Chapter

2

District of Columbia Minimum Control Requirements for Storm Water Management

2.0 District of Columbia Minimum Control Requirements for Storm Water Management

This chapter presents a unified approach for sizing storm water BMPs in the District of Columbia to meet pollutant removal goals, reduce peak discharges, and pass extreme floods. For a summary, please consult Table 2.1 below. The remaining sections describe the four sizing criteria in detail and present guidance on how to properly compute and apply the required storage volumes.

Table 2.1 Summary of the District of Columbia Storm Water Criteria

Sizing Criteria	**Description of Storm Water Sizing Criteria**
Water Quality Volume (V_w) (ft^3)	$V_w = \frac{R*I_a}{12}$ Where: V_w = water quality volume to be treated (ft^3) R = runoff depth (in), see Table 2.2 I_a = impervious area (ft^2) 12 = conversion factor
2 Year Storm Control (Qp_2)	The peak discharge rate from the 2- year storm event controlled to the pre-development rate.
15 Year Storm Control (Qp_{15})	The peak discharge rate from the 15-year storm event controlled to the pre-development rate.
Extreme Flood Requirements (Q_f)	When storm water runoff from a planned development will increase the downstream discharge into an area designated as a flood hazard watershed, an analysis of the downstream peak discharge for a 100 year frequency storm event must be completed, and appropriate controls to avoid exceeding this peak discharge must be installed.

This chapter also presents a list of acceptable BMP options that can be used to comply with the sizing criteria.

All storm water management administration, including review(s) and modification(s) of appurtenances design plans, and sheet flow storm water runoff controls shall be the sole responsibility of the Department. All storm water runoff controls shall conform to 21 DCMR, Chapter 5 as well as the criteria set forth in this chapter. All of the requirements in Chapter 2 may be altered by the Department if it determines that alternative approaches may better control flood damage, mitigate accelerated stream erosion and sedimentation, and improve surface water quality.

2.1 Water Quality Requirements (V_w)

By EPA definition, the first half-inch of runoff should contain 85 - 90% of the pollutants in the initial runoff volume. To meet water quality standards, the District of Columbia requires that the first flush runoff be treated by filter media, natural percolation, detention or extended detention or an equivalent process within 48 hours, then released.

The District of Columbia's management strategy for treating storm water is to capture and isolate the first-flush runoff from impervious surfaces within the contributing drainage area. The following equation is used to determine the water quality volume, V_w (in ft^3 of storage):

$$V_w = \frac{R * I_a}{12} \tag{2.1}$$

Where: V_w = water quality volume to be treated (ft^3)
R = runoff depth (in), see Table 2.2
I_a = impervious area (ft^2)
12 = conversion factor

In the District of Columbia, the post-development land use characteristics and the projected future activities of the impervious area determine the depth of runoff that must be held for water quality treatment (Table 2.2).

Table 2.2 Runoff Depth to Be Treated Based on Post-Development Land Use

Runoff Depth (R)	Land Use
0.5 inches	Parking lots, city streets (with or without on-street parking), highspeed roads
0.3 inches	Rooftops, sidewalks, pedestrian plaza areas

Capturing the first flush runoff is essential to removal of the majority of pollutants. In the District of Columbia, the first flush runoff volumes have been separated into two categories based on land use: 0.5" runoff depth for parking lots, city streets, and high speed roads; and 0.3" runoff depth for rooftops, sidewalks and pedestrian plaza areas. This grouping is based typical pollutant loads from the different land uses.

Pollutants accumulate on impervious areas, then are at least partially washed away by subsequent storm events. This phenomenon is commonly referred to as the first flush of runoff and is characterized with the highest load of pollutants. This is significant because the majority of storm events produce 0.5" or less of runoff. In one study, pollutant loads removed by the first 0.5" of runoff averaged about 52 and 39 % of the total storm load averages (Chang, 1990).

First flush pollutant contributions are typically higher from parking lots, city streets, and highspeed roads (within the 0.5" runoff depth category). Rooftops, sidewalks, and pedestrian areas represent lower concentrations of sediment and nutrients compared to parking lots and streets (Steuer et al., 1997; Bannerman et al., 1993; Waschbusch et al., 2000). PAHs, oil, and grease concentrations also tend to increase in commercial and industrial areas (Sturm, 2000); these areas are characterized by extensive parking lots and streets.

2.2 Quantity Control Requirements (Qp_2 and Qp_{15})

To meet quantity control and peak discharge requirements, the District of Columbia requires the following:

2-Year Storm Control (Qp_2) Maintain the post-development peak discharge for a 24-hour, 2-year frequency storm event at a level that is equal to or less than the 24-hour, 2-year pre-development peak discharge rate through storm water management practices that control the volume, timing, and rate of flows. The rainfall intensity - duration - frequency curve for the District of Columbia is provided in Appendix A.

15-Year Storm Control (Qp_{15}) Maintain the post-development peak discharge for a 24-hour, 15-year frequency storm event at a level that is equal to or less than the 24-hour, 15-year pre-development peak discharge rate through storm water management practices that control the volume, timing, and rate of flows. The rainfall intensity - duration - frequency curve for the District of Columbia is provided in Appendix A.

All storm water facilities and conveyance systems shall be designed using the 15-year design frequency with ultimate land use conditions. If another higher storm frequency is needed, the review engineer will require that all of the computations and assumptions be submitted for detailed evaluation. Where the storm water management facility discharges into a closed conduit system, the release rate of the structure must be designed so as not to adversely affect the downstream hydraulic gradient. See Appendix B for details and guidance on the design of storm water conveyance systems. See Appendix C for details and guidance on the design of flow control structures.

2.3 Extreme Flood Requirements (Q_f)

Where a development is planned in which the storm water runoff will increase the downstream discharge into an area designated as a flood hazard watershed, as delineated on the National Flood Insurance Flood Hazard Boundary Maps (FHBM), the developer shall complete an analysis of the downstream peak discharge for a 100-year frequency storm event, and shall install the appropriate controls to avoid exceeding this peak discharge.

The final release rate of the facility should be modified if any increase in flooding or stream channel erosion would result at a downstream structure, highway, or natural point of restricted streamflow. The release rate of the structure shall:

1. Be reduced to a level that will prevent any increase in flooding or stream channel erosion at the downstream control point;

2. Be not less than the 1-year pre-development peak discharge rate; and when deemed necessary by the Department, the developer shall submit an analysis of the impacts of storm water flows downstream in the watershed. The analysis should include hydrologic and hydraulic calculations necessary to determine the impact of the hydrograph timing modifications of the proposed development upon any control structure, highway, or natural point of restricted streamflow, established with the concurrence of the Department, downstream of a tributary of the following size:

    - The first downstream tributary whose drainage area equals or exceeds the contributing area to the facility; or
    - The first downstream tributary whose peak discharge exceeds the largest designed release rate of the facility.

For on-line designs, the limits of the recorded 100-year floodplain easement or surface water easement sufficient to convey the 100-year flow must be shown. The easement must be acceptable to the District of Columbia floodplain review authority.

The minimum horizontal clearance between a residential structure and the 100-year floodplain is 25 feet. Structure locations, existing and proposed, are to be shown when it is not absolutely clear whether 25-foot setback from the floodplain can be met.

2.4 Additional Storm Water Management Requirements

Any storm water runoff discharge facility which may receive storm water runoff from areas which may be potential sources of oil and grease contamination in concentration exceeding 10 milligrams per liter (mg/l) shall include a baffle, skimmer, grease trap or other mechanism which prevents oil and grease from escaping the storm water discharge facility in concentrations that would violate or contribute to the violation of applicable water quality standards in the receiving water of the District of Columbia.

Any storm water discharge facility which receives storm water runoff from areas used to confine animals and which discharges directly into receiving waters shall be designed to prevent at least eighty-five percent (85%) of the organic animal wastes from escaping the storm water discharge facility. The discharge from the facility shall not violate the water quality standards of the District of Columbia.

2.5 Hydrology Methods

The following are the acceptable methodologies and computer models for estimating runoff hydrographs before and after development. These methods are used to predict the runoff response from given rainfall information and site surface characteristic conditions. The design storm frequencies used in all of the hydrologic engineering calculations will be based on design storms required in this guidebook unless circumstances make consideration of another storm intensity criteria appropriate.

- Rational Method & Modified Rational Method
- Natural Resource Conservation Service TR-55
- TR-20, HEC-1, and SWMM computer models

These methods are given as valid in principle, and are applicable to most storm water management design situations in the District of Columbia. Other methods may be used when the Department approves their application.

The use of the Natural Resource Conservation Service storage indication routing method or an equivalent acceptable method may be required to route the design storms through storm water facilities.

See Appendix A for further details and guidance.

2.6 Pollutant Load Calculations

For all development sites, the following calculations must be performed and certified by a professional engineer (civil or environmental engineer) licensed to practice in the District of Columbia.

1. Estimate the post-development pollutant export of total nitrogen (TN), total phosphorus (TP), and total suspended solids (TSS)
2. Estimate the annual TN, TP, and TSS loads which should be removed by the application of approved BMP(s).

All new development is required to provide these calculations by using the methods outlined in

Appendix D. The loading calculation sheets should be submitted at the 85% project design completion stage to be reviewed by the Department before the submission for final approval.

2.7 Acceptable Urban BMP Options

This section sets forth five acceptable groups of BMPs that can be used to meet the storm water water quality (V_w) criteria.

The dozens of different BMP designs currently used in the District of Columbia are assigned into five general categories for storm water quality control:

BMP Group 1	filtering systems
BMP Group 2	infiltration practices
BMP Group 4	storm water ponds
BMP Group 5	storm water wetlands
BMP Group 6	open channels

A sixth group is set forth to explicitly provide storm water detention to meet Qp_2, Qp_{15}, and / or Q_f requirements:

BMP Group 3	storage practices

Within each BMP group, detailed performance criteria are presented that govern feasibility, conveyance, pretreatment, treatment, environmental/landscaping and maintenance requirements (see Chapter 3).

To be considered an effective BMP, a design shall be capable of:

1. capturing and treating the full water quality volume (V_w),
2. having an acceptable longevity rate in the field.

Guidance on selecting the most appropriate combination of BMPs is provided in Chapter 4.

BMP Group 1. Filtering Systems

Practices that capture and temporarily store the V_w and pass it through a filter bed of sand, organic matter, soil or other media are considered to be filtering practices. Filtered runoff may be collected and returned to the conveyance system. Design variants include:

F-1 surface sand filter
F-2 one-chamber underground sand filter

F-3 three-chamber underground sand filter
F-4 perimeter sand filter
F-5 vertical sand filter
F-6 organic filter
F-7 bioretention areas
F-8 roof downspout system

BMP Group 2. Infiltration Practices

Practices that capture and temporarily store the V_w before allowing it to infiltrate into the soil over a two day period include:

I-1 infiltration trench
I-2 infiltration basin

BMP Group 3. Storage Practices

Storage practices are explicitly designed to provide storm water detention. Storage practices are not considered an acceptable practice to meet the water quality volume requirement (V_w). Design variants include:

S-1 underground vault
S-2 dry pond
S-3 rooftop storage

Design guidance and criteria for rooftop storage practices is provided in Appendix H.

BMP Group 4. Storm Water Ponds

Practices that have a combination of a permanent pool, extended detention or shallow marsh equivalent to the entire V_w include:

P-1 micropool extended detention pond
P-2 wet pond
P-3 wet extended detention pond
P-4 pocket pond

BMP Group 5. Storm Water Wetlands

Practices that include significant shallow marsh areas to treat urban storm water but often may also incorporate small permanent pools and/or extended detention storage to achieve the full V_w include:

W-1 shallow wetland
W-2 Extended Detention (ED) shallow wetland
W-3 pocket wetland

BMP Group 6. Open Channel Practices

Vegetated open channels that are explicitly designed to capture and treat the full V_w within dry or wet cells formed by checkdams or other means include:

O-1 dry swale
O-2 wet swale