TECHNICAL MEMORANDUM

Ohio Environmental Protection Agency

From:	Justin Reinhart, PE, Storm Water Technical Assistance
Date:	October 15, 2019
Subject:	Applying Runoff Reduction credits for on-site infiltration practices to achieve groundwater recharge mitigation for projects within the Big Darby Creek watershed

NPDES Construction General Permit #OHC00005 (CGP) states "a runoff reduction approach may be used to meet the groundwater recharge requirements in the Big Darby Creek watershed." The approach is further described in Part ii of Appendix A, Section A.7: *Groundwater Recharge Mitigation*. This technical memo provides interim technical guidance on the process to calculate the required on-site retention volume ($V_{retention}$) and credit a groundwater recharge volume (GWv) for on-site runoff reduction practices until the *Rainwater & Land Development* (RLD) manual is revised and republished. Note that this memo does not apply to the offsite mitigation process described in Part i of Appendix A, Section A.7.

The intention of this mitigation process is to recognize and account for the fraction of the Water Quality Volume (WQv) that becomes groundwater within an infiltrating stormwater control practice. It is a crediting process that, like the WQv, is a volumetric calculation. An infiltration practice may also be individually modelled to demonstrate groundwater recharge mitigation is achieved.

The on-site retention volume ($V_{retention}$) required is based on the Hydrologic Soil Group (HSG) classification of the soils within the disturbed area as calculated by Equation 3, Appendix A:

$$V_{retention} = (A_{HSG\text{-}A} * 0.90 \text{ in}) + (A_{HSG\text{-}B} * 0.75 \text{ in}) + (A_{HSG\text{-}C} * 0.50 \text{ in}) + (A_{HSG\text{-}D} * 0.25 \text{ in})$$

Example: A new 1-acre development entirely on HSG-C soils with 0.8 acres of planned impervious area would require on-site retention volume of:

$$V_{retention} = (0.00 \text{ ac} * 0.90 \text{ in}) + (0.00 \text{ ac} * 0.75 \text{ in}) + (1.00 \text{ ac} * 0.50 \text{ in}) + (0.00 \text{ ac} * 0.25 \text{ in})$$
$$= 0.50 \text{ ac-in.}$$

Groundwater recharge for the disturbed area is mitigated if $V_{retention}$ will be retained on-site through an approved infiltration practice (or multiple infiltration practices) designed in accordance with the appropriate *Rainwater & Land Development* (RLD) practice standard. The approved practices are listed in the table below.

CGP Table 4b Infiltration Practices	Runoff Reduction Infiltration Practices
Bioretention	Impervious area disconnection (simple disconnection or raingarden)
Infiltration basin	
Infiltration trench	Grass swale
Permeable pavement with infiltration	Sheet flow to grass filter strip
Underground storage with infiltration	Sheet flow to conservation area

A Table 4b practice designed to infiltrate the full or partial WQv for the disturbed area may credit the up to the entire WQv as groundwater recharge volume (GWv) depending on the HSG classification of the soil. This includes practices such as bioretention or permeable pavement that have an underdrain above a

properly designed internal water storage volume. Lined practices do not receive GWv credit. The portion of the 0.90-inch WQv depth available for credit as a Retention Depth is established by the HSG classification of the soil at the infiltrating practice and listed in Table A-4 of the CGP.

Table A-4: Hydrologic Soil Groups and On-site Retention Depth per Acre				
Hydrologic Soil Group	HSG-A	HSG-B	HSG-C	HSG-D
Retention Depth (in)	0.90	0.75	0.50	0.25

In many cases the groundwater recharge can be mitigated by directing the entire disturbed area through an approved Table 4b practice. Offsite drainage area beyond the disturbance is not eligible for GWv credit although it must be included in the design WQv.

Example: The previous 1-acre development entirely on HSG-C soil will discharge to an on-site post-construction bioretention practice on the same HSG-C soil. The portion of the WQv also available as GWv credit is the Retention Depth over the on-site drainage area (DA) to the bioretention practice, which in this case is the same as the disturbed area:

GWv (credit) = $DA_{bioretention}$ (ac) * HSG-C Retention Depth (in)
= 1.00 ac * 0.50 in
= 0.50 ac-in.

The GWv credit of 0.50 ac-in equals the required $V_{retention}$ previously calculated as 0.50 ac-in. If the bioretention practice design follows the RLD practice standard design criteria (i.e. dimensions, soil media, underdrain design, and internal water storage depth), groundwater recharge mitigation for the development is achieved.

Where the disturbance includes multiple HSG classifications, an area weighted $V_{retention}$ is calculated using Equation 3, Appendix A. Groundwater recharge mitigation may or may not be met with a Table 4b practice, depending on the location of the practice.

Example: If the previous 1-acre development is instead comprised of 0.25 ac of HSG-C soil and 0.75 ac of HSG-D soil, Equation 3, Appendix A yields:

$V_{retention}$ = (0.0 ac* 0.90 in) + (0.00 ac* 0.75 in) + (0.25 ac* 0.50 in) + (0.75 ac* 0.25 in)
= 0.31 ac-in.

If the bioretention practice is located on HSG-C soil, the credit remains 0.50 ac-in as previously calculated, which exceeds the $V_{retention}$ requirement of 0.31 ac-in.

If the bioretention practice is located on HSG-D soil, the credit is calculated as:

GWv (credit) =$DA_{bioretention}$ (ac) * HSG-D Retention Depth (in)
= 1.00 ac * 0.25 in
= 0.25 ac-in.

A bioretention cell located on HSG-D soil provides a GWv credit of 0.25 ac-in which does not meet the $V_{retention}$ requirement of 0.31 ac-in. Additional on-site retention practices or off-site mitigation is required.

Infiltrating Runoff Reduction practices designed to the appropriate RLD practice standard and used as supplemental post-construction controls may apply the Runoff Reduction Volume (RRv) established for each practice in the RLD manual and Runoff Reduction spreadsheet as GWv. The credits are listed in the table below.

Runoff Reduction Practice		GWv Credit	
		A/B Soils or Amended C/D Soils	C/D Soils
Impervious area disconnection	Simple disconnection	0.04 cu ft per sq ft of disconnection area	0.02 cu ft per sq ft of disconnection area
	To raingarden	the provided storage volume	
Grass swale		0.2 inches	0.1 inches
Sheet flow to grass filter strip		0.06 cu ft per sq ft of filter strip area	0.03 cu ft per sq ft of filter strip area
Sheet flow to conservation area		0.09 cu ft per sq ft of conservation area	0.04 cu ft per sq ft of conservation area

Where used as groundwater recharge mitigation, Runoff Reduction practices should be protected through a legal instrument such as an environmental covenant to assure their long-term use. An Operation and Maintenance (O&M) plan must be prepared for runoff reduction practices as well as any other post-construction controls. Signage should be installed designating grass filter strips and conservation areas.

Example: It may be possible to utilize a grass filter strip between the parking lot and bioretention cell to meet the $V_{retention}$ deficit in the previous example. If the RLD practice standard criteria for a grass filter strip are met, a credit of 0.03 cu ft per sq ft of filter strip area can be applied on HSG C or D soils. Expanding the previous example to include a 10,000 sq ft grass filer strip:

GWv (credit) = 10,000 sq ft * 0.03 cu ft / sq ft
= 300 cu ft (0.08 ac-in)

so that for the 1-acre development:

GWv (credit) = 0.25 ac-in (bioretention) + 0.08 ac-in (grass filter strip) = 0.33 ac-in.

The GWv credit of 0.33 ac-in exceeds the required on-site retention volume of 0.31 ac-in and the groundwater recharge requirement for the development is met using bioretention with a grass filter strip.

REFERENCES

Ohio EPA. 2006, revised 2018. Rainwater and Land Development. Ohio Environmental Protection Agency, Columbus, OH. Retrieved from https://epa.ohio.gov/dsw/storm/technical_guidance

Ohio EPA. 2018. General Permit Authorization for Storm Water Discharges Associated with Construction Activity under the National Pollutant Discharge Elimination System. Ohio EPA Permit Number OHC000005. Ohio Environmental Protection Agency. Columbus, OH.