STORMWATER MANAGEMENT PRACTICES FOR RUNOFF REDUCTION

Date: 11/11/11

NOTE: This table provides only a general overview of each practice. Reference the New York State Stormwater Design Manual for complete standards, details, specifications, and design variations.

	PRACTICE (Design Manual Page)	LAND USE	CONTRIBUTING DRAINAGE AREA	DESIGN ELEMENTS	SLOPE	SOILS	HEAD	GROUND WATER SEPARATION	ALLOWABLE RUNOFF REDUCTION
Area Reduction	**Conservation of Natural Areas** (5-47)	Commercial/ Residential	If any contributing area, maximum contributing length = 75-180' (depending on soil & impervious)	• Minimum size = 10,000 s.f. • Sheet flow inlet	< 8%	Native	---	> 6"	Area and contributing area deducted
	Reparian Buffers/Filter Strips (5-51)	Commercial/ Residential	Maximum contributing length = 75-180' (depending on soil & impervious) Maximum 5,000 s.f. for filter strip	• Sheet flow inlet or flow dissipation • Minimum width = 50-100' (Depends on slope)	< 15%	Native	---	> 6"	Area and contributing area deducted
	Tree planting/Preservation (5-64)	Commercial/ Residential	Maximum contributing area = ½ crown diameter or maximum 100 s.f. impervious area/tree	• Minimum 4" caliper – existing • Minimum 2" caliper – new deciduous or 6' high (new conifer)	< 5%	Native/ constructed	---	> 6"	100 s.f./tree
	Rooftop Disconnection (5-69)	Commercial/ Residential No hotspots	Maximum contributing area = 2,000 s.f. Maximum length = 75'	• Flow dissipation required for discharges from > 500 s.f. • Minimum vegetated area width – 50'	< 5%	Native/ constructed	---	> 6"	Impervious area changed to pervious for R_v
Volume Reduction	**Infiltration Trench** (6-31)	Commercial/ Residential No hotspots	Maximum 5 acres	• 25-100% pre-treatment • Monitoring required • Soil testing required	< 15%	k> 0.5"/hr.	1'	> 3'	90% contributing WQ_v
	Drywell (6-31)	Commercial/ Residential No hotspots	Maximum 1 acre	• Roof top runoff only • Pre-treatment - sump • Soil testing required	< 15%	k> 0.5"/hr.	1'	> 3'	90% contributing WQv
	Infiltration Basin (6-31)	Commercial/ Residential No hotspots	Maximum 10 acres	• 25-100% pre-treatment • Monitoring required • Soil testing required	< 15%	k> 0.5"/hr.	3'	> 3'	90% contributing WQv
	Bioretention (6-44)	Commercial/ Residential	Maximum 5 acres	• Sheet drainage/flow inlet dissipation • Monitoring required • Sized using Darcy's Law	< 6%	Constructed	5'	> 2'	80% contributing WQv for A & B soils, 40% for C & D soils
	Dry Swale (6-59)	Commercial/ Residential/ Highway	Maximum 5 acres	• Non erodible 2-year flows • Check dams if slope is > 2% • Minimum 30-minute retention time • 10% pre-treatment • Maximum depth 18"	< 4%	Constructed	3-5'	> 2'	40% contributing WQv for A & B soils, 20% for C & D soils
	Vegetated Swale (5-58)	Commercial/ Residential/ Highway	Maximum 5 acres	• Peak WQ_v flow < 3cfs • Convey at < 1.0 fps at depth of < 4" • Minimum length – 100' • 10 minute retention time	< 0.5% to 4%	Native	1-4'	> 2'	20% contributing WQv for A & B soils, 10% for C & D soils
	Green Roof (5-86)	Commercial	Roof area	• Roof loading 16-200 lb/s.f.	<30%	Constructed	.25'- 2.0'	---	100% contributing WQv
	Rain Garden (5-76)	Residential/ Commercial	Maximum 1,000 s.f.	• Located within 30' of contributing source • Max. loading ratio of 5:1 (DA to surface area) • Max. ponding depth = 6"	< 6%	Constructed	2-3'	> 2'	100% contributing WQv for A & B soils 40% for C & D soils
	Planters (5-97)	Commercial	< 15,000 s.f.	• Underdrain for "flow through" & C & D soils • Sized using Darcy's Law	---	Constructed	3.5'	> 2'	100% contributing WQv
	Cisterns/Rain Barrels (5-106)	Commercial/ Residential	Roof area	• Require use of collected water • Approximately 625 gal/1,000 s.f. of roof/1" rain	---	---	---	---	100% contributing WQv
	Porous Pavement (5-114)	Commercial/ Residential No hotspots	Surface area plus small adjacent area	• Requires loading analysis • Sheet flow for contributing area	<5%	Constructed over HSG A, B, or C	2-3'	> 3'	100% contributing WQv

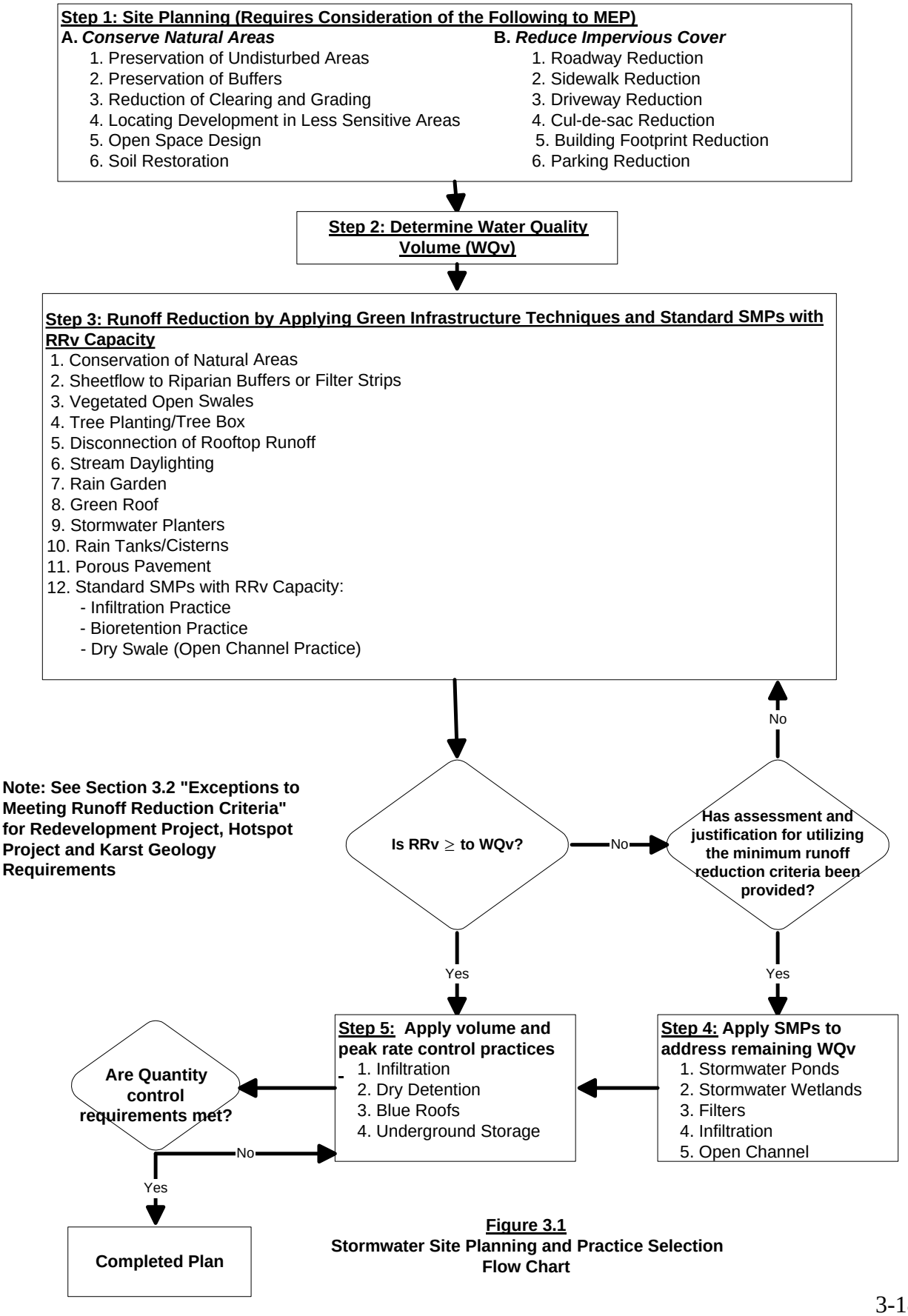

Figure 3.1
Stormwater Site Planning and Practice Selection Flow Chart

RRv Accounting: Spreadsheet Tool (Summary Table)

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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%

RRv Accounting: Spreadsheet Tool (Practice-Specific Worksheets)

Filter Strip

Design							
Enter Site Data For Drainage Area to be Treated by Practice							
Catchment Number	Total Area *(Acres)*	**Impervious Area** *(Acres)*	Percent Impervious *%*	Rv	WQv *(ft^3)*	Precipitation *(in)*	Description

Design Elements			
Is another area based practice applied to this area?		*Y/N*	
Amended Soils & Dense Turf Cover?		*Y/N*	
Is area protected from compaction from heavy equipment during construction?		*Y/N*	
Small Area of Impervious Area & close to source?		*Y/N*	
Composte Amendments?		*Y/N*	
Boundary Spreader?		*Y/N*	*Gravel Diaphram at top*
Boundary Zone?		*Y/N*	*25 feet of level grass*
Specify how sheet flow will be ensured.			*level spreader shall be used for buffer slopes ranging from 3-15%*
Average contributing slope		*%*	*3% maximum unless a level spreader is*
Slope of first 10 feet of Filter Strip		*%*	*2% maximum*
Overall Slope		*%*	*8% maximum*
Contributing Length of Pervious Areas (PC)		*ft*	*150 ft maximum*
Contributing Length of Impervious areas (IC)		*ft*	*75 ft maximum*
Maximum PC Contributing Length for combination of PC & IC	150	*ft*	
Soil Group (HSG)			
Filter Strip Width		*ft*	*50 ft minimum for slopes 0-8%* *75 ft minimum for slopes 8-12%* *100 ft minimum for slopes 12-15%* *HSG C or D increase by 15-20%*
Are All Criteria for Filter Strips in Section 5.3.2 met?			

Area Reduction Adjustments		
Subtract	**0.00**	***Acres from total Area***
Subtract	**0.00**	***Acres from total Impervious Area***

FALSE

Conservation of Natural Areas | Disconnection of Rooftops | Dry Swale | Dry Well | **Filter Strips** | Green Roof (Ext) | Green Roof (Intensive) | #Infiltration Basin | Infiltration Bioretention | Infiltration Trench

Ready | Page: 1 of 5 | 75%

Draft Standards for Stakeholder Discussion (October 17, 2013)

The following draft revision to the 2002 Vermont Stormwater Management Manual (VSMM) is proposed for purposes of focusing stakeholder efforts in the process of revising the VSMM. It serves as an informed starting point from which to establish revised standards.

We propose to add a "runoff reduction" requirement to the existing five required stormwater treatment practice criteria to increase the use of low-impact development (LID) techniques and green stormwater infrastructure (GSI) practices, increase the pollutant removal effectiveness of stormwater practices, and reduce the impacts of stormwater on stream channels.

Draft Runoff Reduction Requirement

The total water quality volume (WQv) shall be reduced via a combination of infiltration, evapotranspiration, re-use, and extended filtration (i.e. minimum 6-hr lag to receiving waters) to ensure that there is no increase in the peak flow or total volume of runoff volume associated with the 90th percentile event (currently defined as 0.9" of rain in the VSMM). At a minimum, pre-development infiltration rates shall be maintained. Additionally, reduction of the channel protection volume (CPv) is encouraged. Any CPv not met through reduction shall be met through a detention practice or the alternative CPv standard. Overbank flood control (Qp10) and extreme flood protection (Qp100) requirements remain in place.

The goal of this standard is to manage stormwater via a combination of site development strategies, stormwater management practices, and good operation and maintenance. The framework will include a clear preference for on-site LID or GSI practices that promote infiltration, followed by more traditional stormwater management practices with runoff reduction capacity (e.g., extended filtration, with minimum 6-hr lag to receiving waters).

Initial Decisions

Based on the draft framework outlined above, fundamental questions that will need to be addressed in preparing an expanded draft are:

- Is the WQv standard (e.g., 90% rule, applied uniformly state-wide) the appropriate reduction volume in terms of achieving sediment and nutrient removal, and in terms of feasibility?
- Is the existing formula for calculating WQv sufficient for addressing conversion of undeveloped land to pervious land uses (e.g. lawn)?
- What, if any, feasibility component should be included in the standard (e.g., site limitations such as physical constraints, hydraulic conditions, soil testing, existing and proposed slopes) in order to demonstrate compliance with runoff reduction as infeasible?
- How will water quality and channel protection requirements be addressed on sites where less than 100% of the WQv and/or CPv is addressed via runoff reduction?

Once an approach to these fundamentals is established we can progress to address other important issues including: establishment of approved practices and revisions to existing practices, the need for enhanced nutrient removal standards, development of pre-treatment standards, operation and maintenance requirements, and the use of continuous simulation modeling as an alternative to the design storm approach.

Desired Outcomes

The Stormwater Program strongly supports better integrating LID and GSI approaches into the VSMM. The draft framework will ensure that runoff reduction practices (e.g. disconnection, bioretention, infiltration) are applied on sites to the maximum extent practicable by adopting robust, inter-related WQv, runoff reduction and CPv standards that seek to: minimize the creation of impervious surfaces through practices such as clustering

development/open space design; minimize the length and width of new roads, driveways and parking areas; and utilize pervious types of pavements as an alternative to conventional asphalt and concrete surfaces. We are reluctant to build in a requirement for the Program to review the project-level decision making process. Rather, we can achieve this goal by establishing a runoff reduction requirement, creating an incentive to maximize infiltration and/or extended filtration of the entire CPv, and by establishing a complete range of approved runoff reduction practices for designers. Information sharing and training can serve to further this goal.

Other State Manuals

In proposing this draft standard we reviewed stormwater manuals from many states, including New York, Maryland, Pennsylvania, Rhode Island, and Minnesota. We found that despite the range in approaches, they all have a similar underlying requirement, or guidance, to reduce a certain volume through the application of LID or infiltration-based GSI practices. The manuals and guidance vary in the extent to which they require the designer to demonstrate that LID approaches have been applied, and to the extent they allow for a feasibility test for implementing runoff reduction.

Based on this review, we believe we can incorporate a runoff reduction standard into the structure of our existing Manual. We can maintain the current sizing criteria and add the additional requirement for runoff reduction. Further, to meet the additional standard, we can incorporate LID approaches under both the acceptable treatment practices section and a suggested planning and credits section. This approach is similar to the adopted 2010 New York State Stormwater Management Design Manual.

For More Information

All information regarding the Vermont Stormwater Management Manual Update process is available at: http://www.vtwaterquality.org/stormwater/htm/sw_manualrevision.htm.

Non-Structural Practices

Practice	Already in VSMM?	Include in revised VSMM?	Level of revision needed? (H,M,L)	Priority for inclusion/ revision? (H,M,L)
Natural area conservation				
Riparian buffer/ floodplain protection				
ESD/ESRD/Open Space Dev.	credit			
Limit site clearing/ grading				
Minimize soil compaction				
Drainage to stream or shoreline buffer	credit			
Minimize impervious areas				
Rooftop disconnection	credit			
Non-rooftop disconnection	credit			
Minimize connected impervious				
Filter Strips / Vegetated buffers	credit			
Grass Channels	standard			
Water-retaining landscaping				
Manage stormwater at source				
Reforestation/ revegetation				
Soil restoration				

Structural (GSI and Standard) Practices

Practice	Already in VSMM?	Include in revised VSMM?	Level of revision needed? (H,M,L)	Priority for inclusion/ revision? (H,M,L)
Green roof				
Rainwater harvesting for use				
Constructed SW wetland	standard			
Infiltration basin/trench	standard			
Infiltration planter				
Trees / tree boxes				
Porous pavement				
Dry well				
Subsurface structure				
Leaching catch basin				
Bioretention	standard			
Rain garden				
Sand filter	standard			
Vegetated soil / organic filter	standard			
Vegetated swale/ bioswale	standard			
Level spreader				
Stream daylighting				
Stormwater pond	standard			