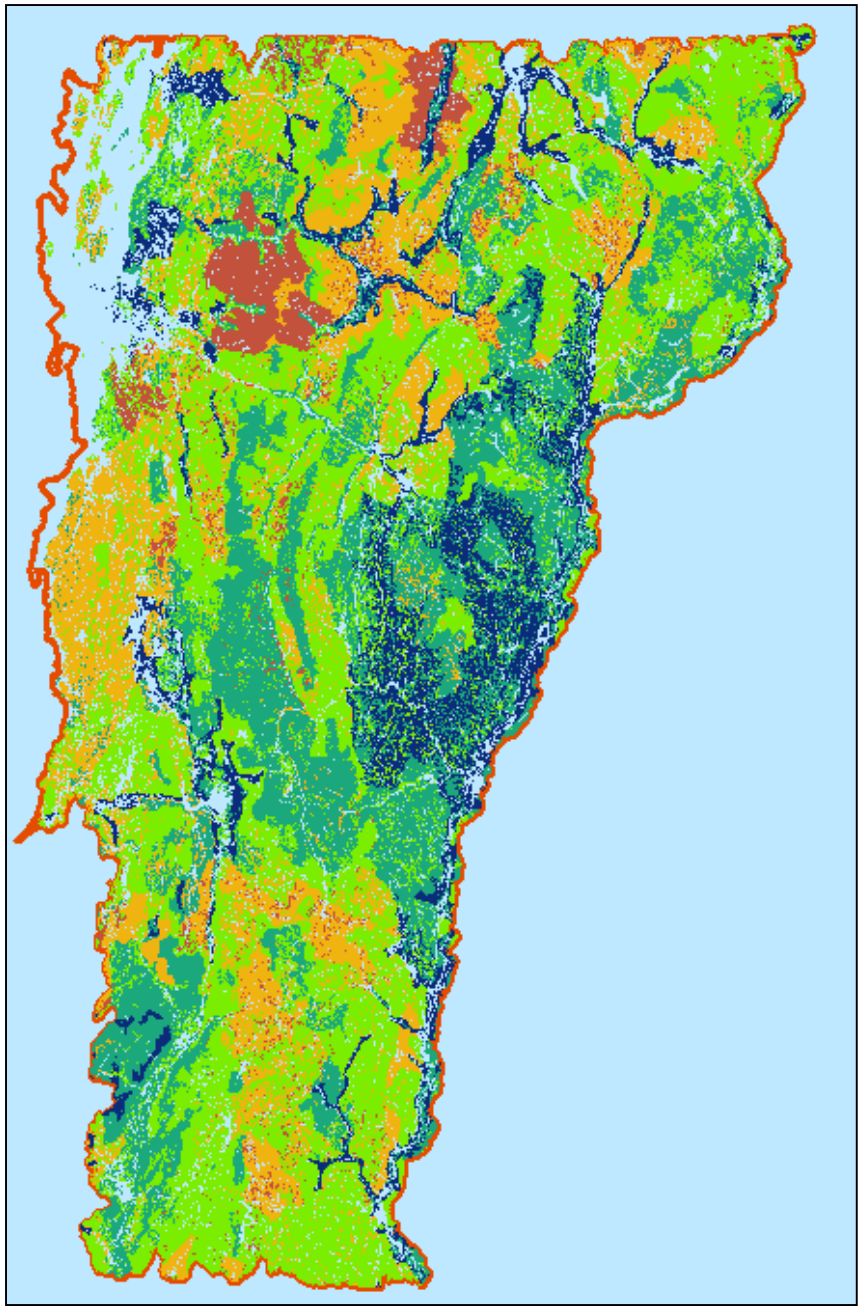
Land use	HYDGRP	Infiltration (%)
Forest	A	99.1%
Forest	B	91.3%
Forest	C	79.9%
Forest	D	78.6%
Grass/Brush	A	94.5%
Grass/Brush	B	80.7%
Grass/Brush	C	67.7%
Grass/Brush	D	67.9%

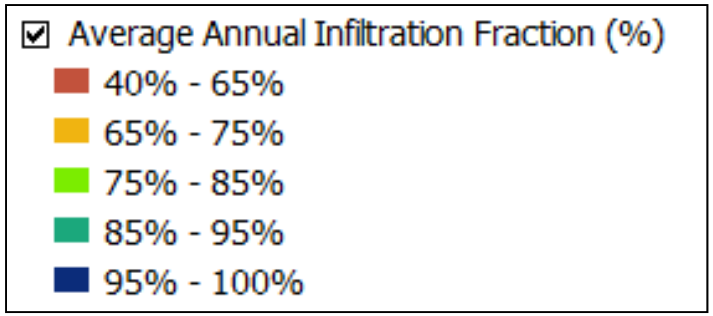
Analysis of Results: Potential Grouping of Expected Infiltration Fractions, Cont.

- Preliminary analysis suggests that the expected infiltration fraction is best explained by a combination of land use, soil hydrologic group, and annual precipitation.
- The table at right compares infiltration fractions for HSG B and C soils for the different land uses and precipitation.
- Within a given land use and soil type, variability in the infiltration fraction is heavily influenced by annual precipitation (or size of rainfall events).

Land Use	HYDGRP	Annual Precip. (mm)	Infiltration (%)
Forest	B	750 - 1000	92.6%
Forest	B	1000 - 1250	89.4%
Forest	B	> 1250	85.1%
Forest	C	750 - 1000	83.7%
Forest	C	1000 - 1250	77.7%
Forest	C	> 1250	67.1%
Grass/Brush	B	750 - 1000	81.9%
Grass/Brush	B	1000 - 1250	78.7%
Grass/Brush	B	> 1250	71.7%
Grass/Brush	C	750 - 1000	70.9%
Grass/Brush	C	1000 - 1250	65.5%
Grass/Brush	C	> 1250	56.1%

Analysis of Results: Mapping Infiltration Potential Geographically





- SWAT model analysis of mean annual precipitation infiltration fraction can be classified and mapped back to the locations of the landscape that are expected to exhibit those characteristics.

Evaluating Progress Toward Meeting the Reduction Target

- New York
- Maryland
- Nashville

New York: RRv Requirements

- GI planning practices are to be employed “to the Maximum Extent Practicable”
- RR target is to reduce 100% of the WQv**
- Projects that cannot meet target must provide a justification that evaluates each GI technique and identifies specific limitations

New York: RRv Minimums

This pilot wet meadow and infiltrating bioswale facility at Spring Creek MTA Bus Terminal in NYC is retaining 100% of measured inflow for storm depths up to 4 inches.
www.nyc.gov/html/dep/html/stormwater/gi_pilot_monitoring_report.shtml

1. Reduce the WQv by:
   - 55% on A soils
   - 40% on B soils
   - 30% on C soils
   - 20% on D soils
   - Weighted average of above
2. Provide treatment for all of the (remaining) WQv

Treatment practices can be oversized to provide additional RRv (up to 100% of initial size or 100% of WQv)

New York: Stormwater Site Planning and Practice Selection Process

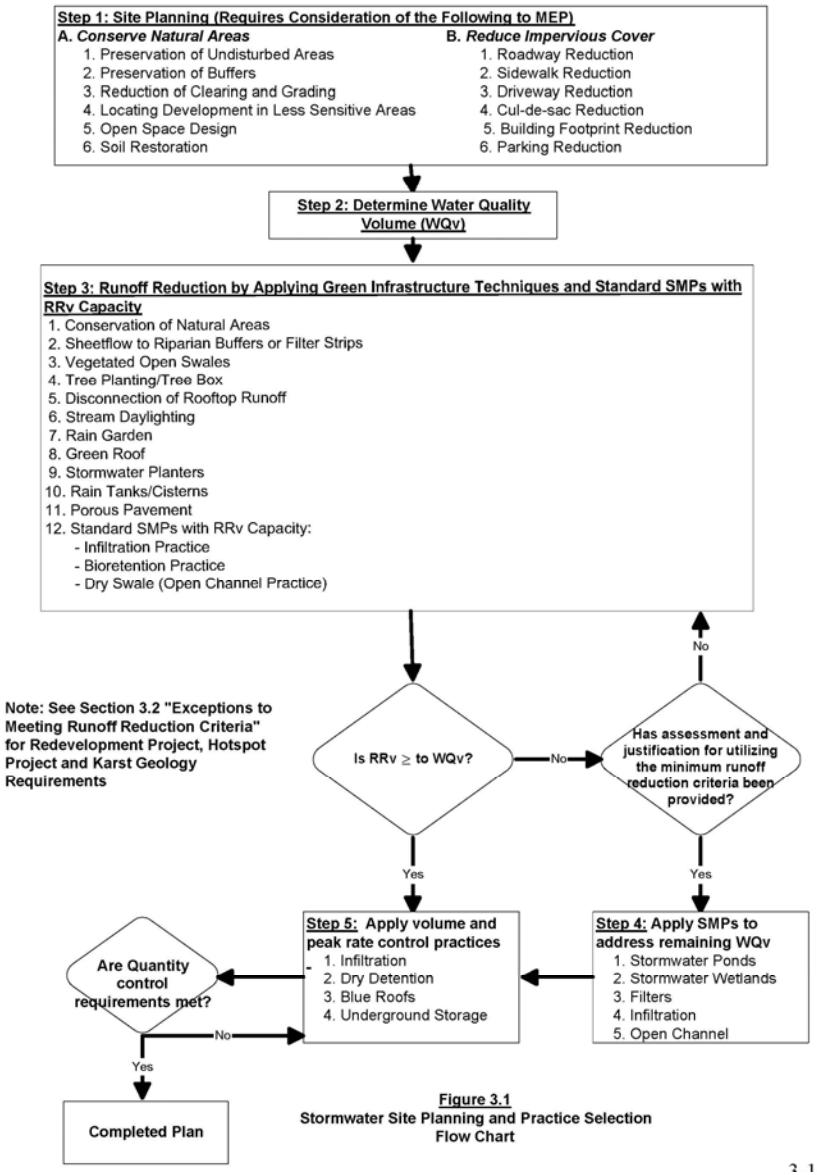


Figure 3.1
Stormwater Site Planning and Practice Selection Flow Chart

1. Site Planning to M.E.P.
2. Calculate Water Quality Volume
3. Apply Runoff Reduction Practices and compute RRv.
4. Subtract RRv from WQv.
5. Apply "Standard" Treatment Practices for remaining, non-reduced WQv.
6. Apply Quantity Control Practices

New York: RRv Accounting Spreadsheet Tool

Click to add header

Runoff Reduction Volume and Treated volumes						
	Runoff Reduction Techiques/Standard SMPs		Total Contributing Area (acres)	Total Contributing Impervious Area (acres)	WQv Reduced (RRv) cf	WQv Treated cf
Area/Volume Reduction	Conservation of Natural Areas	RR-1	0.00	0.00		
	Sheetflow to Riparian Buffers/Filter Strips	RR-2	0.00	0.00		
	Tree Planting/Tree Pit	RR-3	0.00	0.00		
	Disconnection of Rooftop Runoff	RR-4		0.00		
	Vegetated Swale	RR-5	0.00	0.00	0	
	Rain Garden	RR-6	0.00	0.00	0	
	Stormwater Planter	RR-7	0.00	0.00	0	
	Rain Barrel/Cistern	RR-8	0.00	0.00	0	
	Porous Pavement	RR-9	0.00	0.00	0	
	Green Roof (Intensive & Extensive)	RR-10	0.00	0.00	0	
Standard SMPs w/RRv Capacity	Infiltration Trench	I-1	0.00	0.00	0	0
	Infiltration Basin	I-2	0.00	0.00	0	0
	Dry Well	I-3	0.00	0.00	0	0
	Underground Infiltration System	I-4	0.00			
	Bioretention & Infiltration Bioretention	F-5	0.00	0.00	0	0
	Dry swale	O-1	0.00	0.00	0	0
Standard SMPs	Micropool Extended Detention (P-1)	P-1				
	Wet Pond (P-2)	P-2				
	Wet Extended Detention (P-3)	P-3				
	Multiple Pond system (P-4)	P-4				
	Pocket Pond (p-5)	P-5				
	Surface Sand filter (F-1)	F-1				
	Underground Sand filter (F-2)	F-2				
	Perimeter Sand Filter (F-3)	F-3				
	Organic Filter (F-4	F-4				
	Shallow Wetland (W-1)	W-1				
	Extended Detention Wetland (W-2	W-2				
	Pond/Wetland System (W-3)	W-3				
	Pocket Wetland (W-4)	W-4				
	Wet Swale (O-2)	O-2				
Totals by Area Reduction →			0.00	0.00	0	
Totals by Volume Reduction →			0.00	0.00	0	
Totals by Standard SMP w/RRV →			0.00	0.00	0	0
Totals by Standard SMP →			0.00	0.00		0
Totals (Area + Volume + all SMPs) →			0.00	0.00	0	0
	Impervious Cover √	okay				

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Total WQv Calculation | WQv Calculation - Subtotal | Catchment Summary Table | Summary Table | minimum RRv | NOI QUESTIONS | Planning | Bioretention | Cistern-Rainbarrel | Conservation of Natural Areas

Ready | Page: 1 of 2 | 70%

Maryland ESD Requirements

- ESD is to be implemented to the "maximum extent practicable to mimic pre-development conditions"
- At a minimum, ESD shall be used to address both REv and WQv requirements
  - May involve an iterative process to investigate more ESD options, including adjusting site layout to reduce IC or increase forest cover

Table 3. ESD Implementation Checklist			
Check all of the Following ESD Practice That Were Implemented at Site	Yes	No	N/A
1. Environmental site mapping was conducted prior to site layout			
2. Natural areas were conserved (e.g., forests, wetlands, steep slopes)			
3. Stream, wetland and shoreline buffers were reserved			
4. Disturbance of permeable soils was minimized			
5. Natural flow paths were maintained across the site			
6. Building layout was fingerprinted to reduce site clearing/grading			
7. Site grading promoted sheet flow from impervious areas to pervious ones			
8. Better site design was used to reduce needless impervious cover			
9. Site Design maximized disconnection of impervious cover			
10. Future site operations evaluated to identify potential stormwater hotspot			
11. Installation of ESC and ESD Practices are integrated together			
12. Tree planting was used at the site to convert turf areas into forest			

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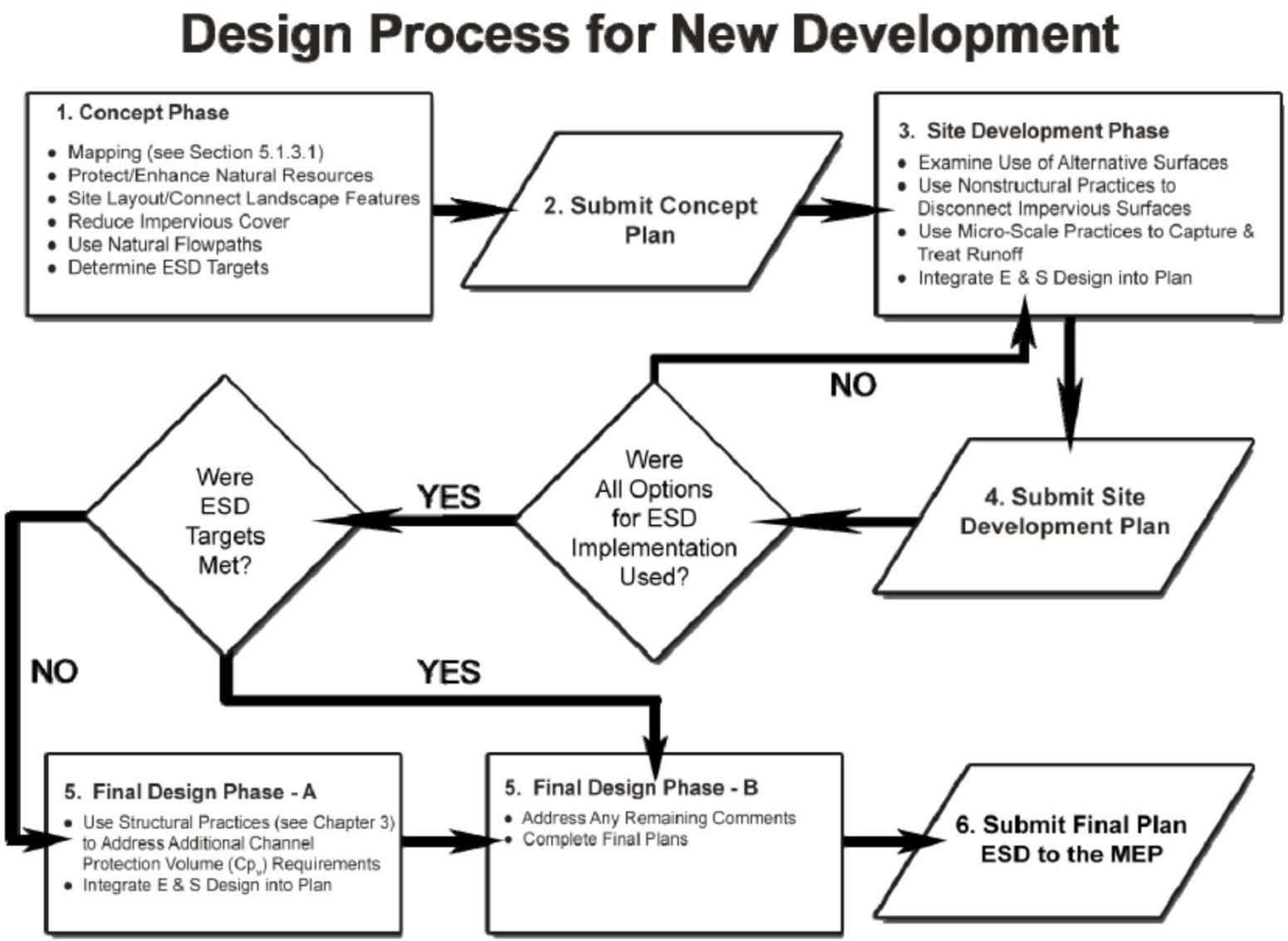
Maryland: Stormwater Site Planning and Practice Selection Process



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Maryland: ESD Compliance Spreadsheet Tool

Step 4: Calculate Environmental Site Design (ESD) Rainfall Target, P_E

% Soil Type A	0%
% Soil Type B	0%
% Soil Type C	0%
% Soil Type D	0%

Pre-Developed Condition, RCN_{woods}	0

Soil Type A ESD Rainfall Target, P_E (in)	0.00
Soil Type B ESD Rainfall Target, P_E (in)	0.00
Soil Type C ESD Rainfall Target, P_E (in)	0.00
Soil Type D ESD Rainfall Target, P_E (in)	0.00

Maximum P_E (in)	2.7

Site ESD Rainfall Target, P_E (in)	0.00

ESD Runoff Depth, Q_E (in)	0.00

ESD Runoff Volume, ESDv (cf)	**0**

Total Treatment Volume (cf)	**0**

Maryland: ESD Compliance Spreadsheet Tool

Select Micro-Scale Practices to Treat the ESD Rainfall Target

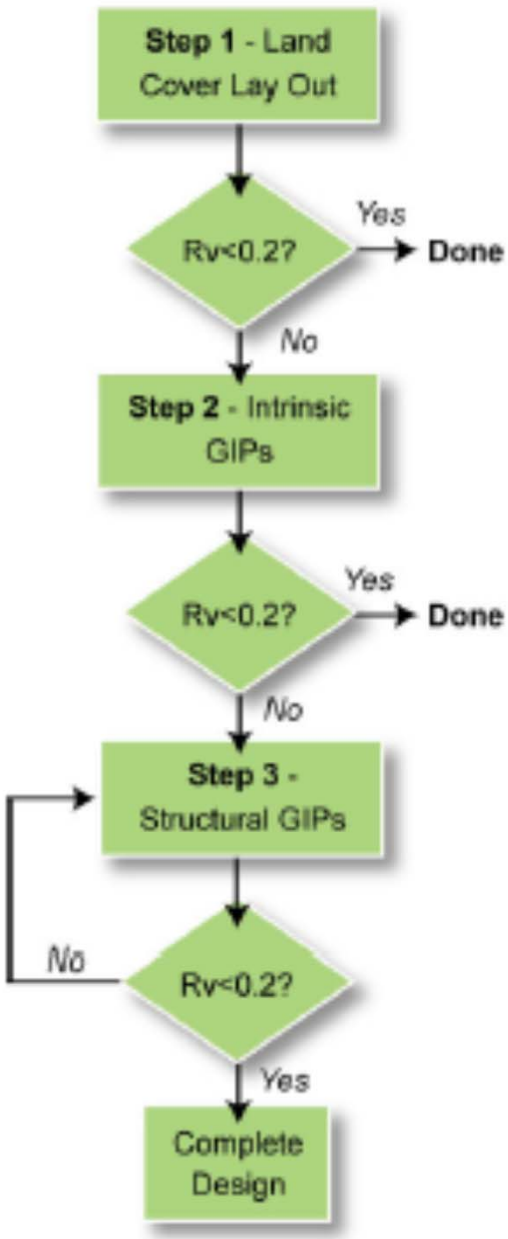
Micro-Scale Practices	P_E Credit Description	Contributing Drainage Area (sf)	Direct ESDv Received by Practice (cf)	WQv or ESDv from Up-Gradient Practices (cf)	WQv or ESDv credit (cf)	Runoff Volume Remaining (cf)
Green Roof (Level 1)	ESDv credit is based on roof thickness	0	0	N/A	0	0
Green Roof (Level 2)	ESDv credit is based on roof thickness	0	0	N/A	0	0
Pemeable Pavement (A Soils)	ESDv credit is based on subbase thickness	0	0	N/A	0	0
Pemeable Pavement (B Soils)	ESDv credit is based on subbase thickness	0	0	N/A	0	0
Pemeable Pavement (C Soils)	ESDv credit is based on subbase thickness	0	0	N/A	0	0
Rainwater Harvesting	ESDv credit is based on design storage volume and annual use	0	0	0	0	0
Submerged Gravel Wetlands	ESDv credit is based on design storage volume	0	0	0	0	0
Micro-Infiltration	ESDv credit is based on design storage volume	0	0	0	0	0
Rain Gardens (A/B Soils)	ESDv credit is based on design storage volume	0	0	0	0	0
Rain Gardens (C/D Soils)	ESDv credit is based on design storage volume	0	0	0	0	0
Micro-Bioretention (A/B Soils)	ESDv credit is based on design storage volume	0	0	0	0	0
Micro-Bioretention (C/D Soils)	ESDv credit is based on design storage volume	0	0	0	0	0
Landscape Infiltration	ESDv credit is based on design storage volume	0	0	0	0	0
Grass Swales (A/B Soils)	ESDv credit is based on design storage volume	0	0	0	0	0
Grass Swales (C/D Soils)	ESDv credit is based on design storage volume	0	0	0	0	0
Bio-swales (A/B Soils)	ESDv credit is based on design storage volume	0	0	0	0	0
Bio-swales (C/D Soils)	ESDv credit is based on design storage volume	0	0	0	0	0
Wet Swales	ESDv credit is based on design storage volume	0	0	0	0	0

Nashville: Rv Approach

- Conserve natural features and resources
  - Includes building upon the least porous soils or limiting construction activities to previously disturbed soils
- Minimize soil compaction
- Manage stormwater close to the source
  - Infiltrate stormwater as soon as possible instead of concentrating and routing flow
- Reduce and disconnect impervious

Nashville: Stormwater Site Planning and Practice Selection Process

- Reduce runoff through land use and ground cover decisions
  - Focuses on “background” land cover and how much rainfall it removes from runoff – retention of forest and vegetative cover, natural areas and undisturbed soils
- Apply ESD practices
  - Implementation of “more intrinsic” GSI practices such as: downspout disconnection, sheet flow, grass channels and planned reforestation
- Apply structural GSI practices
  - Practice effectiveness expressed in terms of percent volume reduction



Nashville: Rv Accounting Spreadsheet Tool

	Basic Land Use Category	Land Use	Lookup Table Code	Rv	R Credit	CN
Step 1 Basic Land Use	Basic Land Use	Impervious Surface	IA	0.95	0.05	98
		Forest A Soil	FA	0.02	0.98	36
		Forest B Soil	FB	0.03	0.97	60
		Forest C Soil	FC	0.04	0.96	73
		Forest D Soil	FD	0.05	0.95	79
		Turf A Soil	TA	0.15	0.85	49
		Turf B Soil	TB	0.18	0.82	69
		Turf C Soil	TC	0.2	0.8	79
		Turf D Soil	TD	0.23	0.77	84
Step 1a Modified Land Use	Permeable Pavement	Level 1	P1	0.55	0.45	98
		Level 2	P2	0.25	0.75	98
	Reforestation	A	RA	0.04	0.96	45
		B	RB	0.06	0.94	66
		C	RC	0.08	0.92	77
		D	RD	0.1	0.9	83
		A Amended	RAA	0.02	0.98	30
		B Amended	RBA	0.03	0.97	55
		C Amended	RCA	0.04	0.96	70
		D Amended	RDA	0.05	0.95	77
	Green Roof	1	G1	0.2	0.8	86
		2	G2	0.1	0.9	86

	GI Practice	Level	Lookup Table Code	R Credit	Rv	Tv Multiplier
Step 2 Intrinsic GIPs	Downspout Disconnection	A/B Soil	DAB	0.5	0.5	0.00
		C/D Soil	DCD	0.25	0.75	0.00
		Amended	DAS	0.5	0.5	0.00
	Sheet Flow	Cons Area A/B	SAB	0.75	0.25	0.00
		Cons Area C/D	SCD	0.5	0.5	0.00
		Strip A	SA	0.5	0.5	0.00
		Strip Amended	SAS	0.5	0.5	0.00
Step 3 & 3a Structural GIPs	Permeable Pavement (see Notes below)	1	P1	0.45	0.55	1.00
		1 (P1 Land Use)	PP1	0	1	1.00
		2 (No Run on)*	P2	0	1	1.10
	Grass Channel	A/B Soil	GAB	0.2	0.8	0.00
		C/D Soil	GCD	0.1	0.9	0.00
		A/B Amended	GAA	0.4	0.6	0.00
		C/D amended	GCA	0.2	0.8	0.00
	Biorentention/ Rain Garden	1	B1	0.6	0.4	1.00
		2	B2	0.8	0.2	1.25
	Water Quality Swales	1	S1	0.4	0.6	1.00
		2	S2	0.6	0.4	1.10
	Infiltration Trench	1	I1	0.5	0.5	1.00
		2	I2	0.9	0.1	1.10
	Urban Bioretention	1	UB	0.6	0.4	1.00
	Ext Detention Pond		D1	0.15	0.85	0.00
	Cistern		CIS	0.01	0.99	1.00

Notes for Permeable Pavement

1. Choose PP1 in Structural GIP for actual area of the Level 1 Permeable Pavement, otherwise use P1 for run-on areas.
2. Level 2 Permeable Pavement cannot have run-on, therefore P2 can only be chosen as Structural GIP for Modified Land Use of P2

Text in Column AC will turn red if these conditions are not met.

Where Does This Leave Things with Respect to the CPv?

- New York
- Maryland
- Nashville

How did we arrive at CPv in the first place?

- Lots of research on stream geomorphic processes was underway in the late-1990s.
- At the same time, there was a push to reconsider 2-year peak rate control to address concerns over channel scour
- Proposed approach - CPv: overcontrol of the bankfull storm to reduce stream flows below erosive velocities

- As we evaluate different runoff reduction approaches, it appears that we need to infiltrate something bigger than the WQv, but probably not as big as the CPv
  - Focus on the threshold for runoff under natural conditions

Currently in Vermont, WQv as % of 24-hour CPv Storage

% Impervious	HydroGroup			
	A	B	C	D
0	no CPV	361%	69%	43%
5	no CPV	245%	63%	41%
10	no CPV	179%	58%	38%
15	no CPV	138%	50%	35%
20	no CPV	127%	48%	34%
25	2688%	123%	54%	38%
30	1285%	118%	58%	45%
35	734%	113%	62%	48%
40	450%	108%	61%	51%
45	320%	103%	64%	53%
50	248%	98%	66%	55%
55	220%	99%	67%	56%
60	182%	94%	68%	57%
65	154%	89%	65%	58%
70	133%	84%	66%	59%
75	115%	79%	66%	59%
80	101%	75%	66%	63%
85	89%	74%	66%	63%
90	79%	70%	63%	63%
95	70%	66%	62%	62%
100	62%	62%	62%	62%

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New York: CPv

- Any RRv achieved can be deducted from ALL quantity controls (CPv, overbank and extreme)

Maryland: CPv

Hydrologic Soil Group C										
%I	RCN*	P_E = 1"	1.2"	1.4"	1.6"	1.8"	2.0"	2.2"	2.4"	2.6"
0%	74									
5%	75									
10%	76									
15%	78									
20%	79	70								
25%	80	72	70	70						
30%	81	73	72	71						
35%	82	74	73	72	70					
40%	84	77	75	73	71					
45%	85	78	76	74	71					
50%	86	78	76	74	71					
55%	86	78	76	74	71	70				
60%	88	80	78	76	73	71				
65%	90	82	80	77	75	72				
70%	91	82	80	78	75	72				
75%	92	83	81	79	75	72				
80%	93	84	82	79	76	72				
85%	94	85	82	79	76	72				
90%	95	86	83	80	77	73	70			
95%	97	88	85	82	79	75	71			
100%	98	89	86	83	80	76	72	70		

Cp_v Addressed (RCN = Woods in Good Condition)

RCN Applied to Cp_v Calculations

Maryland

- The ultimate goal is to provide enough treatment using ESD practices to address Cpv requirements by replicating an RCN for woods in good condition for the 1-year rainfall event. This eliminates the need for structural practices.

Nashville: CPv

- Streams in Nashville are generally stable and bedrock controlled, therefore the is no CPv standard
- Nashville manual includes approach for calculating a adjusted curve number with volume removed for flow control practices that could also be applied to CPv
  - The adjusted runoff depth is the difference between the original total runoff depth and the depth captured by the stormwater management practices:

$$Q_{adj} = Q - \frac{12 * T_v}{43560 * CDA}$$

Nashville: CPv

- The adjusted runoff can the be used to calculate a modified curve number:

$$CN_{adj} = \frac{1000}{10 + 5P + 10Q_{adj} - 10\left(Q_{adj}{}^{2} + 1.25Q_{adj}P\right)^{1/2}}$$

- The adjusted CN can then be used in routing calculations for the CPv (1-year, 24-hour) design storm

What Are the Strengths/Weaknesses?

	New York (RRv)	Maryland (ESD)	Nashville (Rv)
Promotes infiltration?	YES	YES	YES
Promotes soil restoration?	YES includes penalty	SOME overlay plan identifies areas for rehabilitation	YES counts toward Rv
Promotes reforestation?	SOME targets riparian areas	SOME CN focused on IC; cons. area practice	YES
Accounts for rainfall variation?	YES includes isohyet map	NO based on TR-55 CN	YES w/ modification
Ease of application	Fairly difficult	Very difficult	Fairly straightforward
Could be readily applied in Vermont?	YES	YES	YES
Runoff target could be used/adjusted to meet CPv?	YES, but challenging on HSG C/D	YES, but challenging on HSG C/D	POSSIBLY

Where Does This Leave Us?

- Back to our goals, and in particular:
  - Mimic predevelopment hydrology
  - Promote infiltration and evapotranspiration
- Determine site-specific runoff target based on Rv or CN for “woods in good hydrologic condition” and soil condition
  - Employ NY’s one HSG penalty for failing to restore soils
  - Offer one HSG credit for amending HSG C/D soils
  - Promote disconnection to HSG A/B and amended soils
  - Promote reforestation by accurately accounting for the value of disconnection to forested areas

Where Does This Leave Us?

- Use Nashville's streamlined accounting approach for crediting practices
- Recognize that for poorer soils and/or higher levels of impervious cover, we may need to manage for some amount of CPv
  - Based on a threshold CN?

CN <= XX, WQv meets CPv

CN > XX, some CPv storage is needed

Does "incentive" to fully meet CPv thru ESD provide sufficient impetus to not have to explicitly require permittees maximize the use of GSI?

Questions / Discussion