pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

MANAGED RELEASE CONCEPT (MRC) SPREADSHEET INSTRUCTIONS

Revised, April 2, 2026

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.

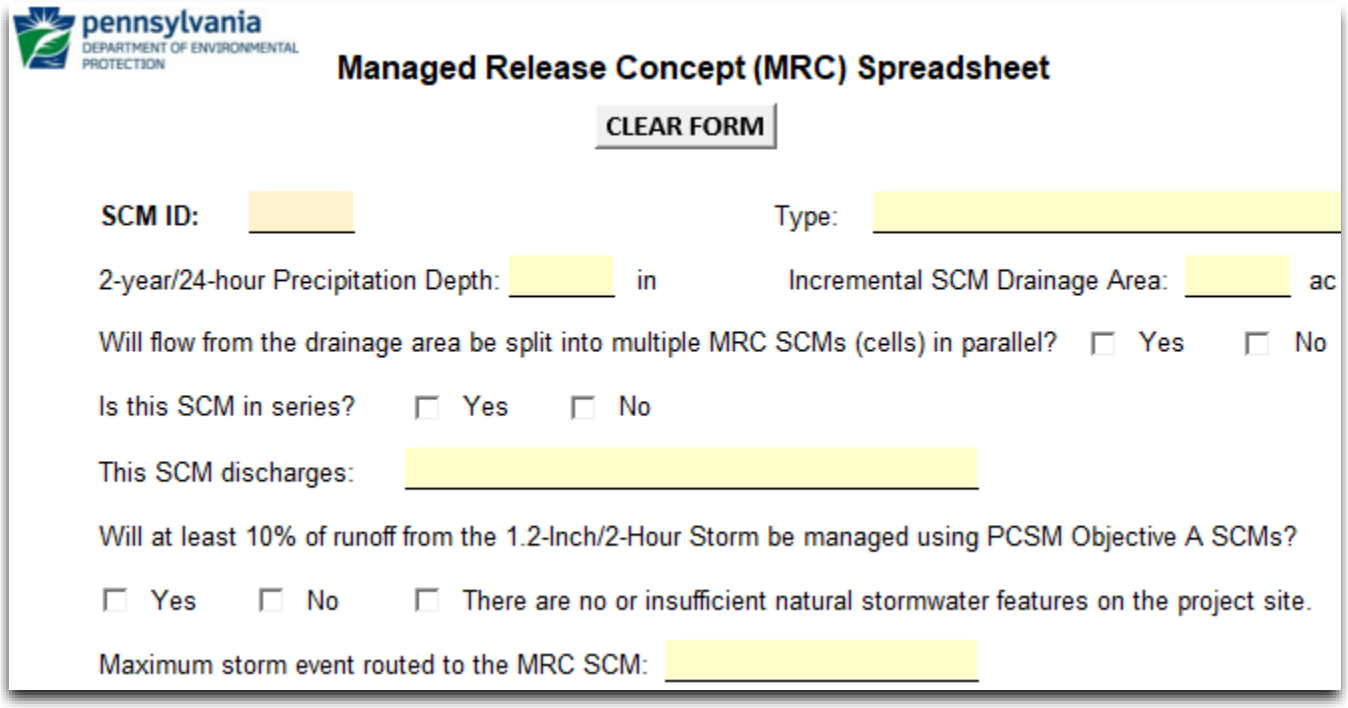
All cells available for data entry or selection from a drop-down menu are highlighted. **The user may use the Tab, arrow, or Enter keys to move from cell to cell. Using the mouse to click from cell to cell may result in validation errors**.

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 total drainage area that will contribute runoff from the 1.2-Inch/2-Hour Storm to the SCM (the entire SCM including all cells comprising the SCM, if applicable), in acres. For the purposes of the MRC Spreadsheet, the Incremental SCM Drainage Area may include areas outside of the disturbed area and outside of the project site.

  The Incremental SCM Drainage Area represents the effective contributing drainage area for the 1.2-Inch/2-Hour Storm event, or the portion of that storm event routed to the MRC SCM. The value entered must account for any upstream management or diversion of the 1.2-Inch/2-Hour Storm (or portion thereof).

  Do not include drainage area that is diverted away from the MRC SCM for the 1.2-Inch/2-Hour Storm (or portion thereof). Do not include drainage area that is treated by an upstream SCM that fully manages the 1.2-Inch/2-Hour Storm. Where an upstream SCM manages only a portion of the 1.2-Inch/2-Hour Storm, only the remaining unmanaged portion of runoff should be included. Upstream SCMs that provide water quality treatment only (e.g., street sweeping, filtering, etc.) do not reduce the Incremental SCM Drainage Area.

Where only a portion of the 1.2-Inch/2-Hour Storm is routed to the MRC SCM, the Incremental SCM Drainage Area should reflect the effective drainage area corresponding to the routed runoff volume. The Equivalent Impervious Area calculation may be used to determine the effective drainage area associated with the routed volume. Where the full 1.2-Inch/2-Hour Storm is routed to the MRC SCM, the Incremental SCM Drainage Area should reflect the total contributing drainage area. **There are limitations on the SCM Drainage Area**, depending on the type of MRC SCM and Maximum Storm Event Routed to the MRC SCM.

Off-site stormwater should, wherever possible, bypass MRC SCMs. When off-site stormwater within the SCM Drainage Area is prevented from flowing to the MRC SCM using a diversion structure, the area associated with the bypassed off-site stormwater should not be included in the reported Incremental SCM Drainage Area.

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).

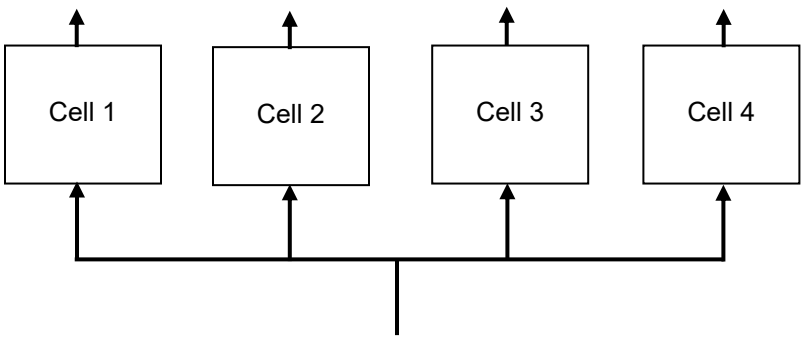
Example 2 – A Bioinfiltration SCM is upstream of an MRC Bioretention SCM. The Bioinfiltration SCM receives runoff from 2 acres and will infiltrate and evapotranspire all of the 1.2-Inch/2-Hour Storm precipitation depth. The MRC Bioretention SCM receives additional flows from the Bioinfiltration SCM plus 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 represents the effective drainage area corresponding to the volume of runoff from the 1.2-Inch/2-Hour Storm that is routed to the MRC SCM. This value may differ from the total post-construction drainage area when only a portion of the runoff is routed to the SCM. The ***Post-Construction Drainage Area*** represents the total contributing drainage area used to develop runoff volumes for analysis. Where only a portion of runoff from the 1.2-Inch/2-Hour Storm is routed to the SCM, the Incremental SCM Drainage Area reflects the effective area corresponding to that routed volume.

- **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**). Cells should function independently and be separated by berms or other materials that prevent flow between cells.

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 of the 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 project site (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.

- **Maximum Storm Event Routed to the MRC SCM** – Select the maximum storm event for which runoff is intended to be managed by the MRC SCM from the following options: < 1.2-Inch/2-Hour Storm, 1.2-Inch/2-Hour Storm, < 2-Year/24-Hour Storm, 2-Year/24-Hour Storm, and > 2-Year/24-Hour Storm. The selected storm event should reflect the design intent of the SCM and the storm event for which volume management is provided (i.e., the 1.2-Inch/2-Hour Storm or the 2-Year/24-Hour Storm), as demonstrated by hydrologic and hydraulic modeling.

  For storm events greater than the selected design storm, diversion structures installed ***prior to the MRC SCM*** are typically used to limit the volume managed by the SCM. Due to hydraulic conditions within the system, a portion of flow from larger storm events may enter or pass through the SCM prior to diversion.

  The presence of flow from storm events greater than the selected design storm does not, by itself, require selection of a larger storm event. Where the SCM is designed to manage the 1.2-Inch/2-Hour Storm or 2-Year/24-Hour Storm, and diversion structures are provided for larger events, the selected storm event should correspond to the intended design storm.

  If a diversion structure prior to the MRC SCM is not proposed to direct flows exceeding the 2-Year/24-Hour Storm away from the MRC SCM, select > 2-Year/24-Hour Storm. If > 2-Year/24-Hour Storm is selected and a forebay is not proposed for an MRC Bioretention SCM or a forebay or settling chamber is not proposed for an MRC Storage System SCM, a **deduction of 50%** is applied 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.

2. Drainage Area Characterization

☑ ***Drainage Area Characterization***

Pre-Construction Drainage Area Rows: 1

☐ ***Exempt from §§ 102.8(g)(2)(ii) & (iii)***
☑ ***Calculate runoff automatically***

Pre-Construction Drainage Area Cover Type	HSG	Area (ac)	Off-Site	Runoff, 1.2-Inch (CF)	Runoff, 2-Year (CF)
Pervious as Meadow	B	18.66	☐	0	18,548
			Totals (CF):	**0**	**18,548**

- **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. If the land cover/HSG combination is located outside of the project site area, check the box for "Off-Site". Select the number of Rows (up to 20). 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.

  NOTE 5 – Earlier versions of Excel may display "FALSE" or hashtags in the cell for "Off-Site" instead of a checkbox. The user may type "TRUE" in the cell and it will have the same effect as if the box was checked.

  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).

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

  NOTE 6 – 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).

  At the top of the Pre-Construction Drainage Area table there is a checkbox next to "Receives direct precipitation only." Check this box if the SCM receives only direct precipitation, i.e., stormwater will not be routed to the SCM through a drainage area outside of the SCM (e.g., MRC Storage Systems beneath artificial turf fields). *De minimis* volumes generated near the SCM are acceptable.

- **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 (including off-site areas) 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.

  The Post-Construction Drainage Area represents the total contributing drainage area used to develop runoff volumes for the 1.2-Inch/2-Hour Storm and the 2-Year/24-Hour Storm, prior to any diversion or routing limitations. The total area entered is not required to match the Incremental SCM Drainage Area, which

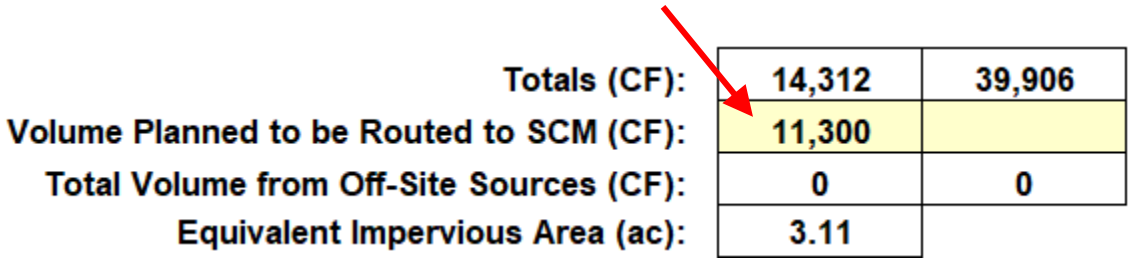
represents the effective drainage area associated with the routed runoff volume. The runoff volumes for the 1.2-Inch/2-Hour Storm and the 2-Year/24-Hour Storm are estimated for each Cover Type / Soil Type combination using the NRCS TR-55 Curve Number method and are summed when the "Calculate runoff automatically" box is checked.

- ***Totals (CF)*** – The total runoff for the 1.2-Inch/2-Hour storm and the 2-Year/24-Hour storm is summed for all land cover/HSG combinations, including runoff originating from off-site, if applicable. These totals represent the entire runoff volume associated with the drainage area.

- ***Volume Planned to be Routed to SCM (CF), 1.2-Inch/2-Hour Storm*** – Enter a value in this cell – as identified by the red arrow below – only if there will be a diversion resulting in volume less than the calculated 1.2-Inch/2-Hour Storm volume reaching the MRC SCM. In the example below, a value greater than 14,312 CF cannot be entered. The entered volume must be consistent with the hydraulic diversion computations (static or dynamic) and the hydrologic modeling for the 1.2-Inch/2-Hour Storm event.

  If the 1.2-Inch/2-Hour Storm volume (exactly) will be diverted to the MRC SCM, this cell can remain blank. If there is no diversion (all flows up to the 100-Year/24-Hour Storm will enter the MRC SCM), this cell must remain blank. A value should only be reported in this cell if the calculated 1.2-Inch/2-Hour Storm volume will not reach the MRC SCM during the 1.2-Inch/2-Hour Storm.

  A value may be entered in this cell only if "< 1.2-Inch/2-Hour Storm" is selected for *Maximum Storm Event Routed to the MRC SCM* in the prior section of the spreadsheet.



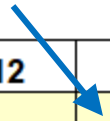
Totals (CF):	**14,312**	**39,906**
Volume Planned to be Routed to SCM (CF):	**11,300**	
Total Volume from Off-Site Sources (CF):	**0**	**0**
Equivalent Impervious Area (ac):	**3.11**	

- ***Volume Planned to be Routed to SCM (CF), 2-Year/24-Hour Storm*** – Enter a value in this cell – as identified by the blue arrow below – only if there will be a diversion resulting in volume less than the calculated 2-Year/24-Hour Storm volume reaching the MRC SCM. In the example below, a value greater than 40,195 CF cannot be entered.

  If the 2-Year/24-Hour Storm volume (exactly) will be diverted to the MRC SCM, this cell can remain blank. If there is no diversion, this cell must remain blank. A value should only be reported in this cell if the calculated 2-Year/24-Hour Storm volume will not reach the MRC SCM during the 2-Year/24-Hour Storm, but the volume routed will be greater than the 1.2-Inch/2-Hour Storm volume.

  If a value is reported in the *Volume Planned to be Routed to SCM, 1-Inch/2-Hour Storm* cell, an entry into the *Volume Planned to be Routed to SCM, 2-Year/24-Hour Storm* cell is not possible.

  A value may be entered in this cell only if "< 2-Year/24-Hour Storm" is selected for *Maximum Storm Event Routed to the MRC SCM* in the prior section of the spreadsheet.



Totals (CF):	**14,312**	**39,906**
Volume Planned to be Routed to SCM (CF):		**24,330**
Total Volume from Off-Site Sources (CF):	**0**	**0**
Equivalent Impervious Area (ac):	**4.00**	

NOTE 7 – If a volume less than the 2-Year/24-Hour Storm, but at least the 1.2-Inch/2-Hour Storm is routed to the SCM, volume management credit can be obtained up to the calculated 2-Year/24-Hour Storm if the post-construction 2-year peak rate is managed back to the pre-construction 1-year peak rate. If a volume is routed that is less than the 1.2-Inch/2-Hour storm, and the post-construction 2-year peak rate is managed back to the pre-construction 1-year peak rate, volume management credit is calculated based on the runoff from the equivalent impervious surface for the 2-Year/24-Hour Storm precipitation depth.

Total Volume from Off-Site Sources (CF) – The volume for each combination of land cover/HSG is summed and displayed for those combinations that are identified as off-site only. The Total Volume from Off-Site Sources is deducted from the calculated Volume Management Credit, consistent with the portion of runoff routed to the SCM.

Equivalent Impervious Area (ac) – The *Equivalent Impervious Area* is calculated and used to calculate the MRC Controlled Release Rate and to evaluate applicable design standards. 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 *Volume Planned to be Routed to SCM*) by 0.083333 (1 inch / 12 inches/foot) and 43,560 SF/acre. In the event the calculated equivalent impervious area is less than the total impervious area with a curve number of 98, the total impervious area with a curve number of 98 is used for equivalent impervious.

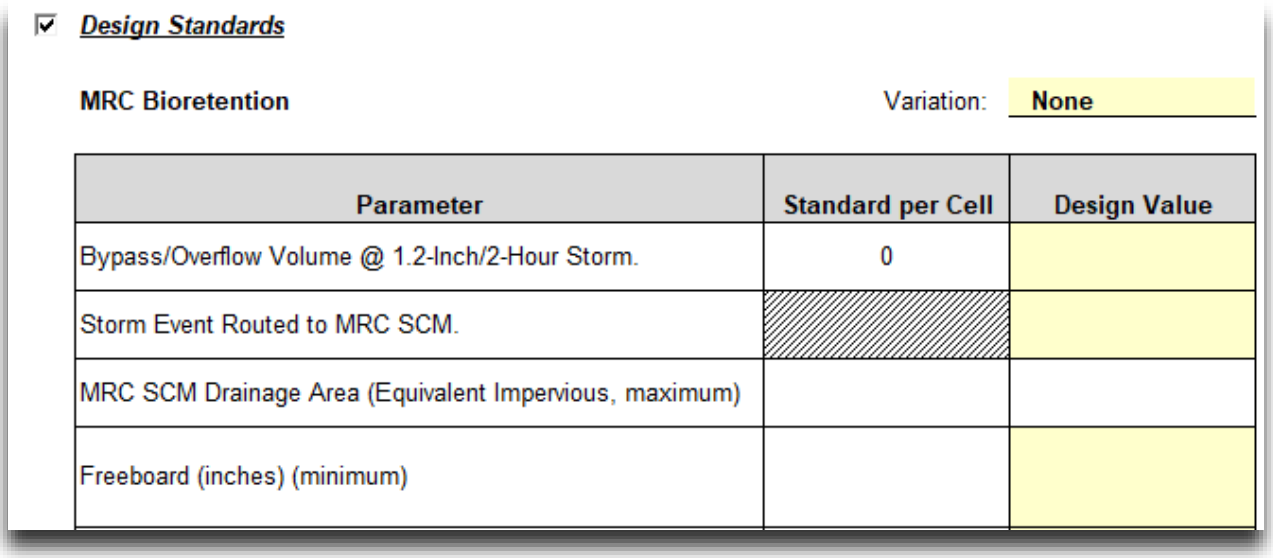
NOTE 8 – Equivalent Impervious Area is calculated based on the volume of runoff associated with the 1.2-Inch/2-Hour Storm that is routed to the MRC SCM. Where the full storm volume is routed, the calculation includes runoff from all contributing areas, including off-site areas, if applicable. Where only a portion of the 1.2-Inch/2-Hour Storm is routed to the MRC SCM, the Equivalent Impervious Area is based on the routed volume, including any off-site runoff that is included in that routed volume.

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 9 – 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 Management Credit section***, below).

- **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 in 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 of more than 0.1 acre, a **deduction of 50%** of volume management credit is applied.

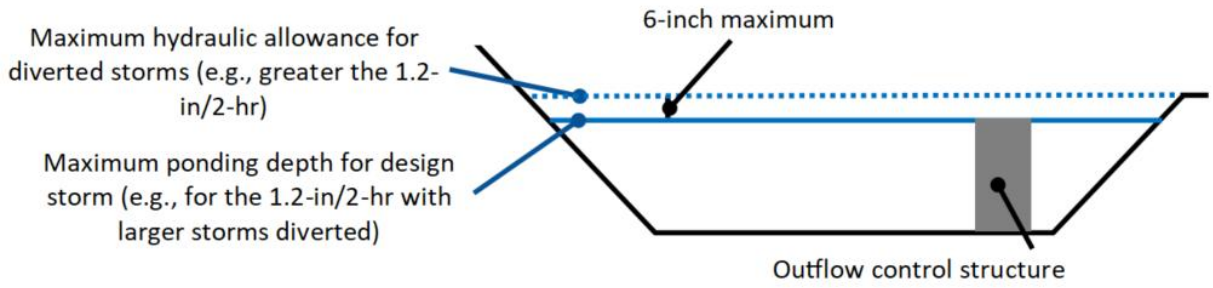
A limit is also enforced on the Incremental SCM Drainage Area. If this area exceeds the following standards by more than 0.1 acre, a **deduction of 50%** of volume management credit is applied:

Maximum Storm Event Routed to SCM	Maximum Incremental SCM 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	6
2-Year/24-Hour Storm (or less but greater than 1.2-Inch/2-Hour Storm), **with** 10% PCSM Objective A	6
2-Year/24-Hour Storm (or less but greater than 1.2-Inch/2-Hour Storm), **without** 10% PCSM Objective A	6
> 2-Year/24-Hour Storm, **with** 10% PCSM Objective A	3
> 2-Year/24-Hour Storm, **without** 10% PCSM Objective A	3

NOTE 10 – The evaluation of whether a deduction will be applied for exceeding the Incremental SCM Drainage Area takes into account whether cells are incorporated into the design. For example, an Incremental SCM Drainage Area of 19 acres that will be treat the 1.2-Inch/2-Hour storm volume with 3 MRC cells will result in a 50% deduction because more than 6 acres drains to each cell. However, if the Incremental SCM Drainage Area includes off-site area, and that off-site area either does not produce runoff at the 1.2-Inch/2-Hour storm or the volume routed to the MRC SCM excludes the off-site runoff, the evaluation will exclude off-site area when the volume routed to the MRC SCM is the 1.2-Inch/2-Hour storm (or less).

- ***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.

- **Hydraulic Allowance for Diversion (maximum)** – If volume associated with larger storms will be diverted away from the MRC SCM (i.e., storms greater than the 1.2-inch/2-hour or 2-year/24-hour storms), it is recognized that additional hydraulic head may be required to enable diversion. This additional hydraulic head is termed *hydraulic allowance*. The hydraulic allowance is a depth above the maximum ponding depth that can occur in the basin for storm events greater than the design storm the MRC is intended to manage (e.g., 1.2-inch/2-hour or 2-year/24-hour storm). The maximum hydraulic allowance is 6 inches and should be lower if achievable. Meeting the maximum hydraulic allowance should be demonstrated using a hydrologic model. See figure below.



If the maximum Hydraulic Allowance is exceeded, a **deduction** (percentage) is assessed based on the following formula:

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

NOTE 11 – Hydraulic allowance is a separate consideration from freeboard requirements (as may be applicable by local requirements), where distance above maximum surface elevation due to a primary outflow failure needs demonstration.

- **Ponding Depth @ 1.2-Inch/2-Hour Storm (ft) (maximum)** – Report the depth, in feet, of stormwater in the SCM resulting from the 1.2-Inch/2-Hour Storm, as determined using hydrologic and/or hydraulic modeling. The reported ponding depth should correspond to the modeled water surface elevation within

the SCM at the 1.2-Inch/2-Hour Storm event. 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.

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

  A **deduction of 100%** is applied if the Post-Construction 2-Year/24-Hour Peak Rate exceeds the Pre-Construction 1-Year/24-Hour Peak Rate (or 0.15 cfs), since meeting this standard is a key MRC design principle.

  NOTE 12 – The modeling for Post-Construction Peak Rate must include any additional flows routed to the MRC SCM from outside the project site 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 of 100%** is applied if the Underdrain Outflow Rate for 1.2-Inch/2-Hour Storm exceeds the Controlled Release Rate for 1.2-Inch/2-Hour Storm, since meeting this standard is a key MRC design principle.

- **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 media 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 **50% deduction** is applied when the Soil Media Depth as designed will be less than the standard.

- **IWS Depth (ft) (minimum)** – Enter the depth of the IWS, in feet. A minimum of 1 foot is required. A **50% deduction** is applied when the IWS Depth as designed will be less than the standard.

- **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 velocity can be reported as either at the point of inflow to the SCM or at the terminus of an energy dissipator or forebay, as applicable.

  The effects of tailwater within the SCM may be considered in the velocity determination. Where the SCM is designed such that water surface elevations equalize between SCM cells or within the SCM during the routed storm event, the resulting reduction in hydraulic gradient may be used to demonstrate a reduction in inflow velocity.

  The standard for the 2-Year/24-Hour Storm and lesser storms is 2 fps. Where an energy dissipation component is designed in accordance with DEP's E&S Manual to control inflow velocity and the routed storm is the 2-Year/24-Hour Storm or less, the standard is considered met and the user can report 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** – Pretreatment is required for all MRC Bioretention SCMs, as follows:

  - 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. Regardless, a forebay or other pretreatment measure may be proposed. Select either Forebay, SCM Surface, or Other from the dropdown list.

    - If Forebay is selected, enter design values for Forebay parameters (note there are no deductions for forebay design values entered when the Maximum Storm Routed to the MRC SCM is the 2-Year/24-Hour Storm or less).

- If SCM Surface is selected, nothing further is required.

- If Other is selected enter a description of the proposed pretreatment.

- If the Maximum Storm Routed to the MRC SCM is greater than the 2-Year/24-Hour Storm, a forebay is required and the user must enter design values for Forebay parameters, as follows. An Operation and Maintenance (O&M) Plan must be prepared that includes a sufficient solids removal frequency to prevent resuspension of sediment.

  These requirements apply only where the SCM is intended to manage runoff from storm events greater than the 2-Year/24-Hour Storm, as demonstrated through hydrologic and/or hydraulic modeling. The incidental passage of runoff from storm events greater than the selected design storm, prior to diversion, does not by itself trigger the need for a forebay.

  - **Forebay Storage Volume (CF) (minimum)** – The design standard is 0.25 inch of runoff per equivalent impervious area.

    Example: An MRC SCM receives runoff from a drainage area with 1 acre of equivalent impervious surface. The volume of the forebay should be at least 908 CF, as follows:

    1 acre x 43,560 SF/acre x 0.25 inch x (1 ft/12 inches) = 908 CF

    A **deduction of 25%** is applied if the forebay volume, as designed, is less than the forebay volume standard.

  - **Forebay Length in Direction of Flow (ft)** – Enter the length of the forebay in the direction of flow (i.e., from point of inflow to outlet structure or berm), in feet. There is no design standard.

  - **Forebay Width (ft)** – Enter the width of the forebay at the mid-point of the flow path, in feet. If the forebay is designed as a parabola use the focal width. There is no design standard.

  - **Forebay Length:Width Ratio** – The length to width ratio is calculated by dividing the entered length by the entered width. The design standard is 2:1 at a minimum. A **deduction** is applied for deviations from the standard, as follows:

    [((Length:Width Standard – 10%) – Design Length:Width) / (Length:Width Standard – 10%)] x 100

  - **Forebay Depth (ft) (minimum)** – Enter the depth of the forebay, in feet. The design standard is 1.5 feet, at a minimum. A **deduction** is applied for deviations from the standard, as follows:

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

  - **Forebay Dewatering Time (hrs) (maximum)** – Report the amount of time, in hours, that it will take to dewater the forebay (using weep holes, gabion baskets, or other measures). The standard is 72 hours. A **deduction** is applied if the Dewatering Time exceeds the standard, as follows:

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

  - **Forebay Flow Rate @ Maximum Routed Storm (cfs)** – Enter the anticipated flow rate (Q) for the maximum storm event that will be routed to the MRC SCM, in cfs. If there are no diversions proposed, use the 100-year/24-hour storm to calculate the flow rate. There is no design standard.

  - **Forebay Cross-Sectional Area Perpendicular to Flow (SF)** – Enter the cross-sectional area (A) of the forebay, in SF, assuming the forebay is 50% full of sediment. If the forebay will not be square or rectangular use the area at the location where width was determined. There is no design standard.

- **Forebay Flow Through Velocity (fps) (maximum)** – The flow through velocity (v) is estimated in fps by using the continuity equation (i.e., v = Q/A). The standard is 2 fps. A **deduction** is applied if Flow Through Velocity exceeds the standard, as follows:

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

NOTE 13 – Where an MRC SCM includes multiple inflow points and separate forebays or settling chambers are provided within the same SCM, each forebay should be designed to provide pretreatment for the tributary runoff directed to that forebay. For purposes of completing the MRC Spreadsheet:

- Forebay Storage Volume (CF) – Enter the storage volume of the smallest individual forebay (i.e., the forebay with the least storage volume) that provides pretreatment for the SCM.

- For all other forebay design standards, enter the corresponding values for that same forebay (i.e., the forebay with the least storage volume).

Supporting calculations should be provided for each forebay, including the tributary drainage area or routed volume to each forebay, storage volume, flow rate, geometry, and any calculated velocity or dewatering time. Where multiple forebays are associated with separate SCM cells that function independently, the forebay calculations shall be based on the tributary flow and pretreatment serving each individual cell.

- **SCM Bed Bottom Area (SF)** – Enter the area of the SCM's bed bottom (including all cells in the MRC SCM), 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.

- **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-Inch/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 "< 2-Year/24-Hour Storm".

    If there is an exceedance of the Maximum Equivalent Impervious Drainage Area Standard of more than 0.1 acre, 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 zone and the design ponding depth at the maximum storm event routed to the SCM).

The minimum freeboard standards are 6 inches (for the 2-Year/24-Hour Storm or less) and 12 inches (for > 2-Year/24-Hour Storm). If the minimum freeboard is not met, a **deduction** is assessed based on the following formula:

[((Freeboard Standard – 10%) – Design Freeboard) / (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.

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

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

- **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

  NOTE 14 – The top of underdrain orifice elevation may be used for determining drawdown time. The vertical interval for analysis should not exceed 0.1 foot (1.2 inches).

- **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 **50% deduction** is applied when the IWS depth as designed will be less than the standard.

- **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.

- **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** – Pretreatment is required for all MRC Storage Systems (either Upstream Vegetated Component, MTD Pretreatment, or Permeable Pavement must be selected). Where the Maximum Storm Event Routed is > 2-Year/24-Hour Storm, additional pretreatment standards apply (see below).

  - 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 15 – 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 16 – An IWS is not required in an Upstream Vegetated Component that is part of an MRC Storage System.

    - **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).

  - 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.

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

  - The MTD must be currently certified* for a minimum TSS removal of 50% for the flow rate associated with the 2-year/24-hour storm of a specific project site by either**:

    1. New Jersey Department of Environmental Protection (NJDEP); or
    2. Washington State Technology Assessment Protocol – Ecology (TAPE) at the General Use Level Designation.

    * Non-proprietary sand filters designed using ASCE Standards of Practice or ASTM Standards do not need to be certified. For MRC Storage Systems below artificial turf fields, DEP considers the incorporation of a minimum of 6 inches of sand into the aggregate or base course as satisfying this criterion.

    ** Current performance verification through the Stormwater Testing and Evaluation for Products and Practices (STEPP) for 50% removal using "Sediment A" in future ASTM Standard E317-22 is considered equivalent to NJDEP/TAPE.

  - The MTD must treat flows up to and including the 2-year/24-hour storm and therefore must be sized to treat the 2-year/24-hour flow for the specific site where its use is proposed.

  - Flow routed to the MTD may not exceed the flow that is certified by NJDEP or TAPE or verified through STEPP. Flows in excess of the verified/certified flow must be diverted (which could include diversion within the MTD).

  - Inspection frequency – 1/quarter and following the 2-year/24-hour storm event to inspect for sediment buildup.

- Pretreatment standards **if Maximum Storm Routed to the MRC SCM is > 2-Year/24-Hour Storm** are as follows.

  - In addition to providing pretreatment via an ***Upstream Vegetated Component***, ***MTD Pretreatment***, or ***Permeable Pavement*** variation, a forebay or underground settling chamber (hereafter "forebay") is required when the Maximum Storm Routed is greater than the 2-Year/24-Hour Storm. Access must be provided in the design for sediment removal. An O&M Plan must be prepared that includes a sufficient solids removal frequency to prevent resuspension of sediment.

    Where diversion structures are used, a portion of runoff from storm events greater than the selected design storm may enter or pass through the SCM prior to diversion due to hydraulic conditions within the system. Such incidental flow does not constitute routing of the larger storm event for purposes of pretreatment requirements or design standards.

  - All flow exceeding the 2-Year/24-Hour Storm must be directed to the forebay. Pretreated flow from an Upstream Vegetated Component, MTD Pretreatment, or Permeable Pavement may bypass the forebay, if desired. Also, see NOTE 12 where there are multiple forebays.

  - **Forebay Storage Volume (CF) (minimum)** – The design standard is 0.25 inch of runoff per equivalent impervious area. A **deduction of 25%** is applied if the forebay volume, as designed, is less than the forebay volume standard.

- **Forebay Length in Direction of Flow (ft)** – Enter the length of the forebay in the direction of flow (i.e., from point of inflow to outlet structure or berm), in feet. There is no design standard.

- **Forebay Width (ft)** – Enter the width of the forebay at the mid-point of the flow path, in feet. If the forebay is designed as a parabola use the focal width. There is no design standard.

- **Forebay Length:Width Ratio** – The length to width ratio is calculated by dividing the entered length by the entered width. The design standard is 2.0:1 at a minimum. A **deduction** is applied for deviations from the standard, as follows:

  [((Length:Width Standard – 10%) – Design Length:Width) / (Length:Width Standard – 10%)] x 100

- **Forebay Depth (ft) (minimum)** – Enter the depth of the forebay, in feet. The design standard is 1.5 feet, at a minimum. A **deduction** is applied for deviations from the standard, as follows:

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

- **Forebay Flow Rate @ Maximum Routed Storm (cfs)** – Enter the anticipated flow rate (Q) for the maximum storm event that will be routed to the MRC SCM, in cfs. If there are no diversions proposed, use the 100-year/24-hour storm to calculate the flow rate. There is no design standard.

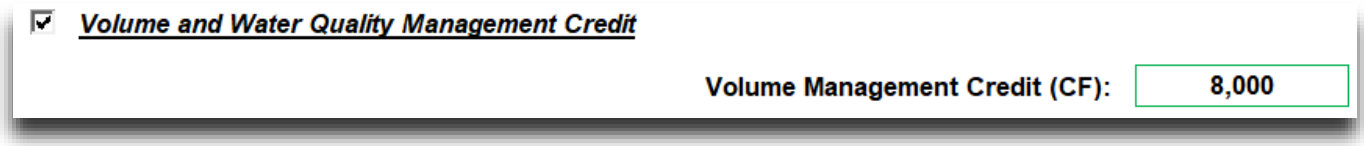
- **Forebay Cross-Sectional Area Perpendicular to Flow (SF)** – Enter the cross-sectional area (A) of the forebay, in SF, assuming the forebay is 50% full of sediment. If the forebay will not be square or rectangular use the area at the location where width was determined. There is no design standard.

- **Forebay Flow Through Velocity (fps) (maximum)** – The flow through velocity (v) is estimated in fps by using the continuity equation (i.e., v = Q/A). The standard is 2 fps. A **deduction** is applied if Flow Through Velocity exceeds the standard, as follows:

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

3. Volume 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.



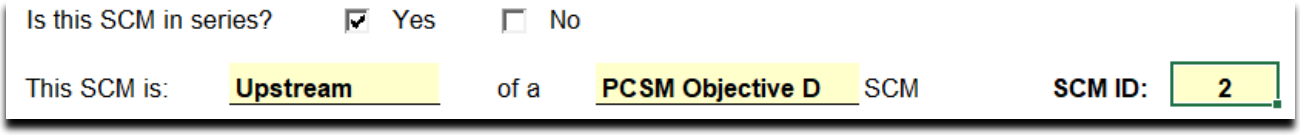
Volume management credit is provided – subject to any applicable deductions – up to the 2-Year/24-Hour Storm event if either of the following are true:

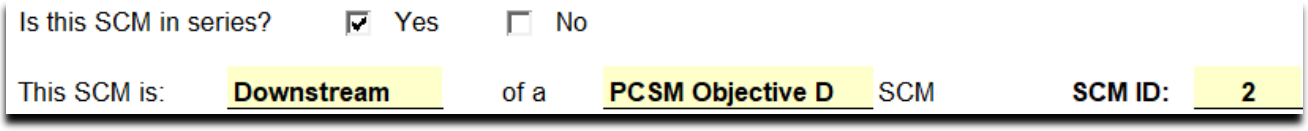
- The volume routed to the MRC SCM is the 2-Year/24-Hour Storm or greater; or

- 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 or downstream 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.





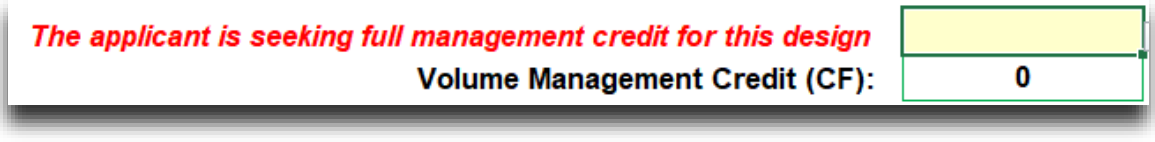
An Objective D SCM that is situated adjacent or parallel to an MRC SCM and receives MRC outflows and/or flows greater than the 2-year/24-hour storm that are diverted away from an MRC SCM should be considered downstream of the MRC SCM for the MRC Spreadsheet.

In either scenario, the full Volume Management Credit can be input into the PCSM Spreadsheet as Managed Release Credits for the MRC SCM.

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.

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.”



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, seal, 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

Design Parameter	Standard
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
  - **B.2: 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
4/2/2026	1.3	Changed location for selecting Maximum Storm Event Routed to MRC SCM from the Design Standards section to the Background section. Added checkboxes and a new column for "Off-Site" in the pre- and post-construction drainage area tables so that runoff from areas outside of the project site can be considered (though not available for credit). Added checkbox for "Receives direct precipitation only" for scenarios where there is no drainage area beyond the SCM (e.g., athletic turf fields). Added clarification that the incorporation of a minimum of 6 inches of sand within the media of an MRC Storage System beneath an athletic turf field meets the pretreatment standard for a non-proprietary sand filter.
9/10/2025	1.2	The Post-Construction 2-Year/24-Hour Peak Rate standard was updated to 0.15 cfs (previously 0.15 cfs/equivalent impervious area) when the Pre-Construction 1-Year/24-Hour Peak Rate is less than 0.15 cfs, for both MRC Bioretention and MRC Storage Systems.
8/28/2025	1.2	The instructions were updated to reflect that a 50% deduction is applied to any deviation from the minimum IWS Depth (MRC Bioretention and MRC Storage Systems) and Soil Media Depth Above Internal Water Storage (MRC Bioretention) standards. No changes were made to the MRC Spreadsheet.
8/15/2025	1.2	1) Added new field for Total Volume from Off-Site Sources (CF) to Drainage Area Characteristics section of the spreadsheet and clarified that a) the total drainage area to the SCM, including area outside the project site, should be reported, and b) off-site volume up to the 2-year/24-hour storm that is routed to the MRC SCM is deducted from Volume Management Credit. 2) Removed Freeboard standard for MRC Bioretention and included new Hydraulic Allowance standard. 3) Revised Freeboard standard from maximum to minimum for MRC Storage Systems. 4) Modified pretreatment standards for MTDs upstream of MRC Storage Systems. 5) Removed IWS Void Space standards for MRC Storage Systems. 6) Added NOTE 9 concerning drawdown time for MRC Storage Systems. 7) Included additional pretreatment standards when flows exceeding the 2-Year/24-Hour Storm are routed to the SCM (i.e., forebays), eliminating the automatic 50% deduction. 8) Provided a 0.1 acre "buffer" for exceedances of the maximum equivalent impervious area standards before the automatic 50% deduction.
4/25/2025	1.1	Added NOTE 10 to clarify for MTDs used as pretreatment for MRC Storage Systems, test reports for pollutants do not need to be submitted for any pollutant with the PCSM Plan, and professional judgment should be used.
3/26/2025	1.1	1) Clarified, for Incremental SCM Drainage Area, that the total drainage area from within the project site (including areas outside the LOD but not off-site) should be entered. 2) Added clarification that where MRC cells are designed, the cells should function independently and be separated by berms or other materials that prevent flow between cells.
2/24/2025	1.1	1) For MRC Storage Systems, changed IWS Void Space Volume design value formula to use one-half the user-entered Void Space in IWS % (rather than the full Void Space in IWS %). 2) When an MRC Storage System is to be lined, the Void Space in IWS % should be entered as zero (0), resulting in a value of 0 for IWS Void Space Volume. Changed logic to eliminate the deduction for lined MRC Storage Systems without IWS Void Space as long as the product of IWS depth and IWS Area is greater than or equal to the standard for IWS Void Space Volume.

Date	Version	Revision Reason
2/6/2025	1.0	Clarified that for MTDs used as pretreatment for MRC Storage Systems, test reports do not need to be submitted with the PCSM Plan.
11/18/2024	1.0	Original