



## RESOLUTION

Be it resolved by the Director of Public Works of Kansas City, Missouri that Section 5600 – Storm Drainage Systems and Facilities of Division V, Design Criteria, approved and adopted March 21, 1990 by the Kansas City Metropolitan Chapter of the American Public Works Association, is hereby modified by the following supplement and adopted as the Official Design Criteria for the Public Works Department of Kansas City, Missouri.

Supplement No. 2 to Section 5600  
STORM DRAINAGE SYSTEMS AND FACILITIES

A copy of said criteria and supplement are attached hereto and incorporated herein by reference. Supplement No. 1, adopted April 16, 1993 is not changed and shall continue to be used.

Supplement No. 2 and its criteria shall become effective June 17, 2002.

Approved and adopted as Official Document No. 0200116  
this \_\_\_\_ day of \_\_\_\_\_, 2002.

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George E. Wolf, Jr., P.E.  
Director of Public Works  
Kansas City, Missouri

Document No. 0200116

## DIVISION V

### APWA STANDARD SPECIFICATIONS AND DESIGN CRITERIA

### SECTION 5600 STORM DRAINAGE SYSTEMS AND FACILITIES

### SUPPLEMENT NO. 2

The following additions, deletions and/or revisions are adopted for use and shall become a part of Section 5600 for use within Kansas City, Missouri.

General: The Rational Method has been determined inappropriate for use in drainage areas larger than 5 acres. The following revisions are all a result of that determination.

5602.5 Paragraphs A and B are to be used only with the Rational Formula. Paragraph C is added

- C. Time of Concentration for use with the SCS Method TR55 “TR-55”, Pen State Runoff Model “PSRM,” and HEC1 or HEC-HMS shall be determined in accordance with their respective documentation Manuals.

5602.6.A. Paragraph 5602.6.A is modified as follows:

#### **A. Subwatershed Areas using Rational Method:**

1. The Rational Method may be used to calculate peak rates of runoff to elements of enclosed and open channel systems, including inlets, when the total upstream area tributary to the point of consideration is less than 5 acres.
2. The Rational Method may be used in tables or computer modeling printouts provided on engineering plans or in Storm Drainage Studies, to calculate peak rates of runoff to approximate the design flow to elements of enclosed system networks the sum of which may total up to 100 acres. However, methods other than Rational Method shall be used to calculate and verify the design flow at critical points of the network. Said critical element(s) are:
  - a) Cross street pipes or culverts regardless of street classification,
  - b) Discharges to impoundment, and/or
  - c) Open channel systems.
3. The Rational Method is defined as follows:  
(Rational Formula breakdown remains unchanged)

5602.6.B. shall be deleted and the following paragraphs added in lieu thereof:

- #### **B. All Watersheds:** The following methods are acceptable for all watersheds.

1. SCS Technical Release No 55 – Urban Hydrology for Small Watersheds, Second Edition, June 1986, or later edition,
  2. Institute for Research on Land and Water Resources, The Pennsylvania State University, PENN STATE RUNOFF MODEL, version June 1983, or later edition,
  3. US Army Corps of Engineers, Davis, Calif., Hydrologic Engineering Center, HEC-1 Flood Hydrograph Package, 1981 (rev. March 1987), or later edition,
  4. US Army Corps of Engineers, Davis, Calif., Hydrologic Engineering Center, River Analysis System, HEC-RAS, version. 2.2, September 1998, or later edition,
  5. US Environmental Protection Agency’s Stormwater Management Model (SWMM), March 1975, or later edition.
- C. The following method is acceptable for watersheds with a time of concentration greater than 1 hour:
1. SCS Technical Release No 20 – Computer Program for Project Formulation - Hydrology, 1985 (revised February 1992), or later edition.
- D. The SCS method and HEC1 do have some limitations. On small areas the peak flow may occur between points of calculation. Engineers shall check their calculations by graphing the runoff hydrograph results and interpolating peak flow if necessary. This problem is generally insignificant in volume calculations.
- E. Lag time for HEC1 shall be calculated from the TR55 method for time of concentration when using the TR55 Hydrology approach.
- F. The SCS soil numbers shown in section 5602.2 are default values for disturbed urban soils. The Kansas City, Metropolitan area has many Type B soils, so the design engineer is encouraged to use judgment especially when calculating predevelopment runoff. Additional default soil numbers are listed below:
- | <u>Land Use</u>        | <u>SCS Curve No. Type “C” Soil.</u> |
|------------------------|-------------------------------------|
| Cultivated             | 81                                  |
| Pasture                | 74                                  |
| Woods                  | 70                                  |
| Townhouses             | 90                                  |
| Inner-City Residential | 90                                  |
| Churches and Schools   | use your judgment                   |
- G. SWMM is the preferred method used for Drainage Masterplans. It is capable of routing peak flows and runoff volumes through both enclosed and open channel systems. Its use is anticipated on large fee projects.

H. Flood Insurance Flowrates. These flow rates were developed in 1980 and generally do not include present or future development rates. Ultimate development condition 100-year flow rates shall be calculated using the method recommended by the Corps of Engineers (generally SWMM) and FEMA regulations.

5606.4.B. shall be deleted and the following paragraphs added in lieu thereof:

**5606.4.B. Release Rate:** The maximum release rate from any development for the 100-year and more frequent storms (Type II, 24-hour) shall be 1.8 c.f.s. per tributary acre, except as follows:

1. Small Urbanized “Previously Developed” Sites<10 Acres: The maximum release rate shall be equal to the 100-year (Type II, 24-hour) pre-existing discharge rate, subject to recommendation by the design engineer and approval by City.
2. Large Urbanized “Previously Developed” Sites>10 Acres: The maximum release rate shall be equal to the 100-year pre-existing discharge rate. The appropriateness of this rate will be based on the design engineer’s submittal information and recommendations, which shall show adequate investigation, coordination, and analysis of the existing receiving system conditions conducted to ensure there are no peak, volume, or timing impacts caused by applying the pre-existing discharge rate as the design allowable rate, subject to approval by the City. Lower release rates may apply where appropriate and in the interest of the general safety and welfare of the public.
3. “Previously Developed Urban Sites:” Where there are no enclosed stormwater receiving systems adjacent to the development, the historical impervious and pervious pre-existing percentages shall not change. Additionally, the characteristics of how stormwater is discharged from the pre-existing site shall not change. Except that provision for stormwater system improvements may be proposed to mitigate the increase in runoff to the receiving system or changes in flow characteristics from the site.

**5606.4.B1. Master Watershed Study Release Rates:** For any development, the City may impose or prescribed allowable discharge rates based on Master Watershed Studies performed under the jurisdiction of the City.

**5606.4.B2. Offsite Area(s) Release Rate:** When areas outside the development are also tributary, their inflow hydrograph(s) may be added to the above maximum allowable site discharge rates to determine the total maximum allowable site release rate. However, in applying Section 5601.3 to determine the inflow hydrograph(s) consideration shall be given to the appropriate use of existing v. ultimate land use conditions in establishing the acceptable maximum allowable site release rate or greatest runoff.

**5606.4.B3. Lower Release Rate:** If downstream conditions dictate a lower release rate, then the above release rates do not govern. The following criteria and considerations shall be utilized in determining when and to what degree a lower release rate is required:

1. Criteria 1: When the increased site runoff discharge volume significantly increases flood levels and/or extends or prolongs the pre-existing flooding problems downstream of the site.  
Criteria 2: When the increased site runoff discharge volume and velocity is erosive to downstream conveyance systems.  
Criteria 3: When the increased site runoff discharge negatively impacts the hydraulic performance of improved open or enclosed downstream conveyance systems.
2. The design engineer shall conduct adequate investigation, hydrologic, and/or hydraulic analysis to identify and address impacts and flooding problems to a point downstream, at a minimum, where the rate of total runoff from the site is 10 percent or less than the total runoff rate conveyed by the downstream system measured at the time of system peak rate under ultimate site condition analysis. The release rate shall be reduced to mitigate the impact or adequate downstream improvements shall be made to the conveyance system. The City may prescribe other criteria on a case-by-case basis where deemed appropriate and in the interest of the general safety and welfare of the public.
3. In establishing the appropriate release rate, an initial study of conditions and constraints should be made by the design engineer in addition to coordination of design approach with City staff, the City's Storm Water Utility, existing development studies, master watershed studies, and/or available records.
4. Upon the formal request by the applicant in writing, the City may pre-evaluate and comment on the design engineer's determination of the maximum allowable site release rate and greatest runoff calculation approach prior to initial submittal of the final Storm Drainage Study.
5. Development Drainage Studies shall be modeled using the Procedures, Format, and Guidelines established by the Storm Water Management Plan Document No 020117.

5606.4.C. The following two paragraphs are added to section 5606.4.C.

3. The Modified Rational Method is not accepted by the City of Kansas City.
4. Figure 11–Simplified Volume Chart is not accepted by the City of Kansas City as a basis for final design. Figure 11 may be used for planning purposes to approximating detention storage volumes, subject to final verification by means of a formal analysis.

**APPROVED AND ADOPTED THIS \_\_\_\_<sup>th</sup> DAY OF \_\_\_\_\_, 2001**

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George E. Wolf, Jr., P.E.  
Director of Public Works