

## Appendix K: On-Site Required BMP Spreadsheet for Determining Loading Rates and Removal Rates for Pollutants of Concern

### Site Characteristics

Post Development TP Loading (TP Load) \_\_\_\_\_ lbs TP/yr From VSMP Calculations  
 Allowed Post Development TP Loading (TP Allow) \_\_\_\_\_ lbs TP/yr From VSMP Calculations

### Design Characteristics

Type of BMP Installed \_\_\_\_\_

Design Guidelines DEQ Clearing House / Bay Program (Circle One)

Enter appropriate removal efficiencies based on design guidelines see attached tables

Phosphorous Removal Efficiency (TP) \_\_\_\_\_ % Use Table V.A.1 DEQ

Nitrogen Removal Efficiency (TN) \_\_\_\_\_ % Use Table V.A.1 DEQ

Suspended Solids Removal Efficiency (TSS) \_\_\_\_\_ % Use Table V.C.1\*

\*If BMP is not located in Table V.C.1, see Public Works Staff

### Calculations (Round Calculations to 2-decimal places)

#### TP Reduction

$$\frac{\text{TP Load}}{\text{TP Allow}} - \frac{\text{TP Allow}}{\text{TP Allow}} = \frac{\text{TP Reduction Required}}{\text{TP Allow}} \text{ lbs TP/yr}$$

$$\frac{\text{TP Load}}{\text{TP Load}} \times \frac{\text{TP}}{\text{TP}} \% = \frac{\text{TP Provided}}{\text{TP Load}} \text{ lbs TP/yr}$$

$$\frac{\text{TP Provided}}{\text{TP Provided}} - \frac{\text{TP Reduction Required}}{\text{TP Provided}} = \frac{\text{Total TP Removed}}{\text{TP Provided}} \text{ lbs TP/yr}$$

#### TN & TSS Percentages

$$\frac{\text{TP Allow}}{\text{TP Allow}} \div \frac{\text{TP Provided}}{\text{TP Provided}} = \frac{\text{TP \%}}{\text{TP Provided}}$$

#### TN Loading

$$\frac{\text{TP Load}}{\text{TP Load}} \times \frac{6.9}{\text{TN Ratio}} = \frac{\text{TN Load}}{\text{TP Load}} \text{ lbs TN/yr}$$

$$\frac{\text{TN Load}}{\text{TN Load}} \times \frac{\text{TN}}{\text{TN}} \% = \frac{\text{TN Removed}}{\text{TN Load}} \text{ lbs TN/yr}$$

$$\frac{\text{TN Removed}}{\text{TN Removed}} \times \frac{\text{TP \%}}{\text{TP \%}} = \frac{\text{Total TN Removed}}{\text{TN Removed}} \text{ lbs TN/yr}$$

**TSS Loading**

$$\frac{\text{TP Load}}{\text{TP Load}} \times \frac{469.2}{\text{TSS Ratio}} = \frac{\text{TSS Load}}{\text{TSS Load}} \text{ lbs TN/yr}$$

$$\frac{\text{TSS Load}}{\text{TSS Load}} \times \frac{\text{TP \%}}{\text{TSS}} = \frac{\text{TSS Removed}}{\text{TSS Removed}} \text{ lbs TN/yr}$$

$$\frac{\text{TSS Removed}}{\text{TSS Removed}} \times \frac{\text{TP \%}}{\text{TP \%}} = \frac{\text{Total TSS Removed}}{\text{Total TSS Removed}} \text{ lbs TN/yr}$$

**Summary of Removal**

Total Phosphorus Removed = \_\_\_\_\_ lbs TP/yr

Total Nitrogen Removed = \_\_\_\_\_ lbs TN/yr

Total Suspended Solids Removed = \_\_\_\_\_ lbs TSS/yr

Removal rates must meet the minimum % increase as shown in Table 2 of the Non-Residential Credit Manual.

Name of Individual Completing this Form: \_\_\_\_\_

**APPENDIX V.A – Virginia Stormwater Clearinghouse BMPs<sup>14</sup>**

To be eligible for these efficiencies, the BMP must meet all the design requirements that are listed in the Virginia Stormwater BMP Clearinghouse's technical specification for that BMP, not just the one inch requirement for runoff depth treated. There are no established efficiencies for TSS in the Virginia Stormwater BMP Clearinghouse. To calculate the TSS reductions, permittees should use the retrofit curves developed by the Bay Program or the Bay Program Established Efficiencies. The methodology for using the retrofit curves is detailed in *Appendix V.B*. For additional information about the Virginia Stormwater BMP Clearinghouse requirements, permittees should see the BMP design standards and specs, which can be found at <http://vwrrc.vt.edu/swc/StandardsSpecs.html>.

**Table V.A.1 - Virginia Stormwater BMP Clearinghouse BMPs, Established Efficiencies**

Practice Number	Practice	TN	TP
1	Rooftop Disconnection <sup>15</sup>	25% or 50% <sup>1</sup>	25% or 50% <sup>1</sup>
2	Sheetflow to Vegetated Filter or Conserved Open Space 1	25% or 50% <sup>1</sup>	25% or 50% <sup>1</sup>
	Sheetflow to Vegetated Filter or Conserved Open Space 2	50% or 75% <sup>1</sup>	50% or 75% <sup>1</sup>
3	Grass Channel	28%	23%
5	Vegetated Roof 1	45%	45%
	Vegetated Roof 2	60%	60%
6	Rainwater Harvesting <sup>15</sup>	Up to 90%	Up to 90%
7	Permeable Pavement 1	59%	59%
	Permeable Pavement 2	81%	81%
8	Infiltration 1	57%	63%
	Infiltration 2	92%	93%
9	Bioretention 1	64%	55%
	Bioretention 2	90%	90%
	Urban Bioretention	64%	55%
10	Dry Swale 1	55%	52%
	Dry Swale 2	74%	76%
11	Wet Swale 1	25%	20%
	Wet Swale 2	35%	40%
12	Filtering Practice 1	30%	60%
	Filtering Practice 2	45%	65%
13	Constructed Wetland 1	25%	50%
	Constructed Wetland 2	55%	75%
14	Wet Pond 1	30% (20%) <sup>2</sup>	50% (45%) <sup>2</sup>
	Wet Pond 2	40% (30%) <sup>2</sup>	75% (65%) <sup>2</sup>
15	Extended Detention Pond 1	10%	15%
	Extended Detention Pond 2	24%	31%

<sup>1</sup>Lower rate is for HSG soils C and D; higher rate is for HSG soils A and B

<sup>2</sup>Lower nutrient removal in parentheses apply to wet ponds in coastal plain terrain

<sup>14</sup> These efficiencies are up to date as of the publication of this guidance. The most up to date list of approved BMPs and their efficiencies can be found on the Virginia Stormwater BMP Clearinghouse website. If there is a discrepancy between this table and the website, the efficiencies on the website supersede those listed in this table. The TN efficiencies may be found in the bodies of the individual BMP reports.

<sup>15</sup> **NOTE:** There are no Bay Program equivalent efficiency BMPs for Rooftop Disconnection and Rainwater Harvesting. Permittees must use the VA Stormwater Clearinghouse technical criteria and efficiencies to receive credit for these practices.

**APPENDIX V.C - Chesapeake Bay Program, Established Efficiencies**

As an alternative to using the Bay Program Curves, permittees may use the Bay Program's established efficiencies for BMPs. Again, these efficiencies may be used for BMPs that do not meet the Virginia Stormwater BMP Clearinghouse design specifications.

**Table V.C.1 – Chesapeake Bay Program BMPs, Established Efficiencies**

Chesapeake Bay Program BMPs	TN	TP	TSS
Wet Ponds and Wetlands	20%	45%	60%
Dry Detention Ponds and Hydrodynamic Structures	5%	10%	10%
Dry Extended Detention Ponds	20%	20%	60%
Infiltration Practices w/o Sand, Veg.	80%	85%	95%
Infiltration Practices w/ Sand, Veg.	85%	85%	95%
Filtering Practices	40%	60%	80%
Bioretention C/D soils, underdrain	25%	45%	55%
Bioretention A/B soils, underdrain	70%	75%	80%
Bioretention A/B soils, no underdrain	80%	85%	90%
Vegetated Open Channels C/D soils, no underdrain	10%	10%	50%
Vegetated Open Channels A/B soils, no underdrain	45%	45%	70%
Bioswale	70%	75%	80%
Permeable Pavement w/o Sand, Veg. C/D soils, underdrain	10%	20%	55%
Permeable Pavement w/o Sand, Veg. A/B soils, underdrain	45%	50%	70%
Permeable Pavement w/o Sand, Veg. A/B soils, no underdrain	75%	80%	85%
Permeable Pavement w/Sand, Veg. C/D soils, underdrain	20%	20%	55%
Permeable Pavement w/Sand, Veg. A/B soils, underdrain	50%	50%	70%
Permeable Pavement w/Sand, Veg. A/B soils, no underdrain	80%	80%	85%

BMP efficiencies for wetland restoration vary depending on hydrogeomorphic region as listed below in Table V.C.2. To use this table the permittee will need to determine which region their MS4 is in and use the appropriate efficiency. If the permittee is unsure which Hydrogeomorphic Region it is located in, resources are available through the USGS at <http://chesapeake.usgs.gov/data.html>.

**Table V.C.2 – Chesapeake Bay Program BMPs, Established Efficiencies Regionally Impacted**

Chesapeake Bay Program Hydrogeomorphic Region affected efficiencies				
BMPs	Region	TN	TP	TSS
Wetland Restoration	Appalachian Plateau Siliciclastic Non-Tidal	7.0%	12%	4.0%
Wetland Restoration	Coastal Plain Dissected Uplands Non-Tidal; Coastal Plain Dissected Uplands Tidal; Coastal Plain Lowlands Tidal; Coastal Plain Uplands Tidal; Coastal Plain Lowlands Non-Tidal; Coastal Plain Uplands Non-Tidal	25%	50%	15%
Wetland Restoration	Blue Ridge Non-Tidal; Mesozoic Lowlands Non-Tidal; Valley and Ridge Carbonate Non-Tidal; Piedmont Crystalline Non-Tidal; Piedmont Carbonate Non-Tidal; Valley and Ridge Siliciclastic Non-Tidal	14%	26%	8.0%