Marian King-Bell

From: Jonathan Kinloch
Sent: Wednesday, November 20, 2019 10:13 AM
To: Gary Brown
Cc: Marian King-Bell
Subject: Fwd: Volume Credit Questions
Attachments: GSI Drainage Credit Calculator_V3 Errors.xlsx; GSI Drainage Credit Calculator_V3 Errors.pdf

Good Morning Gary,

Please find below and attached an email I received this morning from Mr. Andre Brooks. Marian, please add this to communications received from commissioners.

Thank you,

Get Outlook for iOS

From: Andre Brooks <andreb9609@gmail.com>
Sent: Wednesday, November 20, 2019 8:55:08 AM
To: Jonathan Kinloch <Jonathan.Kinloch@detroitmi.gov>
Subject: Re: Volume Credit Questions

Commissioner Kinloch,

I still have not gotten a response from DWSD to the August 5, 2019 questions that were emailed to you. Can you follow up on that please.

Attached is the Results of the Drainage Charge Calculator for 1 area of a project that I am working on. I raised this issue with DWSD in our meeting last week. The volume credit rainfall is listed as 3.5" of rain which yields 11,949 CF of storage per the equation in the Drainage Manual for a 100% Volume Credit. When you enter the 11,949 CF of storage in the Credit Calculator it gives you a 93% credit instead of 100%. To achieve a 100% Volume Credit in the Credit Calculator you have to store more that a 5" rain (100 Year Storm) to achieve

a 100% volume credit. The Volume Storage Equation does not yield the same result as the Credit Calculator. This issue is experienced by all Drainage Credit Applicants.

Attached is the Credit Calculator Spreadsheet and a PDF which illustrates the issue mentioned above.

Thanks,

Andre

On Mon, Aug 5, 2019 at 12:15 PM Andre Brooks <andreb9609@gmail.com> wrote:

Commissioner Kinloch,

Attached is a letter where I have been asking for a response to my questions regarding the Volume Credit for the last 16 months.

During our last conversation you asked is the solution something that a mathematician could solve and the answer is yes. Actually anyone that can divide and multiply can solve the equation.
Take for instance if you have 1 gallon of water and you store 1/2 gallon (50%) of the water you would be eligible for a 50% Volume Credit. When you compare the Figure 2 chart from the 3/1/2019 DWSD Memo which uses 3.5 gallons (Inches) and if we store half of that 50% it should result in a 50% credit. Instead DWSD have been employing some new math where half of 3.5 gallons equals 0.3 gallons instead of 1.75 gallons (Inches). This is the premise of my issue.

Please let me know that this email was received.

Thanks,

Andre' Brooks, PE
President
ABE Associates, Inc.
Office: 313.961.5170 X-101
Fax: 800.449.8045
Mobile: 313.475.2549
DBE - SBE - MBE Certified

2012 Civil Engineer of the Year

--

Andre' Brooks, PE

President

ABE Associates, Inc.

Office: 313.961.5170 X-101

Fax: 800.449.8045

Mobile: 313.475.2549

DBE - SBE - MBE Certified

2012 Civil Engineer of the Year

Welcome to the Green Stormwater Infrastructure Drainage Credit Calculator Version 2, January 2019

This calculator will help estimate how much credit your site can earn if you install various stormwater management practices.

How to Use Calculator

This calculator has a variety of tabs including, Background Information, a Glossary, a Unit Converter, a Next Steps, and a Disclaimer tab.

The *Light Green* tabs to help calculate some of the inputs needed such as Drainage Areas, Stormwater Practice Areas, and EWD (advanced version only)
The *Light Orange* tabs offer additional information and include background information, a unit convertor, a glossary, and the next steps.

Short Cuts

Click on square for a shortcut to the following tabs:

Credit Calculator

How to Determine a Drainage Area

How to Calculate Practice Areas

Equivalent Water Depth (EWD) Calculator

The Next Steps

Once you have finished filling in your information and a credit has been calculated, go to "Next Steps" Tab for your next step options.

Formatting and Nomenclature

The following formatting and nomenclature is used throughout this calculator.

Input	Cells requiring input have an orange background
Calculation	Calculation cells are shown with a gray background and orange typeface
No Information Needed	Cells not requiring an input are shown with a gray background and grey typeface

If you have questions please call or email DWSD

Email: drainage@detroitmi.gov Phone: 313-267-8000 opt. 6

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Unit Conversion Assistance

Need a little help with unit conversions? See below.

Area Conversions

From acres to square feet	2.00	acres	87,120	square feet
From square feet to acres	43,560	square feet	1.00	acres

100-year 24-hour Storm Event: the frequency at which a particular amount of rainfalls in a given duration. For a 100-year 24-hour storm, the estimated amount of rainfall is 5.13 inches for Detroit. (NOAA).

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Glossary of Terms

This glossary explains some of the commonly used terms in this credit calculator. Additional information about these terms can also be found in the "A Guide to Credits for Commonly Used Stormwater Management Practices" provided in the link.

A Guide to Credits for Commonly Used Stormwater Management Practices

Terms

Bioretention is a water quality practice that is landscaped, shallow depressions that capture and temporarily store stormwater runoff. Runoff intercepted by the practice is then filtered through the soil (often engineered soil filter media).

Combined Sewer is a sewer that collects both sewerage and rain/snow melt and transports it to a waste water treatment plant.

Detention is a stormwater management practice that temporarily stores stormwater and releases it at a controlled rate.

Disconnected Impervious Surfaces are a stormwater management practices that direct runoff from impervious surfaces onto properly sized, sloped, and vegetated surfaces.

Downspout Disconnection is the process of disconnecting roof downspouts from the sewer system and redirecting the roof runoff onto pervious surfaces, most commonly a lawn.

Effective Porosity is the difference between the total void space and the water that is held in the soil particles due to capillary action.

Equivalent Water Depth (EWD) defines the depth of water that can be stored in the mix of surface and subsurface storage based on the depth and the effective porosity of each layer.

Green Stormwater Infrastructure (GSI) are designed or constructed to reduce or control the volume and rate at which stormwater leaves a site. This is also referred to as a Stormwater Management Practice.

Infiltration: the process by which rain soaks into the soil or subsurface.

Impervious Surfaces : are hard surface areas which either prevent or retard the entry of water into the soil in the manner that such water entered the soil under natural conditions pre-existent to development, or which cause water to run off the surface in greater quantities or at an increased rate of flow than that present under natural conditions pre-existent to development, including but not limited to such surfaces as roof tops, crushed stone, gravel, asphalt or concrete paving, driveways and parking lots, walkways, patio areas, storage areas, or other surfaces which similarly affect the natural infiltration or runoff patterns existing prior to development. By definition, surfaces which are driven on, or used for parking are impervious surfaces.

Managed Impervious Area is the impervious area of the property that drains into the stormwater management practice. As it is impervious it only includes the area of surfaces that water cannot flow through.

Permeable Pavement is a type of pavement that allows stormwater to infiltrate through it and into the soil.

Retention is a stormwater management practice that permanently reduces stormwater runoff volume. The captured water is reused for irrigation or allowed to naturally infiltrate and evapotranspire.

Site Credit the proration of the practice credit based on how much of the site is managed.

Stormwater is water generated from rain and snowmelt that flows over the land.

Stormwater Practice Area (SWPA) determines the ability of the practice to infiltrate into the underlying soil. It is the effective area from which infiltration can occur. The area is defined differently for each practice.

Subsurface Detention Storage performs the same function as a detention basin however stormwater is routed to underground vaults or a system of large diameter storage pipes.

2-year 24-hour Storm Event: the frequency at which a particular amount of rainfalls in a given duration. For a 2-year 24-hour storm, the estimated amount of rainfall is 2.33 inches for Detroit. (NOAA).

100-year 24-hour Storm Event: the frequency at which a particular amount of rainfalls in a given duration. For a 100-year 24-hour storm, the estimated amount of rainfall is 5.13 inches for Detroit. (NOAA).

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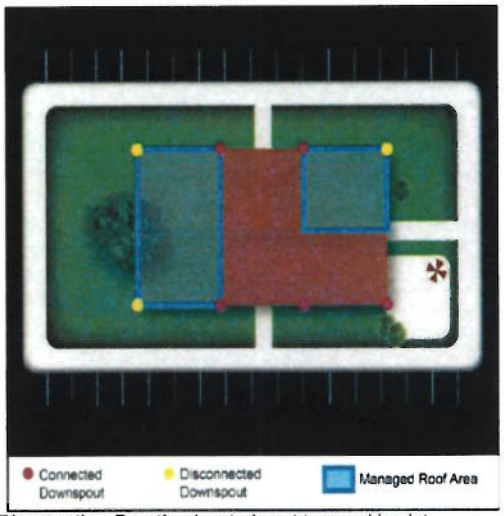
How to Determine Drainage Areas

The Managed Impervious Area is the area from where stormwater is direct to a Green Stormwater Infrastructure (GSI) practice.

For a **Downspout Disconnect**

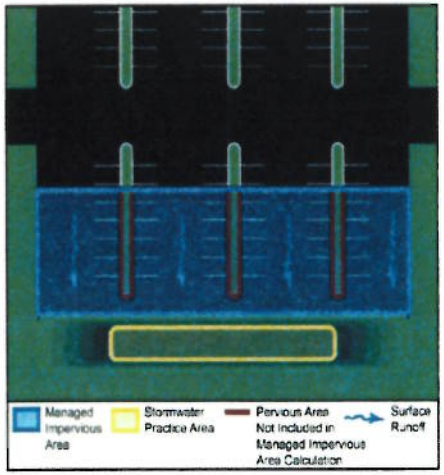
The drainage area is the portion of the roof draining to the downspout that is being disconnected.



Example: This example shows which downspouts can earn a credit and the impervious area that drains to each downspout.

For a **Bioretention Practice** located next to a parking lot

The managed impervious area is the portion of the parking lot sloped so that water flows into the bioretention practice.



Example: The managed impervious area does not include the pervious area in the grassy parking lot islands because they produce no runoff to the parking lot.

For more examples, check the "Guide to Credits for Commonly Used Stormwater Management Practices"

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How to Calculate Stormwater Practice Areas

The stormwater practice area (SWPA) is the area of the practice that allows water to infiltrate, or soak into the ground.

The practice area will differ site by site.

The practice area is defined differently for different practices.

Practice Type	Stormwater Practice Area
Downspout Disconnection	Length from one end of the downspout to the edge of the property measured along the path that water will flow multiplied by an assumed width equal to 5 feet.
Other disconnected Impervious surfaces	The surface over which infiltration will naturally occur. This is based on the width of the sheet flow when it leaves the impervious surface multiplied by the length of the flow path in the pervious area.
Bioretention	Surface area of the bioretention not including the side slopes
Permeable Pavement	The surface area of the aggregate reservoir layer if the equivalent water depth for retention is provided in the aggregate reservoir.

For examples see The Guide for Credits for Commonly Used Stormwater Management Practices.

Detention Storage and Subsurface Detention Storage

Both detention storage and subsurface detention storage use the detention calculation method to calculate the practice's credit. This method uses the storage volume of the practice rather than the area.

Therefore there is no defined stormwater practice area for either of these practices.

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Equivalent Water Depth Calculation Sheet

Many stormwater management practices rely on the temporary storage of stormwater in designed surface and subsurface storage. This storage occurs on the surface of a practice (such as temporarily ponded water on a bioretention system), and below the surface in layers of soil and aggregate. The performance of the stormwater management practice is directly related to this storage volume. The Equivalent Water Depth(EWD) defines the depth of water that can be stored in the mix of surface and subsurface storage.

$$EWD(in) = surface\ storage(in) + (soil\ depth(in) * effective\ porosity) + (aggregate\ depth\ (in) * effective\ porosity)$$

EWD Detention: The depth of water storage *ABOVE* the Underdrain/Exit Pipe. The depth of water storage is based on soil type and effective porosity

EWD Retention: The depth of water storage *UNDER* the Underdrain/Exit Pipe. The depth of water storage is based on soil type and effective porosity

Infiltration Rate:	0.1
Maximum EWD (in):	7.2

Equivalent Water Depth Calculator

Practice	Surface Storage (in)	Soil Depth (In)	Soil Effective Porosity	Aggregate Depth (in)	Aggregate Effective Porosity	Inches Underdrain is off the bottom of practice	EWD-Retention Zone (in)	EWD-Detention Zone (in)
1	4	15	0.2	20	0.3	25	7	6
2							0	0
3							0	0
4							0	0
5							0	0

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For instances where the infiltration rates are not measured at the practice location, a maximum value of 0.1 inches per hour infiltration rate is permitted.

Advanced Credit Calculator

The advanced version of the credit calculator allows the user to specify the stormwater management practices' cross section details and calculate a more accurate credit. For help calculating the EWD, see "EWD Calculator" Tab

Formatting Reminder: Input | Calculation

Site Information and Impervious Area Adjustments

Property Address: 12675 Burt Rd

	Parcel Number	Total Acreage	Site Impervious Acreage	Impervious Acreage Removed	Remaining Impervious Acreage
1		9.09	6.40	0.61	5.79
2					0.00
3					0.00
Total		9.09	6.40	0.61	5.79

Soils

Have you conducted an infiltration test on your property? No

Infiltration Rate: 0.1 inches/hour

Converter

Square Feet	Acres
	0.00
Acres	Square Feet
9.09	395960.40

Data Input Options

EWD: Equivalent Water Depths (EWDs) calculate a volume using the Stormwater Practice Area and EWDs This option assumes vertical side slopes

User inputted volumes. The user may manually input volumes retained and detained into the calculator. When this option is used, the supporting calculations, assumptions, and justifications must be with the credit application This option allows for detention storage in the side slopes

Note: *For infiltration, no volume credit will be given for side slopes as typically side slopes are compacted during construction activities*

GSI Selection, Cross Section, and Size

Practice Number	Practice Information: Description	Practice Information: Managed Impervious Area (Acres)	Practice Information: GSI Practice Type	Physical Characteristics of Practice: Input Type	Stormwater Practice Area (Acres)	EWD-Retention Zone (in)	EWD-Detention Zone (in)	Retention Volume (cf)	Detention Volume (cf)	Volumetric Credit Calculator: Does Practice Qualify for a Volumetric Credit	Practice Ratio	Volume Credit (%)	Practice Volume Credit (%)	Site Volume Credit (%)	Peak Flow Credit Calculator: Does Practice Qualify for a Peak Flow Credit	2 Year Storage Volume Required(cf)	100 Year Storage Volume Required(cf)	Volume Provided (cf)	Peak Flow Credit (%)	Practice Peak Flow Credit (%)	Site Peak Flow Credit (%)	Total Site Credit (%)
1	Retention volume must be greater than a 5" rain to yeild a 100% volume credit	1.8400	Bioretention	Storage Volume	4.0900			29210	21620	YES	N/A	100.00%	40.00%	12.71%	YES	7764.8	21620.0	21620.0	100.00%	40.00%	12.71%	25.42%
2	3.5" rain Retention volume equation yields 11949 CF but does not equal a 100% volume credit	1.8400	Bioretention	Storage Volume	4.0900			11949	21620	YES	N/A	98.43%	39.37%	12.51%	YES	7764.8	21620.0	21620.0	100.00%	40.00%	12.71%	25.22%
3	2" Rain Storage Volume	1.8400	Bioretention	Storage Volume	4.0900			7764	21620	YES	N/A	93.29%	37.31%	11.86%	YES	7764.8	21620.0	21620.0	100.00%	40.00%	12.71%	24.57%
4	1" Rain Storage Volume	1.8400	Bioretention	Storage Volume	4.0900			4324	21620	YES	N/A	77.78%	31.11%	9.89%	YES	7764.8	21620.0	21620.0	100.00%	40.00%	12.71%	22.60%
6				EWDs						NO	N/A	N/A	N/A	N/A	NO	N/A	N/A	N/A	N/A	N/A	N/A	0.00%
7				Storage Volume						NO	N/A	N/A	N/A	N/A	NO	N/A	N/A	N/A	N/A	N/A	N/A	0.00%
8				EWDs						NO	N/A	N/A	N/A	N/A	NO	N/A	N/A	N/A	N/A	N/A	N/A	0.00%
9				Storage Volume						NO	N/A	N/A	N/A	N/A	NO	N/A	N/A	N/A	N/A	N/A	N/A	0.00%
10				EWDs						NO	N/A	N/A	N/A	N/A	NO	N/A	N/A	N/A	N/A	N/A	N/A	0.00%
11				Storage Volume						NO	N/A	N/A	N/A	N/A	NO	N/A	N/A	N/A	N/A	N/A	N/A	0.00%

TOTAL: 80.00%

Site Summary

Impervious Acres Managed: 7.36

Total Volume Site Credit: 40.00%

Total Credit: 80.0%

Site Credit for Bioretention	Site Credit for Permeable Pavement	Site Credit for Detention	Site Credit for Subsurface Detention	Site Credit for Downspout Disconnection	Site Credit for Imp. Disconnection
80.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Impervious Acres Not Managed: -1.57 (You are managing more impervious acres than you have) Total Peak Flow Site Credit: 40.00% (Rounded): [illegible]

Next Steps

Once you have verified that this information is correct continue to the "Next Steps" tab for information on applying for credit.

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Shared Practice Site Credit Calculator

DWSD allows the location of the stormwater management practice to be on a separate parcel from where the stormwater is generated with a shared stormwater practice. This calculator helps calculate the site credit based on the practice's performance.

Practice Credit: 36% **Practice Credit can be calculated using Credit Calculator*

Shared Practice Site Credit Calculator

Owner Number	Site Impervious Acreage	Managed Impervious Area (Acres)	Site Credit (%)
1	4.5	2.85	23%
2			
3			
4			
5			

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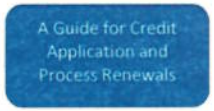
Next Steps

Refer to the Guide for Credit Application Process and Renewals for more infomratin about the next steps. These next steps may include submitting a credit application, submitting an adjustment application, requesting a site assessment, or requesting additional information.



If you have questions please call or email DWSD

Email: drainage@detroitmi.gov Phone: 313-267-8000 Opt. 6

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REFERENCES

This sheet is locked and nothing should need to be edited on it.

Stormwater Practice A
Downspout Disconnection
Impervious Disconnection
Bioretention
Permeable Pavement
Detention
Subsurface Detention Storage

Yes
No

EWDs
Storage Volume

Rational Coefficent
0.2
0.4
0.5
0.6
0.8
0.9
N/A

Water & Sewerage Department
CITY OF DETROIT

Detroit Water and Sewerage Department
Central Services Facility
6425 Huber Street, Detroit, MI 48211
313-267-8000 • detroitmi.gov/DWSD

July 10, 2019

Andre' Brooks, PE
President
ABE Associates, Inc.
440 Burroughs Street, Suite 605
Detroit, Michigan 48202

RE: Public Comment - Solution for Volume Credit Equation

Dear Mr. Brooks,

Please accept this letter as a follow-up to your concerns addressed to the Detroit Water and Sewerage Department (DWSD) at a previous community outreach meeting. In your comment, you posed several questions regarding the Total Average Annual Runoff Volume and calculation of the Volume Credit.

Previously, a technical memorandum dated 3/1/2019 was provided to you, which describes in detail how to determine the runoff volume and volume retained on an annual basis, along with examples. It appears that most of your questions' answers are available in the 3/1/2019-Memo and the Drainage Program Guide posted on the DWSD website at: www.detroitmi.gov/drainage.

Question 1. What is the solution for the Volume Credit Equation?

> *DWSD Response – The 3/1/2019-Memo describes how to determine the runoff volume and the volume retained on an annual basis. As described in the memo, the Percent Volume Credit is calculated based off a long series of individual rain events or historical rainfall records. Two approaches were provided to determine these values. One requires a long series of individual rain events (minimum of 10 years data required). The other is a simplified approach, which uses a regression equation based off historical rainfall records to calculate the Average Annual Percent Volume Retained* ($Average\ Annual\ Percent\ Volume\ Retained\ (\%) = 1 - 2.5^{-2.5 \times Runoff\ Retained}$) *– this equation is provided in the Drainage Program Guide. The regression equation is the preferred approach for simplicity and consistency reasons. Please see the memo for more information.*

Question 2. There are no sample problems in the manual that illustrate how to solve the Volume Credit Equation, please provide the solution.

> *DWSD Response - The Drainage Program Guide has several examples to calculate the Volume Credit in the chapter titled "Credits for Commonly Used Stormwater Management Practices". The 3/1/2019-Memo also provides details on how to solve the Volume Credit Equation.*

Question 3. What is the Design Storm Value of the denominator in this equation, in terms of 1 Year Storm, 2 Year Storm or 5 Year Storm and the Duration (i.e. 24 Hours)?

DWSD Response - Volume credits are calculated relative to the Total Average Annual Runoff Volume. Examples of Volume Credit calculations are provided in "Section 3.0 Examples" of the 3/1/2019-Memo.

Question 4. What is the representative Design Storm Value of the denominator in inches for item No. 3 above?

DWSD Response - Please see the response to Question 3.

Question 5. A definition of the term Total Average Annual Runoff Volume was not provided in the manual, please provide the definition of this term.

DWSD Response - The Total Average Annual Runoff Volume is the total average runoff volume generated from a defined tributary area in a year. The Total Average Annual Runoff Volume was described in detail in the 3/1/2019-Memo.

For more information on the design of stormwater management practices, you are advised to refer to the City of Detroit Stormwater Management Design Manual that is available to download from www.detroitmi.gov/dwsd or other professional literature, such as the SEMCOG LID Manual.

Your concerns regarding the Peak Flow Credit Equation and the 100-year, 24-hour storm were already addressed in previous communication.

If you have further questions, you can contact our customer care center at 313-267-8000 option 6 to speak with a representative.

Respectfully,

Lisa Wallick

Lisa Wallick, P.E.
Stormwater Management Group (SMG) Manager

cc: Honorable Board of Water Commissioners
Nikkiya Branch, Esq.
Syed Ali