COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF CLEAN WATER

MANAGED RELEASE CONCEPT (MRC) SPREADSHEET INSTRUCTIONS

November 18, 2024

Introduction

The Department of Environmental Protection (DEP) has developed the **Managed Release Concept (MRC) Spreadsheet** to facilitate calculations necessary for determining the amount of volume management credit that may be claimed for MRC stormwater control measures (SCMs). The MRC Spreadsheet replaces the ***MRC Design Summary Sheet***, which was previously used to report design parameters for these SCMs. The volume management credit for all MRC SCMs must be calculated using the MRC Spreadsheet with the exception of MRC SCMs that meet the **MRC Simplified Design Standards**. SCMs that will meet the MRC Simplified Design Standards must be documented on the **MRC Simplified Design Spreadsheet**. Volume management credit for either spreadsheet must be reported in DEP's **PCSM Spreadsheet** (Volume Worksheet). When entered into the PCSM Spreadsheet, water quality (WQ) management credit is also applied.

Users should check DEP's website periodically for updates to the MRC Spreadsheet and instructions by visiting www.dep.pa.gov/constructionstormwater and selecting "E&S Resources". In general, DEP/CCD will accept older versions of the spreadsheet no more than 6 months following the revision date of the spreadsheet. DEP/CCD also reserves the right to request completion of the latest version of the spreadsheet for any project.

The spreadsheet was designed using the latest version of Microsoft Excel® and is in Excel macro workbook (XLSM) format. Questions on the use of the MRC Spreadsheet can be directed to the Bureau of Clean Water at **RA-EPCHAPTER102@pa.gov**.

General Information

It is important that the user follow these instructions carefully. Omission of data in any cell designed for data entry may result in the failure of important calculations in the spreadsheet.

If prompted by Excel after opening the spreadsheet, enable editing and macros. *Note that you may need to add additional Trusted Locations in the Trust Center Settings of Excel in order to run the macros*. These locations may include server drives and/or locations where you intend to save the file for use. The following steps may be taken:

1. Excel Options > Trust Center > Trust Center Settings > Trusted Locations
2. Check the box to "Allow Trusted Locations on my network"
3. Select "Add new location"
4. Browse to select the folder (or server) where the file will be saved, check the "Subfolders of this location are also trusted" box, and then OK.

If automated calculations are not executing as expected, the user should verify that calculation settings in Excel® are set to "Automatic" (select Formulas – Calculation Options in the latest version of Excel®).

The top of the worksheet contains a "Clear Form" button. The user may click on the "Clear Form" button at any time to delete **all** data from the current worksheet. If the user wants to revise the information in only one cell, the user should select that cell and use the backspace or delete key to remove the current value and then enter the new value into the cell.

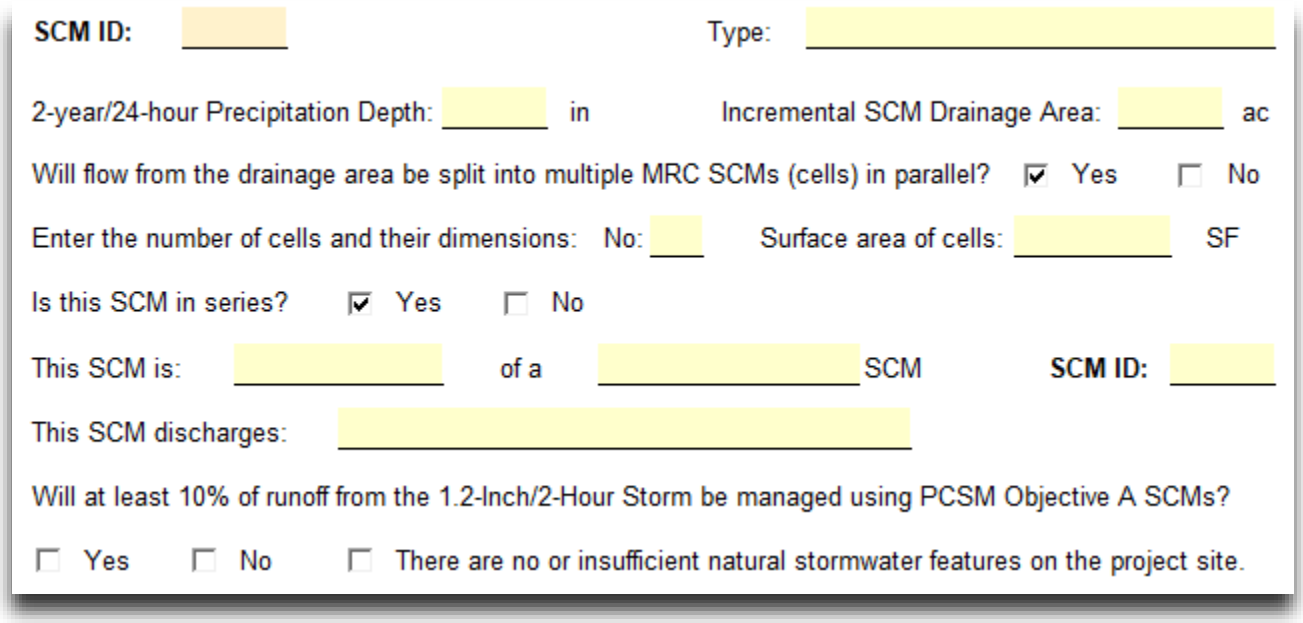
All cells available for data entry or selection from a drop-down menu are highlighted. **The user may use the Tab, arrow, or Enter keys to move from cell to cell. Using the mouse to click from cell to cell may result in validation errors**.

Care must be taken to enter the data in the correct order identified in these instructions to avoid potential errors with the calculations and logic. For example, skipping a cell may prevent a calculation or produce an error message. The MRC Spreadsheet is protected. Formulas are not visible but are explained in this document.

Completing the Spreadsheet

One instance of the spreadsheet must be completed for each SCM.

1. Background Information



- **SCM ID** – Enter the unique ID for the SCM that is identified in the PCSM Plan (i.e., PCSM Plan Drawings, Module 2, etc.).

- **Type** – Select from the dropdown list the type of MRC SCM. The options are MRC Bioretention and MRC Storage Systems.

- **2-year/24-hour storm precipitation** – Enter the 2-year/24-hour median or 90% upper confidence precipitation depth, in inches, for the weather station located closest to the project site from NOAA Atlas 14 or other published sources. This value is used to calculate runoff volumes. The precipitation depth entered here should match the depth used for the overall stormwater analysis (e.g., PCSM Spreadsheet).

- **Incremental SCM Drainage Area** – Enter the drainage area that will contribute the 1.2-Inch/2-Hour Storm to the SCM (the entire SCM including all cells comprising the SCM, if applicable), in acres. Do not include area that is treated by an upstream SCM, unless the upstream SCM only provides water quality treatment (e.g., street sweeping, filtering, etc.) or unless the upstream SCM only manages a portion of the 1.2-Inch/2-Hour Storm Event (for example, a green roof designed to manage 0.5 inch of rainfall). **There are limitations on the SCM Drainage Area**, depending on the Maximum Storm Event Routed to the MRC SCM.

  Example 1 – A Green Roof SCM is upstream of an MRC Bioretention SCM. The Green Roof mitigates 0.9 inch of runoff from 0.5 acre. The MRC Bioretention SCM only receives flows from the Green Roof SCM. The Incremental SCM Drainage Area for the MRC Bioretention SCM is the percentage of the 1.2-Inch/2-Hour Storm precipitation depth treated by the Green Roof, multiplied by the area treated by the Green Roof (i.e., ((1.2 inches – 0.9 inch) / 1.2 inches) x 0.5 acre = 0.125 acre).

  Example 2 – A Bioinfiltration SCM is upstream of an MRC Bioretention SCM. The Bioinfiltration SCM receives runoff from 2 acres and will infiltrate and evapotranspire all of the 1.2-Inch/2-Hour Storm precipitation depth. The MRC Bioretention SCM receives additional flows from the Bioinfiltration SCM

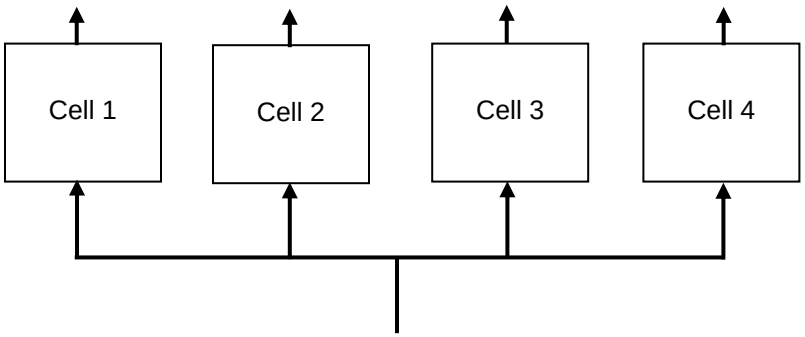
plus an additional 1 acre. The Incremental SCM Drainage Area for the MRC Bioretention SCM is 1 acre.

Example 3 – An MRC Storage System SCM receives flow from a 1.5-acre parking lot that is swept. The MRC Storage System SCM includes an upstream vegetated component. Prior to flows entering the vegetated component there is a filter strip for additional pretreatment. The Incremental SCM Drainage Area for the MRC Bioretention SCM is 1.5 acres. The presence of the filter strip for pretreatment and the vegetated component, which is part of the overall SCM, does not change the drainage area.

NOTE 1 – The value entered for Incremental SCM Drainage Area should be identical to the sum of post-construction drainage area land covers, as entered in the ***Drainage Area Characterization*** section (below). The reason it is requested in the Background Information is to ensure the user understands that it is the incremental, not total, drainage area to the SCM that is considered for crediting purposes. However, if there is additional volume from the total drainage area that is routed to the MRC SCM, up to the 2-year/24-hour storm event, it may be credited (see explanation of the ***Post-Construction Drainage Area table***, below).

- **Will flow from the drainage area be split into multiple MRC SCMs (cells) in parallel?**

  Select the appropriate box (Yes or No) to indicate whether a flow splitter will be used to divide flow from the drainage area to two or more "cells" in parallel, similar to the figure below.



  If the MRC SCM will be divided into cells, enter the number of cells and the surface area (bottom footprint) of each individual cell, in square feet (see **NOTE 3**).

  NOTE 2 – Any bypass/overflow and underdrain outflow should not be routed to another cell of the same SCM.

  NOTE 3 – In order to consider parallel cells to be part of one SCM, they must have a similar surface area (i.e., within 10%). If surface area varies by less than 10%, enter the average surface area into the spreadsheet. If the surface area between any cells varies by at least 10%, each cell should be considered a standalone SCM.

  NOTE 4 – There may be advantages to using multiple cells in parallel as explained further below under ***Design Standards***.

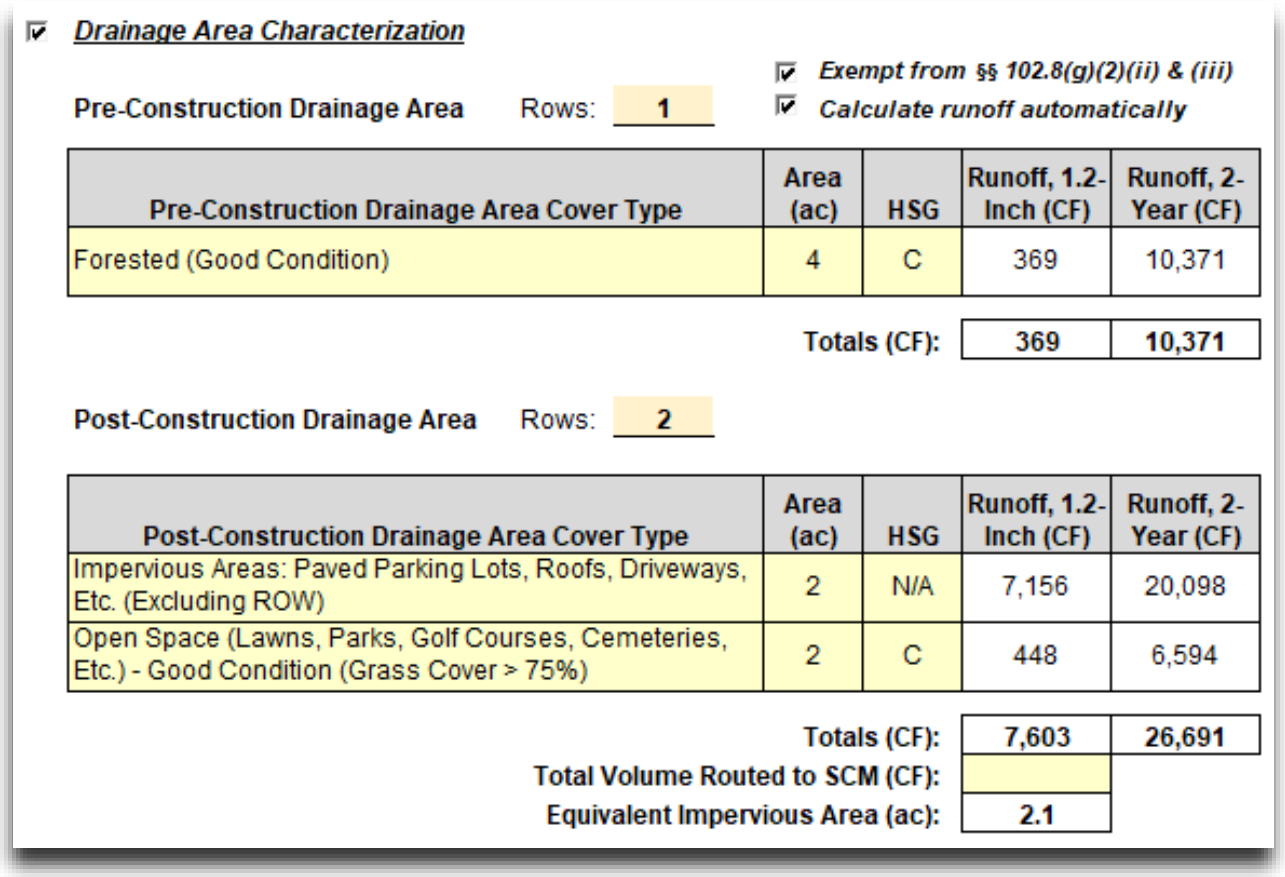
- **Is this SCM in series?** – Check the appropriate box (Yes or No). If Yes, select whether the SCM ("SCM 1") is upstream or downstream of another SCM ("SCM 2"). Then select the SCM type for "SCM 2". The options are PCSM Objective B, PCSM Objective C, and PCSM Objective D (refer to **Attachment A**). For example, if an MRC Bioretention SCM is upstream of a wet basin used for rate control, select "PCSM Objective D." Then enter the SCM ID for "SCM 2", as identified in the PCSM Plan.

- **This SCM discharges** – If the SCM is ***downstream*** of another SCM in series, select from the dropdown list the location where the SCM discharges to. The options are Off-Site and to a downstream (Objective A, B, C, or D) SCM. If the SCM is ***upstream*** of another SCM this question is not displayed.

- **Will at least 10% of runoff from the 1.2-Inch/2-Hour Storm be managed using PCSM Objective A SCMs?**

  See **Attachment A** for PCSM Objective A SCMs. This question applies to the overall limit of disturbance (not solely the drainage area of an MRC SCM). Select "Yes", "No", or "There are no or insufficient natural stormwater features on the project site." There is an incentive for managing at least 10% of the volume from the 1.2-Inch/2-Hour Storm on a project site through PCSM Objective A SCMs in the form of a larger drainage area that can be routed to an MRC SCM. If Yes is selected supporting calculations should be provided.

2. Drainage Area Characterization



Drainage Area Characterization

Exempt from §§ 102.8(g)(2)(ii) & (iii)

Calculate runoff automatically

Pre-Construction Drainage Area Rows: 1

Pre-Construction Drainage Area Cover Type	Area (ac)	HSG	Runoff, 1.2-Inch (CF)	Runoff, 2-Year (CF)
Forested (Good Condition)	4	C	369	10,371
		Totals (CF):	369	10,371

Post-Construction Drainage Area Rows: 2

Post-Construction Drainage Area Cover Type	Area (ac)	HSG	Runoff, 1.2-Inch (CF)	Runoff, 2-Year (CF)
Impervious Areas: Paved Parking Lots, Roofs, Driveways, Etc. (Excluding ROW)	2	N/A	7,156	20,098
Open Space (Lawns, Parks, Golf Courses, Cemeteries, Etc.) - Good Condition (Grass Cover > 75%)	2	C	448	6,594
		Totals (CF):	7,603	26,691
		Total Volume Routed to SCM (CF):		
		Equivalent Impervious Area (ac):	2.1	

- **Pre-Construction Drainage Area** – Select the Pre-Construction Drainage Area Cover Types from the dropdown lists and enter their areas and Hydrologic Soil Group (HSG) Soil Types for the MRC SCM's drainage area in the pre-construction condition. Select the number of Rows (up to 8). When the box for "Exempt from §§ 102.8(g)(2)(ii) & (iii)" box is checked, the same cover types available for post-construction drainage areas will be available for pre-construction drainage areas. This exemption applies to specific activities as set forth in the Chapter 102 regulations.

  The runoff volumes for the 1.2-Inch/2-Hour and 2-Year/24-Hour storms, in cubic feet (CF), are estimated for each Cover Type / Soil Type combination using the NRCS TR-55 Curve Number method and are summed when the "Calculate runoff automatically" box is checked. If the user would like to calculate runoff using a different method for the 1.2-Inch/2-Hour and 2-Year/24-Hour Storms, uncheck this box and manually enter the values (supporting documentation required). When the "Calculate runoff automatically" box is unchecked the user may select the "HSG" header and change it to "USDA Soil." The options for

USD soil types / textures are sand, loamy sand, sandy loam, loam, silt loam, silt, silty clay loam, clay, clay loam, sandy clay loam, and silty clay.

The information in this table is not used in credit calculations but may be used to verify pre-construction land covers and volumes for the overall project site.

NOTE 5 – The land cover "Impervious as Meadow" may be selected to implement the regulatory requirement that 20% of existing impervious to be disturbed is treated as meadow (20% presumption). Regardless of whether this land cover is used in the MRC Spreadsheet, the overall stormwater analysis for the site must apply the 20% presumption in DEP's PCSM Spreadsheet (unless exempt).

- **Post-Construction Drainage Area** – Select the Post-Construction Drainage Area Cover Types from the dropdown lists and enter their areas and HSG Soil Types for the MRC SCM's drainage area in the post-construction condition. The total area entered should match the Incremental SCM Drainage Area entered previously. The runoff volumes for the 1.2-Inch/2-Hour and 2-Year/24-Hour storms are estimated for each Cover Type / Soil Type combination using the NRCS TR-55 Curve Number method and are summed when the "Calculate runoff automatically" box is checked.

  Total Volume Routed to SCM (CF) – If the volume routed to the MRC SCM is different than the volumes calculated for the 1.2-Inch/2-Hour Storm or 2-Year/24-Hour Storm enter a value for *Total Volume Routed to SCM*, in CF. Attach calculations to support the reported volume. If the volume entered for *Total Volume Routed to SCM* exceeds the calculated 2-Year/24-Hour Storm volume (not recommended), no additional volume management credit is provided in excess of the calculated 2-Year/24-Hour Storm volume.

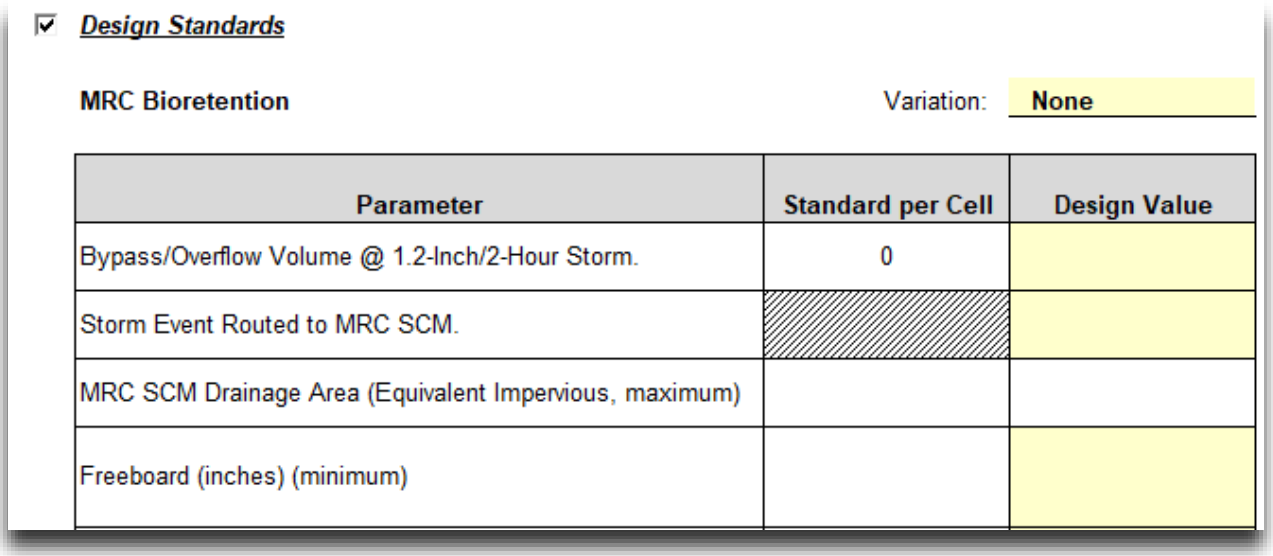
  Equivalent Impervious Area (ac) – The *Equivalent Impervious Area* is calculated, which is used to calculate the MRC Controlled Release Rate. Equivalent Impervious, in acres, is calculated by dividing the volume of runoff at the 1.2-Inch/2-Hour Storm (or a volume less than the calculated 1.2-Inch/2-Hour Storm volume if entered for *Total Volume Routed to SCM*) by 0.083333 (1 inch / 12 inches/foot) and 43,560 SF/acre.

3. Design Standards

Enter a design value into all highlighted cells in order to determine management credit. If the MRC SCM will be divided into cells, receiving approximately equal flows, the heading for "Standard" is changed to "Standard per Cell." If a deduction is taken for deviating from design standards, the cell value will be shown in ***bold italic red text*** (for a deduction less than 50%) or the fill color of the cell will be shown in red (for a deduction of at least 50%).

NOTE 6 – The design standards described in this section are for MRC SCMs that do not meet the **MRC Simplified Design Standards**, for which completion of the MRC Spreadsheet is unnecessary.

MRC Bioretention



☑ ***Design Standards***

MRC Bioretention Variation: **None**

Parameter	Standard per Cell	Design Value
Bypass/Overflow Volume @ 1.2-Inch/2-Hour Storm.	0	
Storm Event Routed to MRC SCM.		
MRC SCM Drainage Area (Equivalent Impervious, maximum)		
Freeboard (inches) (minimum)		

- **Variation** – Select "None" or "MRC Bioswale" from the dropdown list. (There is one additional design standard if "MRC Bioswale" is selected).

- **Bypass/Overflow Volume During 1.2-Inch/2-Hour Storm (CF)** – The design standard is 0 (i.e., no release from the underdrain or bypass up to the 1.2-Inch/2-Hour Storm). If a value greater than 0 is entered, a **deduction of 50%** of volume management credit is applied (see the ***Volume and Water Quality Management Credit section***, below).

- **Maximum Storm Event Routed to MRC SCM** – If *Total Volume Routed to SCM* in the Drainage Area Characterization section is left blank, select "1.2-Inch/2-Hour Storm", "2-Year/24-Hour Storm", or "> 2-Year/24-Hour Storm" from the dropdown list. If "> 2-Year/24-Hour Storm" is selected, a **deduction of 50%** is applied. This is due to the increased potential for long-term MRC SCM failure when storms larger than the 2-Year/24-Hour Storm are routed to the SCM. If a value is entered into the *Total Volume Routed to SCM* cell, select the value that corresponds to the entered volume (e.g., if a value less than the calculated 1.2-Inch/2-Hour Storm is entered, select "< 1.2-Inch/2-Hour Storm").

- **MRC SCM Drainage Area (Equivalent Impervious, maximum acres)** – Both the Design Standard and Design Value for MRC SCM Drainage Area are calculated.

  - ***Design Standard*** – The design standard depends on 1) the Maximum Storm Event Routed to the MRC SCM and 2) whether or not 10% of the 1.2-Year/2-Hour Storm volume within the limit of disturbance has been managed using PCSM Objective A SCMs. See the table below.

Maximum Storm Event Routed to SCM	Maximum Equivalent Impervious Drainage Area (acres)
1.2-Inch/2-Hour Storm (or less), **with** 10% PCSM Objective A	6
1.2-Inch/2-Hour Storm (or less), **without** 10% PCSM Objective A	5
2-Year/24-Hour Storm (or less but greater than 1.2-Inch/2-Hour Storm), **with** 10% PCSM Objective A	2.5
2-Year/24-Hour Storm (or less but greater than 1.2-Inch/2-Hour Storm), **without** 10% PCSM Objective A	2
> 2-Year/24-Hour Storm, **with** 10% PCSM Objective A	1.5
> 2-Year/24-Hour Storm, **without** 10% PCSM Objective A	1

If there is an exceedance of the Maximum Equivalent Impervious Drainage Area Standard, a **deduction of 50%** of volume management credit is applied.

A limit is also enforced on the Incremental SCM Drainage Area. If this area exceeds the following, a **deduction of 50%** of volume management credit is applied:

- Where the Maximum Storm Event Routed to the MRC SCM is the 2-Year/24-Hour Storm or less, 6 acres;
- Where the Maximum Storm Event Routed to the MRC SCM is greater than the 2-Year/24-Hour Storm, 3 acres.

- ***Design Value*** – If the SCM is divided into cells, the design value is the Equivalent Impervious Area (calculated in the ***Drainage Area Characterization*** section) divided by the number of cells; otherwise it is the Equivalent Impervious Area.

- **Freeboard (maximum)** – Enter the design freeboard for the SCM (i.e., vertical distance between the top of embankment and the design ponding depth at the maximum storm event routed to the SCM). The maximum freeboard standards are 6 inches (for the 2-Year/24-Hour Storm or less) and 12 inches (for > 2-Year/24-Hour Storm) and are used as a measure to decrease compaction of the MRC surface. If the maximum freeboard is exceeded, a **deduction** (percentage) is assessed based on the following formula:

  [((Design Freeboard – (Freeboard Standard + 10%)) / (Freeboard Standard + 10%)] x 100

- **Ponding Depth @ 1.2-Inch/2-Hour Storm (ft) (maximum)** – Report the depth, in feet, of stormwater in the SCM following the 1.2-Inch/2-Hour Storm, as designed. The design standard is 1 foot. If the ponding depth standard is exceeded, a **deduction** is assessed based on the following formula:

  [(Design Ponding Depth – (Ponding Depth Standard + 10%)) / (Ponding Depth Standard + 10%)] x 100

- **Ponding Depth @ 2-Year/24-Hour Storm (ft) (maximum)** – This standard is only displayed in the Maximum storm routed to the SCM is greater than or equal to the 2-Year/24-Hour Storm. Report the depth, in feet, of stormwater in the SCM following the 2-Year/24-Hour Storm, as designed. The design standard is 2 feet. If the ponding depth standard is exceeded, a **deduction** is assessed based on the following formula:

  [(Design Ponding Depth – (Ponding Depth Standard + 10%)) / (Ponding Depth Standard + 10%)] x 100

- **Pre-Construction 1-Year/24-Hour peak rate (cfs)** – Enter the 1-Year/24-Hour peak rate, in cubic feet per second (cfs), for the pre-construction SCM drainage area based on hydrologic modeling. There is no design standard for this parameter.

- **Post-Construction 2-Year/24-Hour Peak Rate (cfs)** – Enter the 2-Year/24-Hour peak rate in the post-construction condition, as designed. This may be the peak rate discharge from the MRC SCM or the peak rate discharge from a downstream PCSM Objective D SCM for the volume of stormwater released from the MRC SCM.

  The standard is one of the following:

  - Less than or equal to the pre-construction 1-Year/24-Hour Peak Rate IF the 1-Year/24-Hour Peak Rate is greater than or equal to 0.15 cfs/acre (equivalent impervious).

  - 0.15 cfs/acre if the 1-Year/24-Hour Peak Rate is less than 0.15 cfs/acre.

  A **deduction of 50%** is applied if the Pre-Construction 2-Year/24-Hour Peak Rate exceeds the Pre-Construction 1-Year/24-Hour Peak Rate (or 0.15 cfs/acre).

NOTE 7 – The modeling for Post-Construction Peak Rate must include any additional flows routed to the MRC SCM from outside the SCM drainage area.

- **Controlled Release Rate for 1.2-Inch/2-Hour Storm (cfs)** – The standard is computed by multiplying the Equivalent Impervious by 0.02 cfs/acre of Equivalent Impervious, divided by the number of cells (if applicable). This standard is displayed for informational purposes.

- **Underdrain Outflow Rate for 1.2-Inch/2-Hour Storm (cfs)** – Report the outflow rate, as designed, from the underdrain for the 1.2-Inch/2-Hour Storm condition. The standard is the Controlled Release Rate for the 1.2-Inch/2-Hour Storm. A **deduction** is applied if the Underdrain Outflow Rate exceeds the Controlled Release Rate, as follows:

  [(Underdrain Outflow Rate – (Controlled Release Rate + 10%)) / (Controlled Release Rate + 10%)] x 100

- **Ponding Time for Storm Event Routed to MRC SCM (hrs) (maximum)** – Report the amount of time, in hours, that stormwater will take to recede to the SCM surface for the maximum storm event routed to the MRC SCM, as designed. The standard for all storms is 72 hours. A **deduction** is applied if the Ponding Time exceeds the standard, as follows:

  [(Design Ponding Time – (Ponding Time Standard + 10%)) / (Ponding Time Standard + 10%)] x 100

- **Soil Media Depth Above Internal Water Storage (IWS) (ft) (minimum)** – Enter the depth of soil or other engineered media that will be located above the IWS, in feet. A minimum of 1 foot is required. A **deduction** is applied when the Soil Media Depth as designed will be less than the standard, as follows:

  [((Soil Media Depth Standard – 10%) – Design Soil Media Depth) / (Soil Media Depth Standard – 10%)] x 100

- **IWS Depth (ft) (minimum)** – Enter the depth of the IWS, in feet. A minimum of 1 foot is required. A **deduction** is applied when the IWS Depth as designed will be less than the standard, as follows:

  [((IWS Depth Standard – 10%) – Design IWS Depth) / (IWS Depth Standard – 10%)] x 100

- **Inflow Velocity for Storm Event Routed to MRC SCM (fps) (maximum)** – Enter the velocity, in feet per second (fps), for inflow to the SCM at the Maximum Storm Event Routed to the MRC SCM. The measurement can be reported as either at the point of inflow to the SCM or at the terminus of an energy dissipator. The standard for the 2-Year/24-Hour Storm and lesser storms is 2 fps. The standard for storms greater than the 2-Year/24-Hour Storm is 3 fps. A **deduction** is applied when the design Inflow Velocity exceeds the standard, as follows:

  [(Design Inflow Velocity – (Standard Inflow Velocity + 10%)) / (Standard Inflow Velocity + 10%)] x 100

- **Separation Distance Between MRC SCM Bottom and SHWT (in)** – Select from the dropdown list the depth, in inches, between the MRC SCM bottom and the seasonal high-water table (SHWT). The standard separation distance is 12 inches, unless a synthetic liner is used. If a liner is not used, a **deduction** is applied when the separation distance is less than the standard, as follows:

  [((Separation Distance Standard – 10%) – Design Separation Distance) / (Separation Distance Standard – 10%)] x 100

- **A Synthetic Liner Will Be Installed** – Select "Yes" or "No" from the dropdown list. In general, to maximize infiltration capabilities, a liner should not be installed unless a designer determines that the SCM must be isolated from groundwater. If "Yes" is selected a reason for the liner must be entered.

- **Diameter of Managed Release Orifice (in)** – Report the diameter of the managed release orifice, in inches, that will be used to achieve the MRC release rate standard.

- **SCM Embankment Slopes** – Enter the design slope for the SCM embankments. The standard is 3:1 (33%). Steeper slopes may be designed if the slopes are reinforced. There is no deduction if a value greater than the standard is entered; however, the method of reinforcement should be shown on plan drawings.

- **Check Dams and Level Step Sections Separated by Undisturbed Earth Will Be Provided** – This standard is shown only if the MRC Bioswale variation is selected. Select "TRUE" or "FALSE" from the dropdown list. If "FALSE" is selected, a **deduction** of 25% of the management credit for the SCM will be applied.

- **Pretreatment Will Be Provided** – If the Maximum Storm Routed to the MRC SCM is greater than the 2-Year/24-Hour Storm, adequate pretreatment (prior to the MRC SCM) must be provided, otherwise a **deduction of 50%** is applied. Adequate pretreatment is pretreatment that will produce median outflow concentrations for Total Suspended Solids (TSS), Total Nitrogen, and Total Phosphorus of 10 mg/L, 0.96 mg/L, and 0.24 mg/L, respectively. If the Maximum Storm Routed to the MRC SCM is the 2-Year/24-Hour Storm or less, the vegetated surface of the SCM may be considered adequate pretreatment unless elevated sediment loads are anticipated from the post-construction drainage area. If TRUE is selected for this question, a description of pretreatment must be provided. The user may enter FALSE to this question and there will be no deduction if the Maximum Storm Routed to the MRC SCM is the 2-Year/24-Hour Storm or less.

- **SCM Bed Bottom Area (SF)** – Enter the area of the SCM's bed bottom, in square feet (SF). This is for informational purposes only.

MRC Storage Systems

☑ ***Design Standards***

MRC Storage Systems Variation: **Upstream Vegetated Component**

Parameter	Standard	Design Value
Bypass/Overflow Volume @ 1.2-Inch/2-Hour Storm	0	
Maximum Storm Event Routed to MRC SCM		
MRC SCM Drainage Area (Equivalent Impervious, maximum)		0.0
Storage Unit - Freeboard (inches) (maximum)		

- **Variation** – Select "Upstream Vegetated Component", "MTD Pretreatment", or "Permeable Pavement" from the dropdown list. (MTD is an acronym for manufactured treatment device). ***One of these options must be selected for MRC Storage System***s.

- **Bypass/Overflow Volume During 1.2-Inch/2-Hour Storm (CF)** – The design standard is 0 (i.e., no release from the underdrain or bypass up to the 1.2-Inch/2-Hour Storm). If a value greater than 0 is entered, a **deduction of 50%** of volume management credit is applied.

- **Maximum Storm Event Routed to MRC SCM** – If *Total Volume Routed to SCM* in the Drainage Area Characterization section is left blank, select "1.2-Inch/2-Hour Storm", "2-Year/24-Hour Storm", or "> 2-Year/24-Hour Storm" from the dropdown list. Unlike for MRC Bioretention there is no deduction if flows greater than the 2-Year/24-Hour Storm are routed to an MRC Storage System. However, if an Upstream Vegetated Component is selected for pretreatment, flows exceeding the 1.2-Inch/2-Hour Storm must be bypassed or diverted around the Upstream Vegetated Component. If a value is entered into the *Total Volume Routed to SCM* cell, select the value that corresponds to the entered volume (e.g., if a value less than the calculated 1.2-Inch/2-Hour Storm is entered, select "< 1.2-Inch/2-Hour Storm").

- **MRC SCM Drainage Area (Equivalent Impervious, maximum acres)** – Both the Design Standard and Design Value for MRC SCM Storage Unit are calculated.

  - ***Design Standard*** – The design standard depends whether or not 10% of the 1.2-Year/2-Hour Storm precipitation has been managed across the site using PCSM Objective A SCMs. See the table below.

Maximum Storm Event Routed to SCM	Maximum Equivalent Impervious Drainage Area (acres)
1.2-Inch/2-Hour Storm (or less), **with** 10% PCSM Objective A	6
1.2-Inch/2-Hour Storm (or less), **without** 10% PCSM Objective A	5
2-Year/24-Hour Storm (or less but greater than 1.2-Inch/2-Hour Storm), **with** 10% PCSM Objective A	2.5
2-Year/24-Hour Storm (or less but greater than 1.2-Inch/2-Hour Storm), **without** 10% PCSM Objective A	2
> 2-Year/24-Hour Storm, **with** 10% PCSM Objective A	1.5
> 2-Year/24-Hour Storm, **without** 10% PCSM Objective A	1

  If the flow routed to the SCM is less than the 2-Year/24-Hour Storm but greater than the 1.2-Inch/2-Hour Storm, select the 2-Year/24-Hour Storm.

  If there is an exceedance of the Maximum Equivalent Impervious Drainage Area Standard, a **deduction of 50%** of volume management credit is applied.

  - ***Design Value*** – If the SCM is divided into cells, the design value is the Equivalent Impervious Area (calculated in the ***Drainage Area Characterization*** section) divided by the number of cells; otherwise it is the Equivalent Impervious Area.

- **Storage Unit With IWS**

  - **Freeboard (minimum)** – Enter the design freeboard for the SCM (i.e., vertical distance between the top of storage unit and the design ponding depth at the maximum storm event routed to the SCM). The maximum freeboard standards are 6 inches (for the 2-Year/24-Hour Storm or less) and 12 inches (for > 2-Year/24-Hour Storm) and are used as a measure to decrease compaction of the MRC surface. If the maximum freeboard is exceeded, a **deduction** is assessed based on the following formula:

    [(Design Freeboard – (Freeboard Standard + 10%)) / (Freeboard Standard + 10%)] x 100

  - **Pre-Construction 1-Year/24-Hour Peak Rate (cfs)** – Enter the 1-Year/24-Hour Peak Rate, in cubic feet per second (cfs), for the pre-construction SCM drainage area based on hydrologic modeling. There is no design standard for this parameter.

  - **Post-Construction 2-Year/24-Hour Peak Rate (cfs)** – Enter the 2-Year/24-Hour Peak Rate in the post-construction condition, as designed. This may be the peak rate discharge from the MRC SCM or the peak rate discharge from a downstream PCSM Objective D SCM for the volume of stormwater released from the MRC SCM.

    The standard is one of the following:

    - Less than or equal to the pre-construction 1-Year/24-Hour Peak Rate IF the 1-Year/24-Hour Peak Rate is greater than or equal to 0.15 cfs/acre (equivalent impervious).

    - 0.15 cfs/acre if the 1-Year/24-Hour Peak Rate is less than 0.15 cfs/acre.

    A **deduction of 50%** is applied if the Pre-Construction 2-Year/24-Hour peak rate exceeds the Pre-Construction 1-Year/24-Hour peak rate (or 0.15 cfs/acre).

- **Controlled Release Rate for 1.2-Inch/2-Hour Storm (cfs)** – The standard is computed by multiplying the Equivalent Impervious by 0.02 cfs/acre of Equivalent Impervious, divided by the number of cells (if applicable). This standard is displayed for informational purposes.

- **Underdrain Outflow Rate for 1.2-Inch/2-Hour Storm (cfs)** – Report the outflow rate, as designed, from the underdrain for the 1.2-Inch/2-Hour Storm condition. The standard is the Controlled Release Rate for the 1.2-Inch/2-Hour Storm. A **deduction** is applied if the underdrain outflow rate exceeds the Controlled Release Rate, as follows:

  [(Underdrain Outflow Rate – (Controlled Release Rate + 10%)) / (Controlled Release Rate + 10%)] x 100

- **Drawdown Time for Storm Event Routed to MRC SCM (hrs) (maximum)** – Report the amount of time, in hours, for the media above the IWS to dewater at the maximum storm event routed to the MRC SCM, as designed. The standard for all storms is 168 hours. A **deduction** is applied if the ponding time exceeds the standard, as follows:

  [(Design Drawdown Time – (Drawdown Time Standard + 10%)) / (Drawdown Time Standard + 10%)] x 100

- **Separation distance between MRC SCM bottom and SHWT (in)** – Select from the dropdown list the depth, in inches, between the MRC SCM bottom and the seasonal high-water table (SHWT). The standard separation distance is 12 inches, unless a synthetic liner or equivalent is used. If a liner is not used, a **deduction** is applied when the separation distance is less than the standard, as follows:

  [((Separation Distance Standard – 10%) – Design Separation Distance) / (Separation Distance Standard – 10%)] x 100

- **IWS Depth (ft) (minimum)** – Enter the depth of the IWS, in feet. A minimum of 1 foot is required. A **deduction** is applied when the IWS depth as designed will be less than the standard, as follows:

  [((IWS Depth Standard – 10%) – Design IWS Depth) / (IWS Depth Standard – 10%)] x 100

- **IWS Area (SF) –** Enter the surface area of the IWS zone, in SF. This is generally the bed bottom area of the MRC storage unit. There is no standard.

- **Void Space in IWS (%) –** Enter the void space percentage of the IWS zone. Depending on the media used, this value will generally vary between 30% - 40% and should not exceed 50%. There is no standard.

- **IWS Void Space Volume (CF) (minimum) –** The IWS Void Space Volume, in CF, is calculated by multiplying the IWS Depth by the IWS Area and the IWS Void Space Percentage. The IWS Void Space Volume standard is calculated by the following formula:

  [(0.25 inch x (1 foot / 12 inches) x Equivalent Impervious Area (SF)) – Void Space Reduction for Upstream Vegetated Component (CF) (if applicable)] x 100

  A **deduction** is applied when the IWS Void Space Volume as designed will be less than the standard, as follows:

  [((IWS Void Space Volume Standard – 10%) – Design IWS Void Space Volume) / (IWS Void Space Volume Standard – 10%)] x 100

- **A Synthetic Liner Will Be Installed** – Select "Yes" or "No" from the dropdown list. In general, to maximize infiltration capabilities, a liner should not be installed unless a designer must isolate the SCM from groundwater. If "Yes" is selected a reason for the liner must be entered.

- **Diameter of Managed Release Orifice (in)** – Report the diameter of the managed release orifice, in inches, that will be used to achieve the MRC release rate standard.

- **Pretreatment for Additional Flows** – If Additional Flows will be routed to the SCM (from outside of the MRC SCM drainage area), select True or False to indicate whether these flows will be pretreated or not applicable ("N/A") (i.e., there will be no Additional Flows). If True, or N/A, no deduction is applied. If False, a **deduction** of 25% is applied.

- **Pretreatment** – required for all MRC Storage Systems (a variation must be selected).

  - Pretreatment standards for the ***Upstream Vegetated Component*** variation are as follows:

    - **Ponding Depth @ 1.2-Inch/2-Hour Storm (ft) (maximum)** – Report the depth, in feet, of stormwater in the SCM following the 1.2-Inch/2-Hour Storm, as designed. The design standard is 0.5 foot. If the ponding depth standard is exceeded, a **deduction** is assessed based on the following formula:

      (Design Ponding Depth – (Ponding Depth Standard + 10%)) / (Ponding Depth Standard + 10%)

      NOTE 8 – To ensure long-term protection of the Upstream Vegetated Component, flows exceeding the 1.2-Inch/2-Hour Storm should be diverted directly to the MRC Storage Unit.

    - **Soil Media Depth (ft) (minimum)** – Enter the depth of soil or other engineered media that will be located above the IWS (if used) or native soils, in feet. A minimum of 1.5 feet is required. A **deduction** is applied when the Soil Media Depth as designed will be less than the standard, as follows:

      [((Soil Media Depth Standard – 10%) – Design Soil Media Depth) / (Soil Media Depth Standard – 10%)] x 100

      NOTE 9 – An IWS is not required in an Upstream Vegetated Component that is part of an MRC Storage System.

    - **Rooting Depth** – Select "Deep Plantings" (e.g., deep rooted plug plantings, shrubs, etc.) or "Shallow Plantings" (e.g., mowed turf grass) from the dropdown list to represent the planned vegetation in the Upstream Vegetated Component. If a mix is planned select "Deep Plantings." Rooting depths of 1.5 feet and 0.75 foot is used for Deep Plantings and Shallow Plantings, respectively. These depths are not shown but are used to determine Void Space Reduction (below).

    - **Surface Area** – Enter the bed bottom area of the Upstream Vegetated Component. There is no standard; this parameter is used to determine Void Space Reduction (below).

    - **Void Space in Soil Media** – Enter a value that represents the void space available within the soil media, in percent by volume. Values of 30% - 40% are typical and should not exceed 50%. There is no standard; this parameter is used to determine Void Space Reduction (below).

    - **Void Space Reduction (CF)** – The Void Space Reduction is calculated based on prior entries and serves to reduce the required IWS volume for the MRC Storage Unit downstream; Void Space Reduction is calculated by multiplying Rooting Depth by Surface Area and Void Space.

  - Pretreatment standards for the ***MTD Pretreatment*** variation are as follows:

    - **TSS MOC at Design Flow (mg/L)** – Enter the Median Outflow Concentration (MOC) for TSS as determined through testing by the manufacturer of the MTD or by a third party. The standard is 10 mg/L (i.e., equivalent to the MOC expected for an Upstream Vegetated Component). For testing, it is expected that TSS will be measured in the outflow of the MTD under a range of flow conditions,

and the designer will verify that the MOC will be met at the expected Design Flow for the project (i.e., typically the flow rate associated with the 1.2-Inch/2-Hour Storm).

For example, third party testing of an MTD yields the following data:

Test No.	Influent Flow Rate (cfs)	TSS MOC (mg/L)
1	8.5	6.5
2	18	9.6
3	26.5	11.2

The peak rate entering the proposed MTD for a project is determined to be 20 cfs. It is not appropriate to assume that a linear interpolation can be made, unless a study is performed demonstrating a linear relationship between flow and pollutant concentrations. The designer would need to assume that the TSS MOC will be 11.2 mg/L or would need to reduce the flow rate to 18 cfs or less so that the TSS MOC of 9.6 mg/L can be used.

If the TSS MOC standard is exceeded, a **deduction** is assessed based on the following formula:

[(TSS MOC for Design – (TSS MOC Standard + 10%)) / (TSS MOC Standard + 10%)] x 100

- **TP MOC at Design Flow (mg/L)** – Enter the MOC for Total Phosphorus (TP) as determined through testing by the manufacturer of the MTD or by a third party. The standard is 0.24 mg/L. If the TP MOC standard is exceeded, a **deduction** is assessed based on the following formula:

  [(TP MOC for Design – (TP MOC Standard + 10%)) / (TP MOC Standard + 10%)] x 100

- **TN MOC at Design Flow (mg/L)** – Enter the MOC for Total Nitrogen (TN) as determined through testing by the manufacturer of the MTD or by a third party. The standard is 0.96 mg/L. If the TN MOC standard is exceeded, a **deduction** is assessed based on the following formula:

  [(TN MOC for Design – (TN MOC Standard + 10%)) / (TN MOC Standard + 10%)] x 100

- **Flow Used to Determine MOCs (cfs)** – Report the flow that is associated with the TSS, TP, and TN MOCs. There is no standard. For the example above, if efforts are not made to reduce peak rate of inflow into the MTD, the designer would report 26.5 cfs.

- **Design Flow for Project (cfs)** – Enter the Design Flow for the project (i.e., peak inflow rate to the MTD). This value should be less than or equal to the Flow Used to Determine MOCs. For the example above, the designer would report 20 cfs. If the Design Flow for Project exceeds the Flow Used to Determine MOCs, a deduction is assessed based on the following formula:

  [(Design Flow for Project – (Flow Used to Determine MOCs + 10%)) / (Flow Used to Determine MOCs + 10%)] x 100

- Pretreatment standards for the ***Permeable Pavement*** variation are as follows:

  - **Direct Connections** – Select TRUE from the dropdown list if there will be any direct connections (e.g., roof leaders) to the underground storage layer, otherwise select FALSE. If TRUE, describe the pretreatment that will be provided prior to discharge to underground storage.

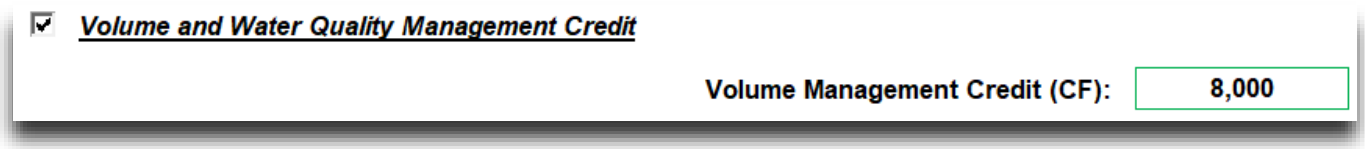
  - **Adjacent Areas** – Select TRUE from the dropdown list if there will be any areas adjacent to the permeable pavement that will flow into the underground storage, otherwise select FALSE. If TRUE, describe the pretreatment that will be provided prior to discharge to underground storage.

  - **Street Sweeper Type** – Select “Regenerative Air” or “Vacuum” for the type of street sweeper that will be used to clean the permeable pavement surface. Note that mechanical broom is not sufficient for pretreatment.

- **Sweeping Frequency** – Select from the dropdown list the planned frequency of sweeping of the permeable pavement surface.

4. Volume and Water Quality Management Credit

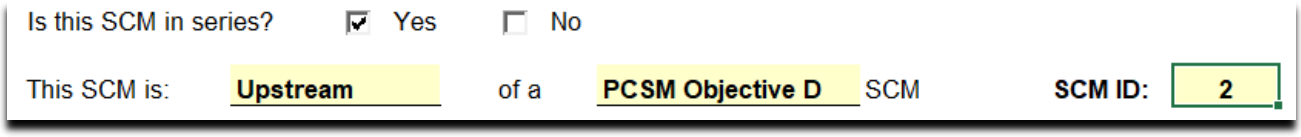
If the sum of deductions described above in the Design Standards section is zero, full credit for volume management for the three pollutants analyzed is displayed.



Volume management credit is provided – subject to any applicable deductions – up to the 2-Year/24-Hour Storm event if either of the following are true:

- The volume routed to the MRC SCM is the 2-Year/24-Hour Storm or greater; or
- The volume routed to the MRC SCM is less than the 2-Year/24-Hour Storm but the volume that is not routed to the MRC SCM is routed to an Objective D SCM (i.e., rate control SCM) where the post-construction 2-Year/24-Hour peak rate is managed back to the pre-construction 1-Year/24-Hour peak rate.

  When the volume associated with a storm event that is less than the 2-Year/24-Hour Storm is routed to the MRC SCM, and the user indicates that the MRC SCM is upstream of an Objective D SCM (as shown below), the MRC Spreadsheet assumes that management of the post-construction 2-year peak rate back to the pre-construction 1-year peak rate is completed within the Objective D SCM, and full management credit up to the 2-Year/24-Hour Storm (subject to deductions) is provided.



If the sum of deductions is greater than zero but less than 50%, the full credit for volume is reduced by the total deduction and a flag is shown that, “There are design standard deviations; a justification for the deviations in attached.”

A PA-licensed professional engineer (PE) may attach an explanation or justification for the design standard deviations. The PE may use professional organization or agency publications (e.g., ASCE, WEF, EPA, etc.), refereed technical publications (e.g., ASCE Journal of Sustainable Water in the Built Environment, ASCE Journal of Hydrology, etc.), or refereed case studies that demonstrate that the design modifications will provide the same degree of volume management as if DEP’s design standards were met. The justification must include a statement, signed and sealed by the PE, that the design will provide equal or better protection to waters of the Commonwealth. If a justification is attached, the PE may select TRUE in the dropdown list, otherwise select FALSE. If TRUE is selected full credit is restored.

There are design standard deviations; a justification for the deviations is attached	TRUE
Volume Management Credit (CF):	10,734

If the sum of deductions is greater than or equal to 50%, the partial credit is displayed and a statement is shown, "The applicant is seeking full management credit for this design."

The applicant is seeking full management credit for this design	
Volume Management Credit (CF):	0

If the user selects TRUE next to this statement, the MRC spreadsheet displays, "The design has been approved by DEP's Bureau of Clean Water (attached)."

The applicant is seeking full management credit for this design	TRUE
Volume Management Credit (CF):	0
The design has been approved by DEP's Bureau of Clean Water (attached)	

If the applicant is seeking full management credit for an MRC design with deviations of at least 50%, the following steps must be taken:

- Submit electronic files containing the following information to DEP's Bureau of Clean Water at RA-EPAlternativeBMP@pa.gov ***prior to submitting an NOI or application for a Chapter 102 permit****:*
  - The MRC Spreadsheet;
  - Plan Drawings showing proposed MRC design details; and
  - A written justification for the deviations from design standards including one or more of the following: 1) a citation to an existing MRC SCM (project and location) that was designed and implemented similarly and has performed successfully; 2) professional organization or agency publications; 3) refereed technical publications; and/or refereed case studies supporting the design.
- DEP's Bureau of Clean Water will review the proposal (generally within 30 days) and provide a written response via email.
- If DEP approves the proposal, the applicant should select TRUE next to the statement, "The design has been approved by DEP's Bureau of Clean Water (attached)", print the MRC Spreadsheet, attach DEP's approval, and submit with an NOI or application for a Chapter 102 permit. Otherwise select FALSE.

The applicant is seeking full management credit for this design	TRUE
Volume Management Credit (CF):	10,734
The design has been approved by DEP's Bureau of Clean Water (attached)	TRUE

Finally, the PE responsible for design should enter their name, company, and license number after reading the certification statement.

MRC Simplified Design Standards

Applicants proposing MRC SCMs are not required to use the MRC Spreadsheet when the MRC Simplified Design Standards will be met. Volume management credit may be claimed for the volume routed up to the 2-year/24-hour storm event for any SCM that will be designed to meet the following standards:

Design Parameter	Standard
MRC SCM Type	MRC Bioretention
Maximum Drainage Area	1 acre
Maximum Equivalent Impervious in Drainage Area	0.5 acre
Maximum Flow (Storm Event) Routed to SCM	2-year/24-hour storm (higher flows are diverted or bypassed)
Maximum Ponding Time	72 hours
Minimum Soil Media Depth (includes a minimum of 1-foot IWS)	2 feet
Maximum Ponding Depth @ 2-Year/24-Hour Storm	1.5 feet (or 6 inches above the Ponding Depth @ 1.2-Inch/2-Hour Storm)
Maximum Ponding Depth @ 1.2-Inch/2-Hour Storm	1 foot (no overflow)
Controlled Release Rate for 1.2-Inch/2-Hour Storm	0.02 cfs/acre equivalent impervious
Underdrain Outflow Rate for 1.2-Inch/2-Hour Storm	≤ Controlled Release Rate
Geomorphologic Protection	Post-Construction 2-Year/24-Hour Peak Rate Managed Back to Pre-Construction 1-Year/24-Hour Peak Rate in a Separate SCM as necessary
Separation Distance to Groundwater or SHWT, minimum (ft)	1 foot (2 feet recommended)

Completion of the **MRC Simplified Design Spreadsheet** is required for each MRC SCM designed to meet these standards.

ATTACHMENT A
SCMs by PCSM OBJECTIVES

- **PCSM Objective A SCMs:**
  - **A.1: Protect and Preserve Natural Landscape Processes**
    - Protected Natural Stormwater Features
    - Preserved Natural Open Spaces
  - **A.2: Enhanced Natural Landscape SCMs**
    - Disconnection of Impervious Surface with Filter Strip
    - Riparian Buffer Establishment and Enhancement
    - Floodplain Restoration
    - Revegetation and Soil Restoration
    - Retentive Grading
    - Vegetated Conveyance
- **PCSM Objective B SCMs:**
  - **B.1: Infiltration-Based SCMs**
    - Bioinfiltration
    - Surface Infiltration Basin
    - Permeable Pavement
    - Infiltration Trench
    - Underground Infiltration Basin
  - **Non-Infiltration SCMs**
    - Bioretention
    - Green Roof
    - Regenerative Step Pool Systems
    - Stormwater Capture and Use
    - Blue Roof
    - Engineered Stormwater Treatment Wetland
    - Water Quality Filtration and Treatment
- **PCSM Objective C SCMs:**
  - Managed Release Concept (MRC) Bioretention
  - MRC Storage Systems
- **PCSM Objective D SCMs:**
  - Wet Basin
  - Naturalized Detention Basin
  - Underground Detention

Revision History

Date	Version	Revision Reason
11/18/2024	1.0	Original