Water Quality Protection Charge Credit Procedures Manual

Prepared for

Montgomery County Department of Environmental Protection

November 30, 2018

DEPARTMENT OF
ENVIRONMENTAL
PROTECTION
MONTGOMERY COUNTY • MARYLAND

Change Log

Date	Version	Change	Author / Editor
11/30/18	**2.0**	Text, Off-site computations	L. Tennekoon

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Appendices

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SECTION 1

Introduction

The purpose of this credit manual is to provide Montgomery County property owners with information regarding how to obtain a credit for their Water Quality Protection Charge (WQPC).

1.1 Overview

Background

The Water Quality Protection Charge (WQPC) is a part of Montgomery County property tax bills. The WQPC raises funds to improve the water quality of our streams and reduce the negative impacts of stormwater runoff. Stormwater is rain that runs off hard surfaces and carries pollution to our streams. It is one of the biggest water quality problems in Montgomery County. When left unmanaged, stormwater flows through storm drains to nearby creeks and streams at high speeds and in large volumes. This polluted, unhealthy water damages property, erodes creek banks, harms wildlife, and eventually ends up in the Chesapeake Bay.

Restoration projects funded by the WQPC reverse and reduce the negative impacts of stormwater. They also create jobs and boost the local economy.

What is the Water Quality Protection Charge?

The Water Quality Protection Charge (WQPC) can be found on Montgomery County property tax bills. All property owners in Montgomery County pay the WQPC, including businesses, Home Owner Associations, and non-profit organizations.

The WQPC is calculated based on the potential for a property to contribute to stormwater runoff. Typically, a larger, more developed property produces more runoff, and therefore, receives a higher charge. The WQPC is based on the amount of impervious area on a property. Impervious surfaces, like rooftops and driveways, block water from infiltrating into the ground. They cause increased runoff, which overloads the drainage system, and transports various pollutants including nutrients and sediment to bodies of water.

What is the Credit Program?

Property owners can receive a credit off their annual Water Quality Protection Charge by maintaining stormwater management practices on their properties. Stormwater management practices capture and treat runoff so that the water does not flow directly into storm drains or streams untreated. They remove pollutants, protect public health and reduce flooding risk, stream damage and erosion.

For more information about the WQPC or the Credit program, please refer to the County Department of Environment's website at the following location:

www.montgomerycountymd.gov/WQPC

1.2 Organization

The remainder of this WQPC Credit Procedures Manual is organized into the following sections:

Section 2: Single-Family Residential Credits
Section 3: Non-Residential/Multi-Family Credits

1.3 Definitions

This section provides definitions for key terms in this WQPC Credit Procedures Manual.

Environmental Site Design (ESD): As defined by the Maryland Department of Environment Stormwater Design Manual, Environmental Site Design, or ESD, is a comprehensive design strategy for maintaining predevelopment runoff characteristics and protecting natural resources and relies on integrating site design, natural hydrology, and smaller controls to capture and treat runoff.

Environmental Site Design Volume (ESDv): The Environmental Site Design Volume (ESDv) is based on the ESD Rainfall Target, P_E, which ranges from 1-inch to 2.6-inches and is multiplied by the volumetric runoff coefficient (Rv) and the site area. Refer to the Stormwater Design Manual for more details.

Impervious Area: As defined in Chapter 19-21 of the Montgomery County Code. Any surface that prevents or significantly impedes the infiltration of water into the underlying soil, including any structure, building, patio, sidewalk, compacted gravel, pavement, asphalt, concrete, stone, brick, tile, swimming pool, or artificial turf. Impervious surface also includes any area used by or for motor vehicles or heavy commercial equipment, regardless of surface type or material, including any road, driveway, or parking area.

Maryland Department of Environment Stormwater Design Manual: Herein referred to as the "Stormwater Design Manual", this refers to Maryland's official guide for stormwater management principals, methods, and practices in Maryland. It is available for download or viewing at MDE's website. The Stormwater Design Manual was originally published in October 2000 and was most recently updated in May 2009.

Maximum Extent Practicable (MEP): As defined in Chapter 19-21 of the Montgomery County Code. Designing stormwater management systems so that all reasonable opportunities for using environmental site design planning techniques and treatment practices are exhausted and, only where absolutely necessary, a structural best management practice is implemented.

Multi-Family Residential (MFR) Property: As defined in Section 19.35.01.02 of the Code of Montgomery County Regulations. Multifamily Residential Property means a mobile home park or a residential building where one or more dwelling units share a common entrance from the outside with other dwelling units that are arranged above, below or next to one another in the same building, and any housing unit that is subject to the condominium regime established under the Maryland Condominium Act.

Non-Residential (NR) Property: As classified in Section 19.35.01.03.I. Nonresidential properties may include commercial properties such as office buildings, hotels, retail establishments or industrial properties such as factories and warehouses. Nonresidential properties may also include properties owned by homeowner associations, nonprofit organizations, and any government-owned properties subject to the Charge. The impervious area for these properties includes all buildings, parking lots and other impermeable installations permanently attached to the land parcel containing those installations.

Single Family Residential (SFR) Property: A detached home or townhome. A detached home is a free-standing residence that does not share a wall with another property. A townhome, also known as a rowhouse or attached house, is a semi-detached property that shares at least one wall with another property.

Volumetric Runoff Coefficient (Rv): Defined by the Stormwater Design Manual as the value that is applied to a given rainfall volume to yield a corresponding runoff volume based on the percent impervious cover in a drainage area. The Rv value is calculated using the following: $Rv = 0.05 + 0.009(I)$; where I = percent impervious cover. Refer to the Stormwater Design Manual for more details.

Water Quality Protection Charge (WQPC): The Water Quality Protection Charge (WQPC) is Montgomery County's stormwater charge, and is a part of Montgomery County property tax bills. The WQPC raises funds to improve the water quality of our streams and reduce the negative impacts of stormwater runoff.

Water Quality Volume (WQv): The Water Quality Volume (WQv) is defined by the Maryland Department of Environment Stormwater Design Manual as the storage needed to capture and treat the runoff from 90% of the average annual stormwater runoff volume equal to 1-inch multiplied by the volumetric runoff coefficient (Rv) and the site area. Refer to the Stormwater Design Manual for more details.

SECTION 2

Single Family Residential WQPC Credits

2.1 Overview

Credits of up to 80% off the Water Quality Protection Charge (WQPC) are available to property owners who maintain stormwater management practices on their property in accordance with the requirements of Section 19-28 of the Montgomery County Code. The credit is provided to property owners who own and maintain on-site stormwater management practices and is based on the volume of water captured as defined by the (MDE) Stormwater Design Manual and as described in the section below.

The County requires specific design information of the stormwater management practices to compute the volume of water captured by the practices. Properties with stormwater management practices that have been permitted through the Department of Permitting Services or built as part of a RainScapes project have technical plans filed with the County and therefore generally do not require to submit this information. However, privately installed practices may be required to submit specific information relating to their design for the County to establish their credit amount.

All properties must submit evidence that the practices are installed properly and have not been removed or altered. This is usually accomplished by submitting photographic evidence of their existence on the property. Those practices that have significant portions underground, such as dry wells, only require evidence of their above ground parts, such as observation pipes or downspout pipes. All residential practices must be maintained in accordance with the maintenance requirements of Section 19-28 of the Montgomery County Code, unless the stormwater facilities are part of a County-approved stormwater management participation project.

In general, stormwater practices located on single family residential properties are smaller and defined substantially in the MDE Stormwater Design Manual, Volume I, Chapter 5 "Environmental Site Design". Additional practices/systems may be recognized by the Department of Permitting Services (DPS) and can be found on the water resources documents website: https://permittingservices.montgomerycountymd.gov/DPS/waterresource/WaterResourceDocuments.aspx.

2.2 SFR Stormwater Practices

The following are definitions for stormwater management system facility types as defined by MDE, County DPS or the County's RainScapes Program that are recognized by the Montgomery County WQPC SFR Credit Application.

2.2.1 Swales

Swales are vegetated landscaped channels that provide drainage, water quality treatment, and lower peak flow rates of stormwater runoff. Swales can be surfaced with grass (grass swales), plants (bioswales) or may be designed to have ponding (wet swales). Swales provide pollutant removal through vegetative filtering, settling of sediment, biological uptake by plants, and/or infiltration into the underlying soil media.

- *MDE Stormwater Design Manual Reference: Page 5.108, ESD Practice M-8*

2.2.2 Roof Leader Disconnection to Pervious Areas

Roof leader disconnection involves directing flow from roof downspouts onto vegetated areas where it can soak into or filter over the ground. This "disconnects" the rooftop from the storm drain system and reduces both runoff volume and pollutants delivered to waterways and water bodies. Disconnected downspouts should be discharged to pervious areas (lawns, landscaping, or undisturbed forests) with slopes less than 5% and to undisturbed or uncompacted soils that will allow stormwater to infiltrate.

- *MDE Stormwater Design Manual Reference: Page 5.57, ESD Practice N-1*

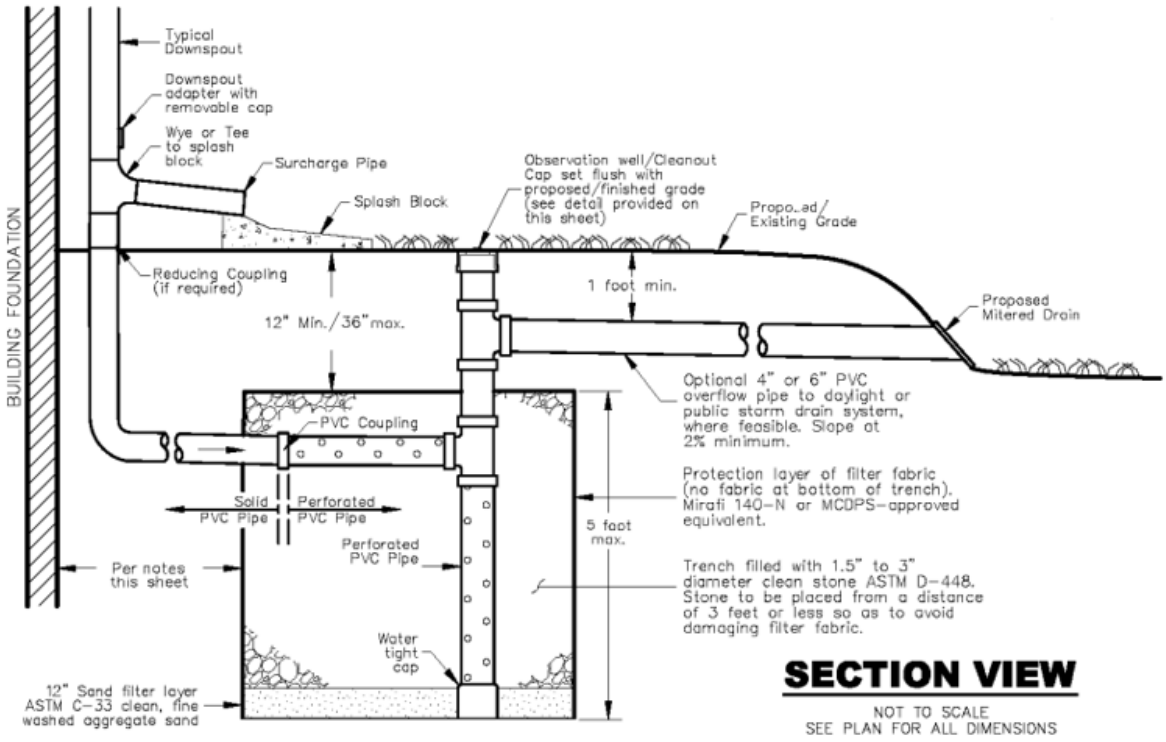
2.2.3 Non-Roof Area Disconnection to Pervious Areas

Non-rooftop disconnection involves directing flow from impervious surfaces onto vegetated areas where it can soak into or filter over the ground. Non-rooftop disconnection is commonly applied to smaller or narrower impervious areas like driveways, patios and small parking lots. Note: when driveways are sloped to drain to the street, they will not qualify for this practice. Disconnections should be discharged to pervious areas with slopes less than 5% and to undisturbed or uncompacted soils that will allow stormwater to infiltrate.

- *MDE Stormwater Design Manual Reference:*
  Page 5.61, ESD Practice N-2

2.2.4 Dry Well

A dry well is an excavated pit or structural chamber filled with gravel or stone that provides temporary storage of stormwater runoff, typically from rooftops. Rooftop runoff is directed to these storage areas and infiltrates into the surrounding soils prior to the next storm event. Pretreatment of water is recommended to filter sediment, leaves, and other debris that might clog the dry well. The drainage area to a dry well should not exceed 1,000 square feet and should not be located in silty or clayey soils.



MDE Stormwater Design Manual Reference: Page 5.91, ESD Practice M-5

2.2.5 Micro-infiltration

Micro-infiltration is comprised of stone gravel or prefabricated plastic structure layers called "infiltration beds" underlaying various site surfaces such as driveways, sidewalks, patios, or turf. Separation with filter fabric or permeable sand layers is needed to keep the infiltration bed clean.

Micro-infiltration must be installed over permeable, sandy soils, and the bottom of the infiltration bed must be level and uncompacted. An underdrain or overflow may be necessary to handle large rain events.

- *As Developed through Montgomery County's Department of Permitting Services.*

2.2.6 Green Roofs

Green roofs are alternative surfaces that replace conventional construction materials and include a protective covering of planting soil and vegetation. Also known as vegetated roofs, roof gardens, or eco-roofs, these may be used in place of traditional flat or pitched roofs to reduce impervious cover and more closely mimic natural hydrology. The more common "extensive" green roof is a lightweight system where the soil layer (growing medium) is between two and six inches thick and limits plants to low-growing, herbaceous varieties. "Intensive" green roofs have thicker soil layers (eight inches or greater) and are capable of supporting more diverse plants including trees and shrubs. A more robust structural loading capacity is needed to support the additional weight of green roofs.

- *MDE Stormwater Design Manual Reference: Page 5.42, ESD Practice A-1*

2.2.7 Conservation Landscaping

Conservation landscaping includes removing impervious surfaces, mowed turf, and/or invasive species and decompacting existing soil to a depth of 6-9", incorporating a 2" layer compost and replanting with 75%- native plant species. In addition, runoff is directed to the garden which has 1-3" of ponding depth (a depression above the soil that allows water to pond temporarily before infiltration), created by microberms or check dams. Conservation landscaping also helps with stormwater management because native plants don't need as much fertilizer or pesticide to thrive. This means that when it rains, fewer chemicals are channeled into the nearby waterways, which leads to healthier and cleaner streams and rivers.

- *As Developed through Montgomery County's RainScapes Program.*

2.2.8 Micro-bioretention and Rain Gardens

Micro-bioretention practices capture and treat runoff from small impervious areas by passing it through a filter bed mixture of sand, soil, and organic matter. Filtered stormwater is either conveyed to the stormwater network through an underdrain or partially infiltrated into the soil. Micro-bioretention practices are versatile and may be adapted for use anywhere there is landscaping. Micro-bioretention should be downhill and set back at least 10' from structures to protect the structures, unless an impermeable liner is provided. They should be comprised of a 2-4' filter media underlain by a gravel drainage layer. A perforated underdrain pipe is recommended in all applications and is required in poorly draining soils such as silts and clays.

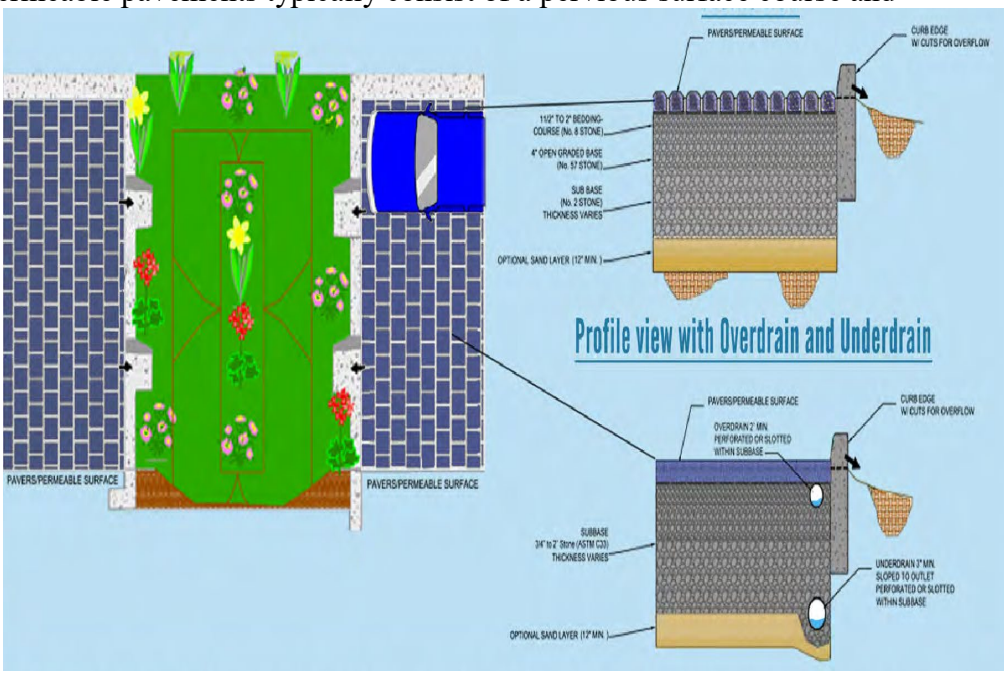
Rain gardens are similar practices, except are typically smaller and do not have underdrainage (typically buried perforated pipe). Rain gardens always depend on the underlying soil for proper drainage. Also, rain gardens are built with native soils mixed with compost or a special soil mix, while bioretention has a special soil mixed with sand, as well as gravel beneath, for the system to hold more water. The rain garden soil and mulch layer should be 12" minimum. Rain gardens are expected to have a ponding depth of 6" inches above the surface of the mulch

layer. An overflow conveyance system should be included to pass larger storms. Rain gardens are restricted for smaller drainage areas, 2,000 square feet or less.

- *MDE Stormwater Design Manual Reference:*
  - *Micro-bioretention Page 5.96, ESD Practice M-6*
  - *Rain Garden Page 5.104, ESD Practice M-7*

2.2.9 Permeable Pavements

Permeable pavements are alternatives that may be used to reduce imperviousness. While there are many different materials commercially available, permeable pavements may be divided into three basic types: porous bituminous asphalt, pervious concrete, and permeable interlocking concrete pavements. Permeable pavements typically consist of a pervious surface course and open graded stone base/subbase or sand drainage system, with a minimum open graded stone depth of 12". Stormwater that drains through the pavement, is captured in the stone layer, and infiltrates into the surrounding soils. Porous pavements are best suited over sandy, permeable soils, and may require an underdrain or overflow for large rain events.



- *MDE Stormwater Design Manual Reference: Page 5.46, ESD Practice A-2*

2.2.10 Rainwater Harvesting: Rain Barrels and Cisterns

Rainwater harvesting practices intercept and store rainfall for future use. Stored water may be used for outdoor landscaping irrigation, car washing, or non-potable water supply. The capture and re-use of rainwater promotes conservation, as well as reduces runoff volumes and the discharge of pollutants downstream. These practices should be drained after each storm to make room to store rainfall runoff from the next storm.

Rain barrels are small stormwater containers, typically prefabricated, less than 100 gallons, and in the shape of a barrel. They are typically used to provide temporary storage of stormwater from roof leaders. These systems are generally designed for outdoor use.

Cisterns are large storage tanks typically used in capturing rainwater for non-potable water supply, providing a year-round source. The complexity of the sizing, installation, and accessories of this type of application make it more realistic for commercial operations.

- *MDE Stormwater Design Manual Reference: Page 5.71, ESD Practice M-1*

2.2.11 Sheet Flow to Conservation Area

Conservation areas or easements are typically set up when land is developed and may or may not be owned by individual residents themselves. Stormwater runoff is effectively treated when flow from developed land is directed to adjacent conservation areas which are essentially natural, undisturbed areas water can soak into or filter over the ground. Landscaping should consist of uncompacted soils with native, non-turf landscaping or vegetation. This practice can only be used for stormwater that is sheet flowing (not concentrated or channelized) from an impervious area less than 100 feet in length. The conservation area should have a slope less than 5%, a minimum width of 50 feet, and should be approximately ½ acre or larger in total size.

- *MDE Stormwater Design Manual Reference: Page 5.66, ESD Practice N-3*

2.3 SFR Credit Application and Calculator

The SFR credit application is available on the County's WQPC website and prepopulates initial application information including parcel area, impervious area and other related WQPC

information once a property tax account is selected. Applicants then need to select the types of stormwater management practices present on their property from the list of eligible practices. When the practices are permitted through the County, the application will pre-populate the list of practices on the property. Next, applicants have to complete the "Inspections and Maintenance Checklist" where they have to complete questions on the maintenance performed on each stormwater facility. By completing the self-inspection form for each of the facilities, property owners confirm the practices are functioning in accordance with the maintenance requirements of the Montgomery County Department of Environmental Protection. Once the inspection information is completed, applicants are directed to complete their contact information and whether they are the owner or the owner's agent completing the application.

After completing the "Inspections and Maintenance Checklist" and the contact information, applicants arrive at the "SFR Credit Calculator" form. In the SFR Credit Calculator, applicants must input the size and/or number of stormwater management systems on their property along with any date information. Based on this information, the SFR Credit Calculator computes a volume of water treated by the practice based on assumptions typical for each practice within the County, and within the context of a typical single-family residential structure and how it typically drains to stormwater facilities. ***Explanation of how volume of water captured by each practice is computed is provided in Appendix A.***

In general, practices which are larger and/or hold more volume such as bioretention receive more credit, while smaller and/or less intensive practices such as rainwater harvesting receive less credit.

Once completed, the SFR Credit Calculator accumulates the volume treated by all practices on the site and prorates the WQPC credit up to 80%. Credit is prorated according to Equation 2.1 based on how much volume is provided ("Volume Captured") versus how much is required at the property per the MDE Maryland Stormwater Design Manual ("Environmental Site Design Volume", ESDv):

Eqn. 2.1

$$SFR\ WQPC\ Percent\ Credit = \frac{Total\ Volume\ Captured}{Environmental\ Site\ Design\ Volume,\ ESDv} \times 80\%$$

The credit and WQPC charge (after credit) is computed according to Equations 2.2 and 2.3:

Eqn. 2.2 $WQPC\ Credit = Percent\ Credit \times WQPC\ Charge\ on\ Bill\ (before\ credit)$

Eqn. 2.3 $WQPC\ Charge\ (after\ credit) = WQPC\ Charge\ on\ Bill\ (before\ credit) - WQPC\ Credit$

SECTION 3

Nonresidential/Multifamily Residential WQPC Credits

3.1 Overview

Credits of up to 60% or 80% off the Water Quality Protection Charge (WQPC) are available to non-residential and multi-family property owners. Practices must be maintained by the property owner and in accordance with the maintenance requirements of Section 19-28 of the Montgomery County Code, unless the stormwater practices are part of a County-approved stormwater management participation project. Property owners may be required to submit technical documentation in support of the stormwater management practices to be eligible for a credit when the practices have not been permitted through the Department of Permitting Services (DPS) or built as part of a RainScapes project.

The Non-Residential/Multi-Family (NR/MFR) WQPC Credit is calculated for a property parcel with stormwater management practices (referred to herein as "the site") and is based on the sum of the volume of stormwater treatment provided by each stormwater management system practice at the site. Stormwater management system practices are generally based on the Maryland Department of the Environment (MDE) recognized practices as specified in the Maryland Stormwater Design Manual (MDE, revised 2010) and any additional practices recognized by the DPS. After the sum volume of stormwater treatment provided ("total Treatment Volume") is calculated, it is compared against the site stormwater runoff volume to compute the total site WQPC Credit as described later in this section.

When the stormwater treatment achieved on the site is via environmental site design (ESD) practices exclusively, as defined according to the Maryland Stormwater Design Manual, property owners are eligible for up to 80% credit. Non ESD practices are eligible for up to 60% WQPC credit. For property owners that treat stormwater drainage from offsite in addition to all the onsite required volume, WQPC credits of up to 100% are available. The list of approved NR/MFR WQPC practices which are eligible to receive credit is provided in Table B-2 of Appendix B.

3.2 NR/MFR Credit Application and Calculator

The NR/MFR Credit application is available on the County's WQPC website and prepopulates initial application information including parcel area, impervious area and other related WQPC information once a property tax account is selected. Applicants must provide

their contact information and whether they are the owner or owner's agent completing the application. No further information is generally required. Applicants can submit the application after signing it. The credit calculations will be performed by the County using the NR/MFR calculator based on information the County has regarding the stormwater practices on the site. When information regarding the practices are not available, the County will request them from the applicant or any other source as needed.

The first section in the calculator is for site data information such as the parcel area and impervious surface areas. Based on this information the required stormwater treatment volume for full WQPC credit are computed for the site. If available, site specific soils data according to the Soil Conservation Services (SCS) Hydrologic Soil Group, can be used to calculate the Environmental Site Design (ESD) runoff volume. If no site-specific soil data is available, Type C soils are assumed, since that is the predominant soil type in Montgomery County.

The second section in the calculator is for off-site data information and is used only if stormwater drainage from offsite is also treated by one of the onsite stormwater management systems and the maximum onsite credit has been achieved by the systems. ***Explanation of how the Offsite Data and additional WQPC Credit is calculated is provided in Appendix B.***

The primary section on the calculator is Section 3, called the "Stormwater Management System Information". At a minimum, the following information is required in this section for each stormwater management system entry:

- Facility Type: To be selected from a prepopulated list of approved practices which generally correspond to practices approved by MDE according to the Maryland Stormwater Design Manual. See Table B-2 provided in Appendix B for a complete list of approved practices.
- Year Permit Approved: The year that the stormwater management system was permitted, to be selected from the following eras: Pre-1986, 1986-2002, 2003-2010, or Post-2011.
- DEP Maintained: Only stormwater management systems maintained by the property owner exclusively are eligible for WQPC Credit, unless it was a stormwater management system built as part of a County-approved stormwater management participation project.
- Onsite Drainage Area: The total contributing onsite drainage area which drains to the stormwater management system, to be entered in units of square feet.
- Onsite Impervious Drainage Area: The portion of total onsite contributing drainage area which is considered to be impervious, to be entered in units of square feet.

There are two options for obtaining WQPC Credit for each approved practice:

1. Applicant Input Design Volume ("Provided WQv"): The design volume is directly input into the NR/MFR Credit Calculator if design plans or other design data are available. This volume will typically be provided in the design plans as Water Quality Volume (WQv) (if project pre-dates Environmental Site Design (ESD) site requirements), or Environmental Site Design Volume (ESDv), and should be entered in units of cubic feet. When design plans do not have this information, the County may require the applicant to have an agent evaluate the design treatment volume. Note that the County DEP will check design documentation for all applications with input design treatment volume.

2. Assumed Volume ("Assumed Provided WQv"): If no design data are available for the stormwater management system's treatment volume, the NR/MFR Credit Calculator can automatically calculate an Assumed Treatment Volume based on the practice's design era and contributing drainage area for certain approved practices. The assumed volume method cannot calculate and account for offsite credit. Offsite credit must be calculated using the Applicant Input Design Volume method and engineering calculations must be submitted to support the offsite treatment. ***Explanation of how the Assumed Treatment Volume is calculated is provided in Appendix B***.

Once completed, the NR/MFR Credit Calculator accumulates the volume treated by all approved practices on the site and prorates the WQPC Credit up to a maximum of 60% (non-ESD type) or 80% (ESD type) based on the site's full Environmental Site Design volume (ESDv), as defined in Chapter 5 of the MDE Maryland Stormwater Design Manual. For sites with stormwater management systems that treat only up to the full Water Quality Volume (WQv) as defined in Chapter 2 of the MDE Maryland Stormwater Design Manual, a maximum WQPC Credit of up to 45% is available for both ESD and non-ESD practices. When less than the WQ_V is treated, then the WQPC credit is proportionally reduced from the maximum 45%.

In the Calculator, credit for each stormwater management is prorated based on how much total volume of treatment is provided versus how much is required for either full ESDv treatment at the property per the MDE Maryland Stormwater Design Manual or the WQv treatment (stormwater runoff from the 1-inch rainfall event). After the WQPC percent Credit is calculated for each individual stormwater management practice by prorating based on the type of practice (ESD or non-ESD practice), the total property WQPC % Credit is calculated by summing all individual WQPC percent credits. For properties which provide treatment volume using a combination of non-ESD and ESD practices, credit for each stormwater management practice is prorated to a maximum of 60% and 80%, respectively, based on the volumetric fraction provided by each practice relative to the full ESDv treatment required for the property. See Appendix B for more information on the NR/MFR credit calculation method.

After the WQPC Percent Credit is calculated, the credit and WQPC charge (after credit) is then computed according to Equations 3.1 and 3.2:

Eqn. 3.1 $$WQPC\ Credit = Percent\ Credit \times WQPC\ Charge\ on\ Bill\ (before\ credit)$$

Eqn. 3.2 $$WQPC\ Charge\ (after\ credit) = WQPC\ Charge\ on\ Bill\ (before\ credit) - WQPC\ Credit$$

3.3 NR/MFR Credit Calculation Examples

The following examples are provided to further illustrate the NR/MFR WQPC Credit program.

3.3.1 Example 1 – Design Data Available - NR/MFR Pre-ESD Era

EXAMPLE 1 – NR/MFR PRE-ESD ERA, DESIGN DATA AVAILABLE

➢ **Site Information:**

- Single wet pond extended detention SWM system (P-3) to treat all onsite impervious and some pervious area, built in 2005
- Design Plans available
- Site-specific soils data, split between "HSG-B" and "HSG-C" soils
- **WQPC = $2,968.49** for 80,794 SF of impervious

From County WQPC:

Surface	Area (square feet)
Building Area	29,773
Driveway/Parking	51,021
Other Impervious	0
Total Impervious	**80,794**
Total Lot Area	**121,096**
% Impervious	**66.72%**

% Impervious
% I = 66.72%

Site Runoff Coefficient
Rv = 0.05 + 0.009 x % I
Rv = 0.65

Note: WQPC Property Image used to illustrate example only and does not reflect actual site treatment conditions.

➢ **SWM System Information:**

- ✓ **Facility Type**: Wet Pond Extended Detention (P-3)
- ✓ Permitted in the 2003-2010 era
- ✓ Property Owner maintained
- ✓ **Total Drainage Area:** 106,349 square feet
- ✓ **Impervious Drainage Area:** 80,794 square feet
- ✓ No Offsite Area Treated
- ✓ **Provided WQv for P = 1-inch:**
  - WQv = 5,765 cubic feet from design plans
  - Applicant input

➢ **Calculate Required WQv:**

1. Rainfall Depth, P = 1 inch
2. Site Runoff Coefficient, Rv = 0.65 (rounded)
3. Required WQv per Stormwater Design Manual:

$$WQv = \frac{P \times Rv \; x \; Area}{12 \; inch/ft} = \frac{(1 \; inch) x \; 0.65 \; x \; 121{,}096 \; sq-ft}{12 \; inch/ft} = 6{,}564 \; cubic \; ft$$

➢ **Calculate WQPC % Credit (for treatment up to the first 1-inch):**

$$\text{WQPC \% Credit} = \frac{Provided \; WQv}{Required \; WQv} \times 45\% = \frac{5{,}765 \; cu-ft}{6{,}564 \; cu-ft} \times 45\% = \mathbf{39.52\%}$$

➢ **Calculate WQPC Credit:**

$$\text{Onsite WQPC Credit} = Percent \; Credit \times Onsite \; WQPC = 39.52\% \times \$2{,}968.49 = \mathbf{\$1{,}173.15}$$

➢ **Calculate WQPC:**

$$\text{WQPC (after credit)} = Onsite \; WQPC - WQPC \; Credit = \$2{,}968.49 - \$1{,}173.15 = \mathbf{\$1{,}795.35}$$

3.3.2 No Design Data - NR/MFR Pre-ESD Era

EXAMPLE 2 – NR/MFR PRE-ESD ERA, NO DESIGN DATA

➢ **Site Information:**

- Single Bioretention SWM system to treat all onsite impervious/pervious area, built in 2000
- No design documentation available
- No soils data
- **WQPC = $2,968.49** for 80,794 SF of impervious

From County WQPC:

Surface	Area (square feet)
Building Area	29,773
Driveway/Parking	51,021
Other Impervious	0
Total Impervious	**80,794**
Total Lot Area	**121,096**
% Impervious	**66.72%**

% Impervious
% I = 66.72%

Site Runoff Coefficient
Rv = 0.05 + 0.009 x % I
Rv = 0.65

Note: WQPC Property Image used to illustrate example only and does not reflect actual site treatment conditions.

➢ **SWM System Information:**

- ✓ **Facility Type**: Bioretention (F-6)
- ✓ Permitted in the 1985-2003 era
- ✓ Property Owner maintained
- ✓ **Total Drainage Area:** 121,096 SF
- ✓ **Impervious Drainage Area:** 80,794 SF
- ✓ No Offsite Area Treated
- ✓ **No Design WQv available**
  - Auto-calculate WQv in Calculator

➢ **Required WQv calculated in (Ex. 1)**

- 6,564 cubic feet

➢ **Design Treatment Volume (Assumed Provided WQv):**

1. Treatment Fraction, By Era = 0.50 (*from Table B-2*)
2. Treatment Depth for Full Credit, By Era = 1.0 inch (*from Table B-2*)
3. Treatment Depth Credit, P = 1.0 inch x (0.50) = 0.50 inch
4. Provided WQv calculated per Stormwater Design Manual:

$$WQv = \frac{P \times Rv \times Area}{12\ inch/ft} = \frac{(0.50\ inch) \times 0.65 \times 121{,}096\ SF}{12\ inch/ft} =$$

$$= 3{,}282\ cubic\ ft$$

➢ **Calculate WQPC % Credit (for treatment up to the first 1-inch):**

$$\text{WQPC \% Credit} = \frac{Provided\ WQv}{Required\ WQv} \times 45\% = \frac{3{,}282\ cu-ft}{6{,}564\ cu-ft} \times 45\% = \mathbf{22.50\%}$$

➢ **Calculate WQPC Credit:**

$$\text{Onsite WQPC Credit} = Percent\ Credit \times Onsite\ WQPC = 22.50\% \times \$2{,}968.49 = \mathbf{\$667.91}$$

➢ **Calculate WQPC:**

$$\text{WQPC (after credit)} = Onsite\ WQPC - WQPC\ Credit = \$2{,}968.49 - \$667.91 = \mathbf{\$2{,}300.58}$$

3.3.3 No Available Treatment Volume - ESD era Practice

EXAMPLE 3 – NR/MFR ESD ERA, NO DESIGN DATA

➢ **Site Information:**

- Submerged Gravel Wetland SWM system to treat all onsite area, built in 2011
- No design documentation available, no soils data
- **WQPC = $2,968.49** for 80,794 SF of impervious

From County WQPC:

Surface	Area (square feet)
Building Area	29,773
Driveway/Parking	51,021
Other Impervious	0
Total Impervious	**80,794**
Total Lot Area	**121,096**
% Impervious	**66.72%**

% Impervious
% I = 66.72%

Site Runoff Coefficient
Rv = 0.05 + 0.009 x % I
Rv = 0.65

Note: WQPC Property Image used to illustrate example only and does not reflect actual site treatment conditions.

➢ **SWM System Information:**

✓ **Facility Type:** Submerged Gravel Wetland (M-2)
✓ Permitted in the Post-2010 era
✓ Property Owner maintained
✓ **Total Drainage Area:** 121,096 square feet
✓ **Impervious Drainage Area:** 80,794 square feet
✓ No Offsite Area Treated
✓ **No Design WQv/ESDv available**
  - Auto-calculate WQv and ESDv in Calculator

➢ **Required WQv calculated in (Ex. 1)**
  - 6,564 cubic feet

➢ **Calculate Required ESDv (Assumed Provided ESDv):**

1. Site ESD Rainfall Target, P_E = 2.0 inch
2. ESDv calculated per MDE Stormwater Design Manual:

$$ESDv = \frac{P_E \times Rv \times Area}{12\ inch/ft} = \frac{(2.00\ inch) \times 0.65 \times 121{,}096\ sq-ft}{12\ inch/ft} = 13{,}128\ cubic\ ft$$

➢ **Design Treatment Volume (Assumed Provided WQv):**

1. Treatment Fraction, By Era = 1.0 (*from Table B-2*); Treatment Depth for Full Credit, P_E = 2.0 inch
2. Treatment Depth Credit, P_E = 2.0 inch x (1.0) = 2.0 inch
3. Provided ESDv Calculated per MDE Stormwater Design Manual:

$$ESDv = \frac{P_E \times Rv \times Area}{12\ inch/ft} = \frac{(2.0\ inch) \times 0.65 \times 121{,}096\ sq-ft}{12\ inch/ft} = 13{,}128\ cubic\ ft$$

➢ **Calculate WQPC % Credit (for treatment over 1-inch):**

$$\text{WQPC \% Credit} = \frac{Provided\ WQv\ (6{,}564\ cf)}{Required\ WQv\ (6{,}564\ cf)} \times 45\% + \frac{Provided\ (ESDv-WQv)\ (13{,}128\ cf - 6{,}564\ cf)}{Required\ (ESDv-WQv)\ (13{,}128\ cf - 6{,}564\ cf)} \times 15\% = \mathbf{60.00\%}$$

➢ **Calculate WQPC Credit:**

Onsite WQPC Credit = $Percent\ Credit \times Onsite\ WQPC = 60.00\% \times \$2{,}968.49 = \mathbf{\$1{,}781.09}$

➢ **Calculate WQPC:**

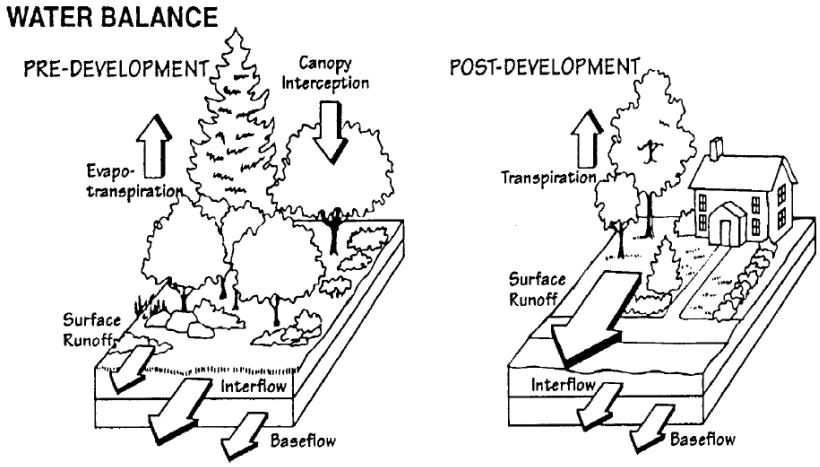
WQPC (after credit) = $Onsite\ WQPC - WQPC\ Credit = \$2{,}968.49 - \$1{,}781.09 = \mathbf{\$1{,}187.40}$

Appendix A: Basis for Single Family Residential Credit Calculation

A.1 Background

Stormwater practices located on SFR properties are smaller and defined substantially in the MDE Stormwater Design Manual, Volume I, Chapter 5 "Environmental Site Design" (ESD). According to the manual, the target for ESD implementation is "woods in good condition" or better, representing a predevelopment condition. Woods in good condition holds and treats stormwater much better than typical residential land by storing, soaking in, filtering, evaporating, and consuming water. This is demonstrated by the Water Balance Figure below from Page 1.3 of the MDE Manual.

Figure 1.1 Water Balance at a Developed and Undeveloped Site
(Source: Schueler, 1987)



Surface runoff is minimal in an undeveloped site, but dominates the water balance at a highly impervious site.

ESD stormwater practices and approved facilities mimic how woods in good condition keeps and treats stormwater. Acceptable ESD practices are defined in the body of this Manual; however, applicants can also download and refer to the MDE Stormwater Design Manual.

A.2 Environmental Site Design Volume (ESDv) Requirement

The primary requirement under ESD stormwater facilities is to provide the equivalent volume of water that "woods in good condition" at that site would provide. Contingent on the

ESD practice, this volume can be based on the equivalent storage, infiltration, or evapotranspiration of the stormwater.

1. The **ESDv Formula** is located on page 5.18 of the MDE Manual and is calculated by the following equation:

$$\textbf{ESDv (Required)} = \frac{\textbf{Design Rainfall (Pe) x Runoff Coefficient (Rv) x Area (A)}}{\textbf{12}}$$

2. **Area** is equal to the residence's Parcel Area. This entire area must mimic "woods in good condition" land in terms of stormwater to fully satisfy ESD requirements.

3. **Design or Target Rainfall, Pe**, is the inches of rain required to be captured. Pe is variable dependent on how impervious the parcel is and what type of soils are on the parcel. The more impervious the parcel is, the more that ESD stormwater facilities must provide capture volume to compensate. The better the soils are (the more porous and better at soaking in rain) the more stormwater that must be captured to mimic woods in good condition. Type A and B soils are best and tend to be sandy and coarse in texture. Type C and D soils are finer, such as clays and silts. **For the SFR application, Type C soils are assumed, since that is the predominant soils type in Montgomery County.**

   Table 5.3 below from Page 5.22 of the MDE manual is used to determine the Design Pe for Type C soils, dependent on the percent imperviousness (%I). An example of how to use this table for a 25% impervious site is displayed, resulting in a Pe requirement of 1.2".

Table 5.3 Runoff Curve Number Reductions used for Environmental Site Design (continued)

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

4. **Runoff Coefficient, Rv**, is a dimensionless coefficient in the ESDv Formula that represents the percent of rainfall that will be converted to stormwater runoff. This is also

a function of % Impervious because impervious surfaces do not let rain soak into the ground.

The formula for calculating Rv is provided below. The maximum Rv for a 100% impervious site is 0.95 since even impervious surfaces have a small amount of surface storage for evaporation, and may even have cracks or joints in the surface. The runoff coefficient in this example is 0.257:

Rv = 0.05 + 0.009 (%I) = 0.05 + 0.009 (25%) = 0.275

5. Revisiting the ESDv equation above, the **ESDv Required** is divided by 12 to convert Pe from inches to feet, resulting in an ESDv in units of cubic feet which is reported in the SFR Credit Calculator.

A.3 Volume Captured Calculations for Approved Practices

ESD practices accepted in the SFR Credit Application are listed in the SFR Credit Calculator under "Stormwater Management System Information". The SFR Credit Calculator tab of the SFR application requires the applicant to input the size, and in some cases the quantity, of Stormwater Management Systems on the property. These inputs are used to compute the Volume Captured. A summary of the equations used to compute Volume Captured is provided in the sections below with important assumptions depending on the practice.

A.3.1 Swales

Credit for swales is based on the assumption that most houses are placed at the high point of the parcel, with the half of the residence's impervious area sloped to the front of the parcel and the other half sloped to the rear of the parcel. A swale located either across the front or rear of the property would accordingly treat one half of the property's impervious area. Therefore, the volume captured by a swale is assumed to be the following, where the runoff coefficient is 0.95 for 100% impervious area:

- **Volume Captured = 50% of Lot's Impervious Area x 2.2" Pe x Runoff Coefficient (0.95) / 12**

Note, the County will check the linear feet of swale to ensure the volume provided by the swale is practical given the amount of volume provided as calculated by this equation.

A.3.2 Roof Leader Disconnection to Pervious Areas

Disconnection practices rely on the porosity and infiltration of the soils on the property to treat stormwater. To determine the volume captured, the SFR Credit Calculator requests the

square feet of pervious areas (such as lawns and landscaped areas) receiving flow from disconnected roof leaders, as well as the number of roof leaders disconnected. Important assumptions regarding this practice include:

i. 100 square feet of pervious area is assumed able to hold approximately 2 cubic feet of volume, capped at the pervious area on the parcel.

ii. The SFR Credit Calculator checks whether the volume received by the pervious area can hold the volume it receives from the roof leaders, otherwise the volume is capped at the volume of the pervious area.

iii. The SFR Calculator checks the volume received by the roof leaders (assuming the house's roof is drained by approximately 4 leaders) to ensure it does not exceed 500 square feet, which is the maximum amount allowed to this practice per the MDE Stormwater Design Manual.

iv. Overall, the practice volume is discounted by 50% to account for compacted soils and/or insufficient groundcover in pervious areas, or insufficient flow path lengths prior to the disconnected flow potentially re-entering an impervious area and ultimately in the storm drain system, etc.

The logic for computing the volume captured by this practice therefore is:

- **If** 2 ft^3 per 100 ft^2 of pervious area < Roof Leader Impervious Area x 2.2" Pe x Runoff Coefficient (0.95) / 12, **then Volume Captured** = 50% Discount x 2 ft^3 per ft^2 pervious area disconnected to, capped at parcel's pervious area.
- **If** 2 ft^3 per 100 ft^2 of pervious area > Roof Leader Impervious Area x 2.2" Pe x Runoff Coefficient (0.95) / 12, **then Volume Captured** = 50% Discount x Roof Leader Impervious Area x 2.2" Pe x Runoff Coefficient (0.95) / 12, capped at 500 ft^2 roof impervious area.

A.3.3 Non-Roof Area Disconnection to Pervious Areas

The assumptions used to compute Volume Captured by this practice are identical to the previous practice (Roof Area Disconnection to Pervious Areas), except that since the impervious areas tributary to this practice are non-roof areas (such as driveways, parking, decks, sidewalks, etc.), assumption (iii) from A.3.2 above must be revised to the following:

iii. The SFR Calculator checks the volume received by a maximum of 2 non-roof areas (assuming the non-roof areas are evenly split between front and back of parcel, where the pervious disconnection areas are assumed to be) to ensure it does not exceed 1,000 square feet, which is the maximum amount allowed to this practice per the MDE Stormwater Design Manual.

The logic for computing the volume captured by this practice therefore is:

- **If** 2 ft^3 per 100 ft^2 of pervious area < Non-Roof Impervious Area x 2.2" Pe x Runoff Coefficient (0.95) / 12, **then Volume Captured** = 50% Discount x 2 ft^3 per ft^2 pervious area disconnected to, capped at parcel's pervious area.
- **If** 2 ft^3 per 100 ft^2 of pervious area > Non-Roof Impervious Area x 2.2" Pe x Runoff Coefficient (0.95) / 12, **then Volume Captured** = 50% Discount x Non-Roof Impervious Area x 2.2" Pe x Runoff Coefficient (0.95) / 12, capped at 1,000 ft^2 non-roof impervious area.

A.3.4 Dry Well

Dry wells have been permitted to be constructed as stormwater management practices in Montgomery County since 2003, even though the practice was not included in the MDE Stormwater Design Manual until ESD was introduced and ESD-type dry wells began to be constructed in approximately 2011. Therefore, Volume Captured credit is based on the era in which it was permitted as itemized below. The SFR Credit Calculator caps tributary impervious area to each dry well at the residence's roof area or 1,000 square feet, which is the maximum to the practice according to the MDE Stormwater Design Manual.

- **If Dry Well(s) permitted prior to 2003**, the practice was not permitted or approved for water quality treatment in the County, therefore **Volume Treated = 0.**
- **If Dry Well(s) permitted between 2003 and 2010**, the practice was permitted/approved for 1" water quality volume credit (pre-ESD volume requirement) and therefore:

  Volume Captured = # Dry Wells x 1,000 ft^2 or Roof Area x 1" Pe x Runoff Coefficient (0.95) / 12
- **If Dry Well(s) permitted between 2011 or after**, the practice was permitted/approved for ESD treatment therefore:

  Volume Captured = # Dry Wells x 1,000 ft^2 or Roof Area x 2.2" Pe x Runoff Coefficient (0.95) / 12

A.3.5 Green Roofs

Green roof design as it relates to storage volume is widely varied based on the structural capacity of the roof, drainage configuration, roof slope (if any), types of media, and thicknesses of the media. The average depth of an extensive green roof, the most common green roof type, is approximately 4" and contains approximately 25% voids, which equates to approximately 1" of storage in the media. The SFR Calculator therefore computes volume captured as:

- 1" storage x 1 square foot area / 12 = 0.083 ft^3 volume x 7.48 gallons per ft^3 = 0.62 gallons
- Rounding down to account for media compaction, system fouling and variability:

  Volume Captured = 0.5 gallons per ft^2 green roof

Note, this is also the basis for calculating volume for the County's Rainscapes Rewards program.

A.3.6 Conservation Landscaping

Conservation landscaping receives flow from the residence's impervious areas and stores stormwater within depressed areas around plantings. Since this practice is not drained, ponding depth is typically minimal therefore 2" ponding is assumed. The SFR Calculator therefore computes volume captured as:

- 2" ponding x 1 square foot area / 12 = 0.166 ft^3 volume x 7.48 gallons per ft^3 = 1.24 gallons
- 9" planting soil with 33% voids is assumed, or 9" x 33% x 7.48 gallons per ft^3 / 12 = 1.85 gallons
- Rounding to the nearest whole number, 1.24 gallons + 1.85 gallons = 3 gallons
- **Volume Captured = 3 gallons per ft^2 conservation landscaping**

Note, this is also the basis for calculating volume for the County's Rainscapes Rewards program.

A.3.7 Rain Gardens, Micro-bioretention, and Micro-infiltration

These three practices are designed similarly in that the volume captured varies based on the amount of surface ponding and media depth that is placed. 6" is the most common ponding depth for these practices, which represents a balance of capturing volume while avoiding excessive standing water. While media depth varies between these 2 practices, rain garden depths are between 1' minimum and 3' maximum while micro-bioretention is typically always at the equivalent of a 3' depth (including drainage layer). Micro-infiltration designs vary widely but are also assumed to capture the equivalent of a 3' media depth (including drainage layer).The SFR Calculator therefore computes volume captured as:

- 6" ponding x 1 square foot area / 12 = 0.5 ft^3 volume x 7.48 gallons per ft^3 = 3.74 gallons
- 1' media x 65% of ponding area (assumed) x 33% voids (assumed) x 1 square foot area / 12 = 1.60 gallons
- **Volume Captured (1' media Rain Garden) = 3.74 + 1.60 = 5 gallons per ft^2 (rounded)**
- **Volume Captured (2' media Rain Garden) = 3.74 + (2 x 1.60) = 7 gallons per ft^2 (rounded)**
- **Volume Captured (3' media Rain Garden, Micro-bioretention, or Micro-infiltration) = 3.74 + (3 x 1.60) = 9 gallons per ft^2 (rounded)**

Note, this is also the basis for calculating volume for the County's Rainscapes Rewards program.

A.3.8 Pervious Pavement

Pervious pavement does not contain surface storage, and the pervious pavement matrix itself is designed not to hold water to prevent damaging the pavement and standing water. Therefore, volume captured by pervious pavement is limited to the underlying stone layer(s) which typically consists of a leveling or base course immediately beneath the pavement, and possibly a coarser stone reservoir or subbase course beneath that. Typically the combination of the stone courses is approximately 12" for pervious pavement designs, therefore the SFR Credit Calculator computes volume captured as:

- 1' stone course x 40% voids (assumed) x 1 square foot area x 7.48 gallons per ft^3 = 2.99 gallons
- **Volume Captured = 3 gallons per ft^2 pervious pavement**

A.3.9 Rainwater Harvesting: Rain Barrels and Cisterns

Stormwater captured by rainwater harvesting practices are not treated, rather, they are reused onsite for a variety of purposes at a highly variable rate. While the volume of the harvesting devices are fixed and easy to measure and count, the SFR Credit Calculator assumes approximately 40% of the volume is regularly used or "turned over" due to inefficiency in using the volume after rain events, or alternatively assuming the other 60% overflows, becoming stormwater runoff or otherwise not being captured. Therefore, the SFR Credit Calculator computes volume captured as:

- **Volume Captured = Volume of Rainwater Harvesting Device x 40% reuse efficiency**

A.3.10 Sheet Flow to Conservation Area

This practice is similar to the disconnection practices except that conservation areas are typically much larger and are often part of the subdivision process in a development.

To determine the volume captured, the SFR Credit Calculator requests the square feet of conservation area receiving flow. Important assumptions regarding this practice include:

i. 100 square feet of conservation area is assumed able to hold approximately 6 cubic feet of volume, capped at the pervious area on the parcel.

ii. The SFR Calculator assumes the entire non-roof impervious on the parcel drains to the conservation area.

iii. Roof impervious is not eligible for credit due to its proximity to turf areas and that it is unlikely to exist as "sheet" flow (not concentrated or channelized). The roof disconnection credit should be used instead.

iv. The SFR Credit Calculator checks whether the volume received by the conservation area can hold the volume it receives from the roof leaders, otherwise the volume is capped at the volume of the conservation area.

The logic for computing the volume captured by this practice therefore is:

- **If** 6 ft^3 per 100 ft^2 of conservation area < Non-Roof Impervious Area x 2.2" Pe x Runoff Coefficient (0.95) / 12, **then Volume Captured** = 6 ft^3 per ft^2 conservation area disconnected to.
- **If** 6 ft^3 per 100 ft^2 of conservation area > Non-Roof Leader Impervious Area x 2.2" Pe x Runoff Coefficient (0.95) / 12, **then Volume Captured** = Non-Roof Impervious Area x 2.2" Pe x Runoff Coefficient (0.95) / 12, capped at the parcel's total non-roof impervious area.

Appendix B: Basis for Non-Residential/Multi-Family Residential Credit Calculation

B.1 Credit Calculation for Treatment of Onsite Areas

The maximum WQPC Credit for providing stormwater treatment of all onsite area by non-Environmental Site Design (ESD) practices is 60% and is based on providing the full Environmental Site Design volume (ESDv) treatment as defined in Chapter 5 of the MDE Stormwater Design Manual. The 60% maximum WQPC credit is based on the fact that approximately 60% of the County's Municipal Separate Storm Sewer System (MS4) permit impervious area is located within private property parcels in the County. To provide additional credit for the use of ESD practices, which are a more decentralized and natural form of treatment, properties using ESD practices are eligible for up to 80% maximum WQPC credit for treatment of the full ESDv.

Calculation of the required ESDv requires site impervious/pervious data in addition to hydrologic soil group data specific to the site. If no site-specific soils data are available, Hydrologic Soil Group "C" (i.e. HSG C) will be used to evaluate the ESDv required for full treatment.

For sites that provide less than the full onsite ESDv treatment requirement, WQPC credit is prorated based on the fraction of the onsite ESDv treatment (as defined in Chapter 2 of the MDE Stormwater Design Manual) provided by the approved stormwater management practices. The credit is prorated according to the County average ESDv treatment depth of 2.2-inches (based on typical Hydrologic Soil Group "C" soils within the County) and Table 5.3 of the MDE MS4 guidelines, "Accounting for Stormwater Wasteload Allocations and Impervious Area Treated" (MDE, 2014). Table B-1 correlates the ESDv treatment depth with an impervious acre credit per acre of impervious watershed area (also referred to as "impervious area factor") as shown below. For a treatment depth of 2.2-inches (i.e. the typical ESDv depth for the County), the corresponding impervious area factor is 1.3 impervious acres per acre of watershed impervious area and the corresponding WQPC Credit is 45% (i.e. 60% divided by 1.3, rounded from 46% to 45% for simplicity). A WQPC Credit of 45% therefore applies to practices which treat the full WQv treatment depth of 1-inch, with treatment depths below 1-inch and above 1-inch (but less than the ESDv) prorated as indicated below in Figure B-1.

Table B-1. Impervious Acre Credit for Treatment Above and Below 1-inch of Rainfall
Based on Table 3 of the MDE MS4 guidelines, "Accounting for Stormwater Wasteload Allocations and Impervious Area Treated (2014)"

Impervious Acre Credit for Treatment Above and Below 1 Inch of Rainfall (Source: Table 3: Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated Guidance for NPDES Stormwater Permits, MDE, August 2014).	
Rainfall Depth Treated with ESD (inches), From Table 5.3 in MD Stormwater Manual	Impervious Acre Credit per Acre of Watershed Impervious Area
0.5	0.5
0.75	0.75
1.0	1
1.4	1.1
1.8	1.2
2.2	1.3
2.6	1.4

In summary, the WQPC Credit associated with treatment of the full WQv (based on 1" of treatment depth) is prorated based on linear interpolation according to the values provided in Figure B-1 below.

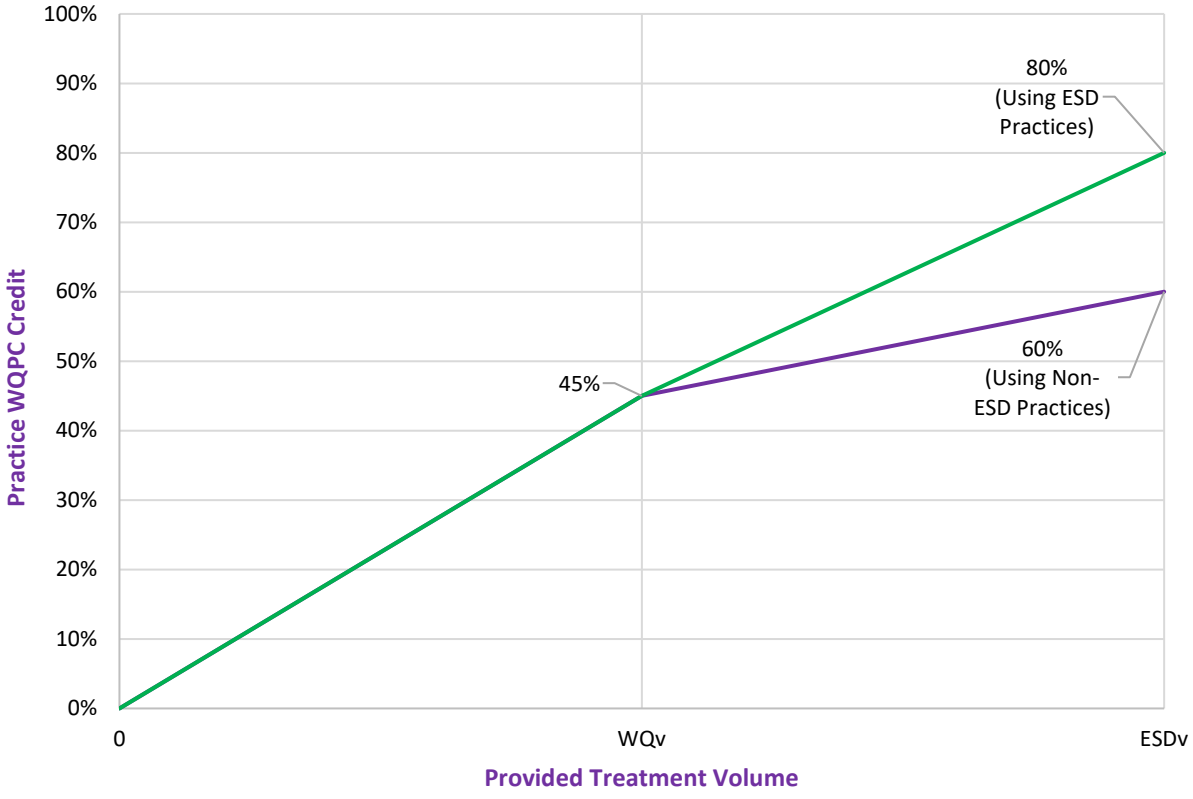


Figure B-1. WQPC Credit Based on Provided Onsite Treatment Volume

B.2 Treatment Volume Calculations

Stormwater treatment practices eligible for credit are generally based on Maryland Department of the Environment (MDE) recognized practices in the Maryland Stormwater Design Manual (MDE, revised 2010). The treatment volume can be determined using one of the following methods:

1. Applicant Input Design Volume ("Provided WQv", to be entered by the applicant)

- or -

2. Assumed Volume ("Assumed Provided WQv", to be evaluated by the WQPC calculator)

These two methods are described in more detail in this section.

B.2.1 Design Volume

If design information is available, the Design Volume is used in the calculator. The Design Volume may also be referred to on the recorded plans or drawings as the Water Quality Volume (WQv) provided, or Environmental Site Design Volume (ESDv) provided. The Design Volume should be entered in units of cubic feet.

Treatment Volume calculations for each practice should be completed in accordance with the MDE Stormwater Design Manual using the Unified Stormwater Sizing Criteria referenced in Chapters 2 and 5. For convenience, a summary of these calculations is also provided below.

ESD Sizing Requirements:

P_E = Rainfall Target from Table 5.3 used to determine ESD goals and size practices

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

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

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

$$WQ_v = \frac{(1.0)\,(R_v)(A)}{12}$$ Eastern Rainfall Zone P = 1.0 inches of rainfall

where: WQ_v = water quality volume (in acre-feet)
R_v = 0.05 + 0.009(I) where I is percent impervious cover
A = area in acres*

Figure B-2. ESDv and WQv Sizing Requirements
Excerpts from the Maryland Stormwater Design Manual (MDE, 2010)

B.2.2 Assumed Volume

If design information is not available, the Assumed Volume will be evaluated in the NR/MFR calculator based on design era as determined by the Year Permit was Approved for each practice. The volume is calculated using an assumed fraction of required treatment according to what was typical in that design era as shown below in Table B-2. This assumed fraction of required volume is applied to the typical design standard (provided in treatment depth in inches) as per Year Permit was Approved for each practice as follows:

- Pre-1986: Stormwater management regulations came into effect after this era, and typically no stormwater management was provided prior to 1986; therefore no Assumed Volume will be calculated for practices permitted in this era;
- 1986-2002: Practices permitted in this era included flood control requirements, and the typical design standard is ½-inch of water quality treatment with varying design criteria depending on the practice;
- 2003-2010: The current MDE Stormwater Design Manual (MDE, 2002) was implemented in this era and the typical design standard is treatment of 1-inch of water quality treatment according to water quality volume (WQv) requirements; and
- Post-2011: Chapter 5 of the MDE Stormwater Design Manual took effect in 2010 and the design standard is based on treatment of the required Environmental Design Volume (ESDv), which varies from 1-2.6 inches and is evaluated using hydrologic soil group classification and site imperviousness.

The Assumed Volume is evaluated by multiplying the Treatment Fraction for the selected practice, by the Treatment Depth Required for the era, in order to determine the assumed Treatment Depth. The assumed treatment depth is then applied to the Water Quality Volume (WQv) equation as defined by the MDE Maryland Stormwater Design Manual and summarized below.

$$\text{Assumed Volume (cubic feet)} = \frac{\text{Treatment Fraction} \times \text{Treatment Depth Required (inch)} \times \text{Site Runoff Coefficient, Rv} \times \text{Drainage Area to Practice (square feet)}}{\text{12 inch/foot}}$$

See Table B-2 below for assumed Treatment Fractions and Treatment Depths by era.

Table B-2: Assumed Treatment Volume Fractions for use in NR-MFR WQPC Credit Application Based on Design Era for valid treatment Practices

Water Quality Treatment Practice Category	Facility	Assumed Volume Fraction Provided of the 1" WQv Requirement or ESDv			
		Approved Pre-1986 (No water quality requirements)	**Approved from 1986-2002** (Fraction of 1" WQv Provided)	**Approved 2003 - 2010** (Fraction of 1" WQvProvided)	**Approved 2011 or after** (Fraction of ESDv Provided; varies 1" to 2.6")
Proprietary Structural Practices (Non-ESD)	Aquafilter	0	0.5	1	1
	Bayfilter	0	0.5	1	1
	Stormfilter	0	0.5	1	1
	Stormchamber	0	0.5	1	1
Structural Practices (Non-ESD)	Bioretention (F-6)	0	0.5	1	1
	Vegetated Swale	0	0.5	1	0
	Dry Swale (O-1)	0	0.5	1	1
	Infiltration Trench (I-1)	0	0.5	1	1
	Infiltration Basin (I-2)	0	0.5	1	1
	Sand Filter	0	0.5	1	1
	Wet Pond (P-2)	0	0.5	1	1
	Wetland	0	0.5	1	1
	Wet Pond Extended Detention (P-3)	0	0.5	1	1
	Wetland Extended Detention (W-2)	0	0.5	1	1
	Dry Pond with Sand Filter Base	0	0.5	1	0
ESD Practices Constructed Prior to ESD	Permeable Pavement	0	0	1	0
	Green Roof	0	0	1	0
	Dry Well	0	0	1	0
ESD Practices	Rain Garden (M-7)	0	0	0	1
	Permeable Pavement (A-2)	0	0	0	1
	Rainbarrel (M-1)	0	0	0	1
	Cistern (M-1)	0	0	0	1
	Micro - Bioretention (M-6)	0	0	0	1
	Submerged Gravel Wetlands (M-2)	0	0	0	1
	Landscape Infiltration (M-3)	0	0	0	1
	Micro - Infiltration	0	0	0	1
	Swales (M-8)	0	0	0	1
	Green Roof (A-1)	0	0	0	1
	Reinforced Turf (A-3)	0	0	0	1
	Disconnection (N-1 or N-2)	0	0	0	1
	Sheet Flow (N-3)	0	0	0	1
	Dry well (M-5)	0	0	0	1

Stormwater Pretreatment and Quantity Practices not Providing Water Quality Treatment Volume

Type	*Name*
Proprietary	Aquaswirl
	Baysaver
	Baysaver Flowsplitter
	Contech CDS System
	Flow Splitter
	Flow Splitter Underground
	Oil/Grit Separators
	Stormcepter
	Infiltrator/Stormtech
	Snout
	V2B1
	Vortechnics
	Vortsentry
Generic	Dry Pond
	Dry Pond Extended Detention
	Underground Storage

B.3 Treatment of Offsite Areas

For stormwater management systems that provide full treatment of the Environmental Site Design Volume (ESDv) as defined by Chapter 5 of the MDE Maryland Stormwater Design Manual and also treat additional stormwater runoff from offsite, a WQPC Credit up to a maximum of 100% may be obtained for an NR/MFR site. To be eligible for the additional offsite credit, an onsite NR/MFR WQPC Credit of 60% must already be achieved and is calculated as described in Section 3 of the Manual and B-1 and B-2 of this Appendix.

In Section 2 of the NR/MFR WQPC Credit Calculator, when the "Yes" option is selected in the Offsite Treatment Information dialogue box, the following additional site information is required:

- Total Offsite Impervious Area: The portion of contributing offsite drainage area which is considered to be impervious, to be entered in units of square feet. This area does not include onsite impervious area.
- Total Offsite Drainage Area: The total contributing offsite drainage area which drains to the stormwater management system practice(s) providing treatment, to be entered in units of square feet. This area does not include onsite contributing drainage area.

Site specific soils data according to the Soil Conservation Services (SCS) Hydrologic Soil Group may be used, if available. If no site-specific soil data is available, Type C soils are assumed for all offsite areas, since that is the predominant soils type in Montgomery County. The data in Section 2 is used to calculate the offsite required Water Quality Volume (WQv) and the Environmental Site Design Volume (ESDv) as defined by Chapter 5 of the MDE Maryland Stormwater Design Manual.

In Section 3 of the NR/MFR WQPC Credit Calculator, the option "Yes" in the "Offsite Area Treated?" dialogue box is selected for individual stormwater management systems which treat additional offsite areas. A design Treatment Volume must be available and entered for all facilities that treat offsite area, and this Treatment Volume should include both onsite and offsite areas in units of cubic feet. Additional design plans or other design data is required in order to be eligible for the offsite credit, and design treatment volume will be verified by the County DEP when provided by the applicant or their agent. The "Incremental Offsite Treatment Volume" will be back-calculated for each practice from the onsite required ESDv, and a total offsite treatment volume will be calculated for applications with multiple stormwater management systems providing offsite treatment. The Total Incremental Offsite Volume will be used to calculate the additional offsite WQPC Percent Credit.

The Offsite WQPC is calculated based on the total offsite impervious area treated and the County DEP's WQPC formula:

$$\text{Offsite WQPC} = \left[\frac{\text{Offsite Impervious Area}}{\text{Equivalent Residential Unit, ERU}} \times \text{Rate}\right]$$

The Equivalent Residential Unit (ERU) is equal to 2,406 square feet, and represents the median amount of impervious space on residential properties in the County. The Rate is set by the County Council each year.

The Offsite WQPC Percent Credit is calculated in a similar fashion to the onsite percent credit calculation method. When the total Incremental Offsite Volume equals or exceeds the offsite ESDv (full ESDv treated), the practice(s) are eligible to receive up to 60% offsite WQPC credit. When total Incremental Offsite Volume equals a portion of the offsite ESDv, the credit is prorated similar to the onsite percent credit methodology. An offsite WQPC Credit of 45% applies to practices which treat the full WQv treatment depth of 1-inch, with treatment depths below 1-inch and above 1-inch (but less than the ESDv) prorated as indicated in Figure B-1.

Once the Offsite WQPC Percent Credit is computed, the Potential Offsite WQPC credit is computed as shown in Equation B.1.

Eqn. B.1 $\textit{Potential Offsite WQPC Credit} = \textit{Offsite WQPC Percent Credit} * \textit{Offsite WQPC}$

The offsite WQPC credit is limited to 40% of the onsite WQPC so that the full credit afforded to a property owner does not exceed 100% of the onsite WQPC. Only non-ESD practices are eligible to receive offsite credit as the small-scale ESD practices treat small drainage areas thus limiting their credit eligibility to only onsite treatment. Therefore, the maximum onsite credit afforded to a property will be 60% (maximum non-ESD practice credit percentage) before the calculation of offsite credits are performed which will enable the property to receive up to 100% of its WQPC.

The offsite WQPC credit afforded to a property owner is limited as per Equation B.2 so as not to exceed the 40% of the Onsite WQPC threshold:

Eqn. B.2 $\textit{Offsite WQPC Credit} = \min(\textit{Potential Offsite WQPC Credit}, \textit{Onsite WQPC} \times 40\%)$

The Total WQPC Credit is computed according to Equation B.3:

Eqn. B.3 $\textit{Total WQPC Credit} = \textit{Onsite WQPC Credit} + \textit{Offsite WQPC Credit}$

The WQPC Charge is computed according to Equation B.4:

Eqn. B.4 $\textit{WQPC Charge (after credit)} = \textit{WQPC Charge on Bill (before credit)} - \textit{Total WQPC Credit}$