Appendix 2.A.3 The Critical Storm Method

The critical storm method may be used to control the peak rates of runoff from a development generated by less-common (1- to 100-year recurrence interval) storms to mitigate flooding and channel erosion produced by events of this magnitude. Designing a stormwater management practice according to the critical storm method reduces stormwater discharge rates to no more than those that occurred prior to development for a selected design storm. It may be applied to detention or infiltration practices as well as low-impact site design.

Use of the critical storm method is **recommended** in conjunction with the post-construction stormwater management (water quality volume) required by the Ohio EPA NPDES stormwater general permit as multiple levels of runoff control provides comprehensive stormwater management. Any requirement for peak discharge control in Ohio is established in municipal, township, or county regulations. Consult the local government with jurisdiction over the development location to ensure compliance with all local stormwater management requirements.

The Critical Storm Method

The peak rates of runoff from an area after development may be no greater than the peak rates of runoff from the same area before development for all 1- to 100-year frequency, 24-hour storms (matching the peak rate of runoff for the 1-, 2-, 5-, 10-, 25-, 50-, and 100-year storms is considered adequate).

If the volume of runoff from an area after development will be greater than the volume of runoff from the same area before development, it shall be compensated by reducing the peak rate of runoff from the critical storm and all more frequent storms (shorter return periods) occurring on the development area to the peak rate of runoff from a 1-year frequency, 24-hour storm occurring on the same area under predevelopment conditions. Storms of less-frequent occurrence (longer return periods) than the critical storm up to the 100-year storm shall have peak runoff rates no greater than the peak runoff rates from equivalent size storms under predevelopment conditions.

Apply the critical storm method to each individual watershed within the development area. Calculate all pre- and post-development runoff rates and volumes at each outlet using their respective drainage divides and design stormwater management practice accordingly.

Determining the Critical Storm

Determine the critical storm for a specific development area by the following steps.

1. Estimate the total volume of runoff from a 1-year frequency, 24-hour storm, occurring on the development area before and after development. The runoff curve number method described in NRCS Technical Release 55 (USDA, 1986) is recommended. Select a composite curve number appropriate for the area's land cover types and Hydrologic Soil Groups from tables published in Technical Release 55.
2. Calculate the percent increase in volume of runoff due to development using the volumes from step 1.
3. Select the critical storm from Table 2.A.3.1 given the percentage calculated in step 2.

Table 2.A.3.1 Critical Storm Determination Using Percent Increase in Runoff Volume

If the percent of increase in runoff volume is		The critical storm for peak rate control will be
equal to or greater than	and less than	
-	10	1-year
10	20	2-year
20	50	5-year
50	100	10-year
100	250	25-year
250	500	50-year
500	-	100-year

Controlling the Critical Storm Discharge

Measures to control discharge up to the critical storm may include the following.

- Utilize impervious surface disconnection, grass swales, or open channels to convey flow at a lower velocity. These practices lower peak discharge by reducing the travel time of runoff in addition to potential volume reduction and pollutant removal.
- Use grade control structures to reduce the runoff travel time by reducing flow path slopes.
- Restore post-construction pervious area to good hydrologic soil conditions. Healthy soil reduces runoff volume through infiltration and storage while supporting a healthy, flow-resisting vegetative cover.
- Implement low-impact development strategies that, in addition to the above, place management practices such as bioretention near the runoff source. Managing runoff in smaller quantities can be more effective at reducing overall runoff volume through infiltration.
- Provide detention volume in a wet, dry, or wetland basin. Note that reducing peak discharge without measures to reduce runoff volume simply lengthens the duration of outflows. These lower, sustained outflows may not mimic pre-development hydrology and can still be erosive.

All stormwater management methods must be designed so that they will function long-term, with the least maintenance necessary, and with specific regard to safety.

References

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