POST CONSTRUCTION BULLETIN 2.0
STORMWATER TREATMENT PRACTICES

Minimum Stormwater Treatment Calculation Methods

Minimum stormwater treatment control volumes is determined by factors that influence the nature of stormwater pollutants likely associated with runoff from land use type.

Calculation Methods | Stormwater treatment will help protect water resources in our community from polluted stormwater runoff. Knowing how much runoff volume needs treated to protect water quality is an essential criteria to establish. If the criteria is too high, each development will treat more runoff on more land area than necessary. If the criteria is too low, some pollutants in the runoff will continue to impact receiving water. The goal of the design criteria is to make sure the amount of stormwater treatment required is "just right."

A variety of calculation methods are used all over the country and the Nebraska Department of Environmental Quality does not determine which method our community must use. A survey of current methods used by communities in our region shows that each has selected a calculation method that achieves the requirements and goals of their community. A snapshot of the most common calculation methods used around the region is provided below. A hybrid of these methods is proposed for Nebraska H_2O communities to consider. **The hybrid method is described on the back of this Bulletin.**

	Description	Pros	Cons
Method A	Some communities require the first 1/2" of runoff over the entire area of a project to be calculated as the stormwater treatment volume. This is also described as the "first flush" treatment method	Easy to calculate. Easy to review. Treats a volume of stormwater that is anticipated to discharge the highest concentration of pollutants.	All developments treat the same volume per acre regardless of site conditions. Some developments treat too much while others treat too little to reduce stormwater pollution. As a result, a 1/2" treatment standard is less common than the design storm standards used in many regions.
Method B	Some communities require each project to establish the area of total impervious surface and soil properties to calculate the amount of rainfall that will be conveyed as runoff. Based on a minimum rainfall depth, this calculation determines the stormwater treatment volume.	Required treatment volume reflects the impact to receiving water with increasing impervious surface area. Soil properties influence the required treatment volume also. Developers may choose to limit impervious surfaces or improve soil quality to reduce required treatment volume.	Introduces additional calculations for the designer to provide and for the city to verify for accuracy. Validation of soils information may require adequate soils testing for each project. Changes to the site after project are difficult to anticipate or enforce if they would modify stormwater runoff.
Method C	Some communities allow the designer to distinguish connected and disconnected impervious surfaces when calculating stormwater runoff. Disconnected impervious surfaces flow onto or through a pervious surface instead of directly to a storm drain inlet. Based on a minimum rainfall depth and a discount for disconnected impervious surfaces, this calculation determines the stormwater treatment volume.	This revised calculation provides a discount for the required treatment volume over the disconnected portion of the project site. The runoff reduction credit is beneficial for soils that provide greater infiltration. Disconnection can provide incentive for developers to protect and design green infrastructure throughout the site.	Variables that influence calculations for runoff reduction require extensive validation by the community. Ensuring that public and private projects are constructed and perpetually maintained according to the approved design is a drain on community resources for oversight, and if necessary, enforcement.

NDEQ requires urban areas, called Municipal Separate Storm Sewer Systems (MS4s) to, "control stormwater discharges from total land disturbance of one or more acres. The municipality must describe site design strategies, control measures and practices deemed necessary." This fact sheet explains methods to calculate stormwater treatment volumes and the method recommended for Nebraska H_2O.

For additional information on the City of XXXXX Stormwater Program, or if you have any questions please contact:

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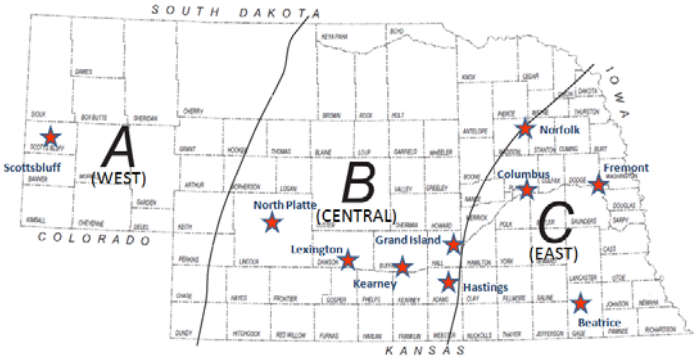
Rainfall Distribution | The recommended rainfall event for design calculations is 80% for new development and 70% for redevelopment. This criteria is consistent with other Phase II MS4s and represents a "just right" standard for rain event values for each region of the State. The following distribution regions are consistent with NDOR design guidance for calculating rainfall.



Rainfall Depths | Each community may calculate their own rainfall depths from local rainfall data. The 80% and 70% rainfall depths are estimated below for each region and may be used if the local values are not available. Rainfall depths for new development projects and redevelopment projects are provided for reference. Rainfall amounts should not be exceeded 80% and 70% of the time based on historical rainfall data. In other words, 20% and 30% of rainfall depths for rain events may exceed these amounts.

	Region A (West)	Region B (Central)	Region C (East)
New Development 80% Rain Event	0.61"	0.72"	0.83"
Redevelopment 70% Rain Event	0.44"	0.53"	0.62"

Rainfall Depth and Runoff Volume | Rainfall is converted to runoff by a range of factors. Some factors are problematic for municipalities to control, such as soil quality and amount of disconnected impervious surfaces maintained long-term. One important factor a municipality can control is the amount of impervious surface allowed within a land use type. The type of land use strong influences the portion of a project that conveys stormwater runoff. When land is highly developed, less rainfall is infiltrated and more is conveyed as runoff. The recommended calculation for converting rainfall to runoff is consistent with the City of Lincoln design criteria. The recommended equation for Nebraska H_2O communities is as follows:

$$WQCV = P \times (0.05 + 0.009 \times \%Imp) \times Acres \times 1/12 \times 43{,}560$$

The calculation returns the volume of runoff, in cubic feet, that requires stormwater treatment. This equation represents the "just right" calculation method for determining runoff volume.

Land Uses and Impervious Surfaces | The impervious surface intensity can be grouped by land use type to simplify calculation of runoff for designers and reviewers. The recommended approach is for Nebraska H_2O communities to apply use of the maximum percent impervious surface by zoning classification in the WQCV equation provided above. Using the maximum percent impervious surface allows for full build out of the zoned lot for the intended use without modification of the constructed stormwater treatment facility. Where there are multiple land uses within a drainage area, the maximum percent impervious for each land use can be pro-rated based on the size of the zoned area.

To simplify the process further, individual communities may elect to group similar zoning classifications by maximum percent impervious surface. The following table illustrates how various land use types can be applied into one of four groups. The four groups shown range from less than 30% maximum impervious surface, followed by up to 50%, followed by up to 75% and greater than 75%. When a new development or redevelopment project is proposed, the land use type will determine the percent impervious anticipated over the area of the project.

	Parks & Open Space	Single Family Residential	Light Commercial & Multi-Family	General Commercial & Industrial
Region A 80% (70%)	0.20" (0.14")	0.31" (0.22")	0.44" (0.32")	0.55" (0.40")
Region B 80% (70%)	0.23" (0.17")	0.36" (0.27")	0.52" (0.38")	0.65" (0.48")
Region C 80% (70%)	0.27" (0.20")	0.42" (0.31")	0.60" (0.45")	0.75" (0.56")

The depth of runoff displayed in this table represent the amount of runoff that may be expected to discharge from each group of land use types. The land use types for each community may fall into different groups depending on local guidance and requirements for subdivision of land and zoning. This method of calculating runoff volume represents a convenient method to quickly get the "just right" approach for overseeing the review process and long-term management of stormwater treatment designs for a municipality.

Water Quality Discharge Rate | Not all stormwater management practices are designed to treat a volume of runoff by infiltration or detention. Some practices are designed to provide treatment as stormwater flows through them instead. To achieve stormwater treatment in this way, the designer must follow a different calculation method that makes sure the "just right" discharge rate is controlled based on the design rainfall event.

The design rainfall event for calculation of Water Quality Discharge Rate is the 80% rainfall depth. Runoff is calculated using NRCS Curve Number procedure for a 24 hour duration storm event and a time of concentration of 5 minutes. The area used in the equation reflects the amount of impervious surface within the treatment drainage area. The table below illustrates estimated amounts of runoff, by region, for sites with up to 4 acres of impervious area. Greater areas may be used in site calculation.

Impervious Area (Acres)	Q_{WQ} (cfs) By Region West – Central - East	Impervious Area (Acres)	Q_{WQ} (cfs) By Region West – Central - East
0.4	0.3 - 0.3 - 0.4	2.4	1.6 – 2.0 – 2.4
0.8	0.5 - 0.7 - 0.8	2.8	1.9 – 2.4 – 2.8
1.2	0.8 – 1.0 – 1.2	3.2	2.2 – 2.7 – 3.2
1.6	1.1 – 1.4 – 1.6	3.6	2.5 – 3.0 – 3.6
2.0	1.4 – 1.7 – 2.0	4.0	2.7 – 3.4 – 4.0