Rational Equation Calculator

Compute peak discharge from a drainage basin using the Rational Equation Method

Click to Calculate

Rational runoff coefficient, c:	0.7	
Rainfall intensity, i:	0.100	inch/hour
Drainage area, A:	1.65	acre
Peak discharge, Q:	0.1155	ft3/s (cfs)

Units in Rational Equation calculation: ft^3=cubic foot, m^3=cubic meter, mm=millimeter, s=second

Rational Method Equation

The Rational equation is the simplest method to determine peak discharge from drainage basin runoff. It is not as sophisticated as the SCS TR-55 method, but is the most common method used for sizing sewer systems.

Rational Equation: Q=ciA
The Rational equation requires the following units:
Q = Peak discharge, cfs
c = Rational method runoff coefficient
i = Rainfall intensity, inch/hour
A = Drainage area, acre

Note that our calculation allows you to use a variety of units.

The Rational method runoff coefficient (c) is a function of the soil type and drainage basin slope. A simplified table is shown below. See the references at the bottom of the page for more complete tables including impact of slope.

The Rainfall intensity (i) is typically found from Intensity/Duration/Frequency curves for rainfall events in the geographical region of interest. The duration is usually equivalent to the time of concentration of the drainage area. The storm frequency is typically stated by local authorities depending on the impact of the development. A 10-yr, 25-yr, 50-yr, or even 100-yr storm frequency may be specified.

Simplified Table of Rational Method Runoff Coefficients (see references below)

Ground Cover	Runoff Coefficient, c
Lawns	0.05 - 0.35
Forest	0.05 - 0.25
Cultivated land	0.08-0.41
Meadow	0.1 - 0.5
Parks, cemeteries	0.1 - 0.25
Unimproved areas	0.1 - 0.3

To:
LMNO Engineering home page (more calculations)

Related calculations:

Time of Concentration

SCS TR-55 Peak Discharge

Detention Storage Calculator

Water Quality Volume

Unit Conversions

Register

Pasture	0.12 - 0.62
Residential areas	0.3 - 0.75
Business areas	0.5 - 0.95
Industrial areas	0.5 - 0.9
Asphalt streets	0.7 - 0.95
Brick streets	0.7 - 0.85
Roofs	0.75 - 0.95
Concrete streets	0.7 - 0.95

Error Messages given by calculation

"Need 0<c<1", "Need i>0" "Need A>0". Input values must be in these ranges.

References and Bibliography

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Please contact us for consulting or questions about the rational equation for peak discharge.

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