

ERRATUM SHEET

Classification: **ERRATA: 2.0. - ESC-2024:**
Date: **31 JANUARY 2025**
Manual: **CPESC GENERAL PRINCIPLES REVIEW MANUAL, VERSION 7.0**

STEP-BY-STEP GUIDE TO USING THE RUNOFF EQUATION

Understanding the Equation:

- **Q:** Runoff Depth (inches)
- **P:** Precipitation (inches)
- **S:** Potential maximum retention (inches)
- **CN:** Curve number (a dimensionless parameter representing the runoff potential of a given land cover)

Steps:

1. Determine the Curve Number (CN):

- The CN is a numerical value that ranges from 0 to 100. A higher CN indicates greater runoff potential.
- Use a table or soil survey to find the CN for your specific land cover type (e.g., forest, grass, urban).

2. Calculate Potential Maximum Retention (S):

Use the formula: $S = (1000 / CN) - 10$

Example: You calculated the CN to be 70, solve for S first.

$$S = (1000 / 70) - 10$$

Note 1: Solve the quantity in the parenthesis first

$$= (14.28) - 10 \approx \underline{4.29 \text{ inches}}$$

3. Measure or Estimate Precipitation (P):

- Obtain the rainfall amount for the period of interest {you will be given the rainfall}.

4. Calculate Discharge Q (inches):

- Plug the values for P and S into the equation:

Using the formula: $Q = (P - 0.2S)^2 / (P + 0.8S)$ or $(P - 0.2S)^2 / (P + 0.8S)$

Note 1: Plug in a value for P and solve the terms inside the numerator (top) first by solving (P - 0.2S), write that value down on the notes and show it will be subsequently squared (see below). Solve the denominator as discussed below and proceed.

Make sure you do this step by step so you do not make a mistake !

For example, if given P = 2 inches and S = 4.29 inches {calculated above}, then:

$$Q = ((2 - 0.2(4.29))^2 / (2 + (0.8 * 4.29)))$$

Note 2: It is essential to remember to organize terms here by solving the terms in the parentheses first. Here you solve the $0.8 * 4.29$ on the right side and $(2 - 0.2(4.29))^2$ on the left side !

$$Q \approx (1.14)^2 / (2+(3.43))$$

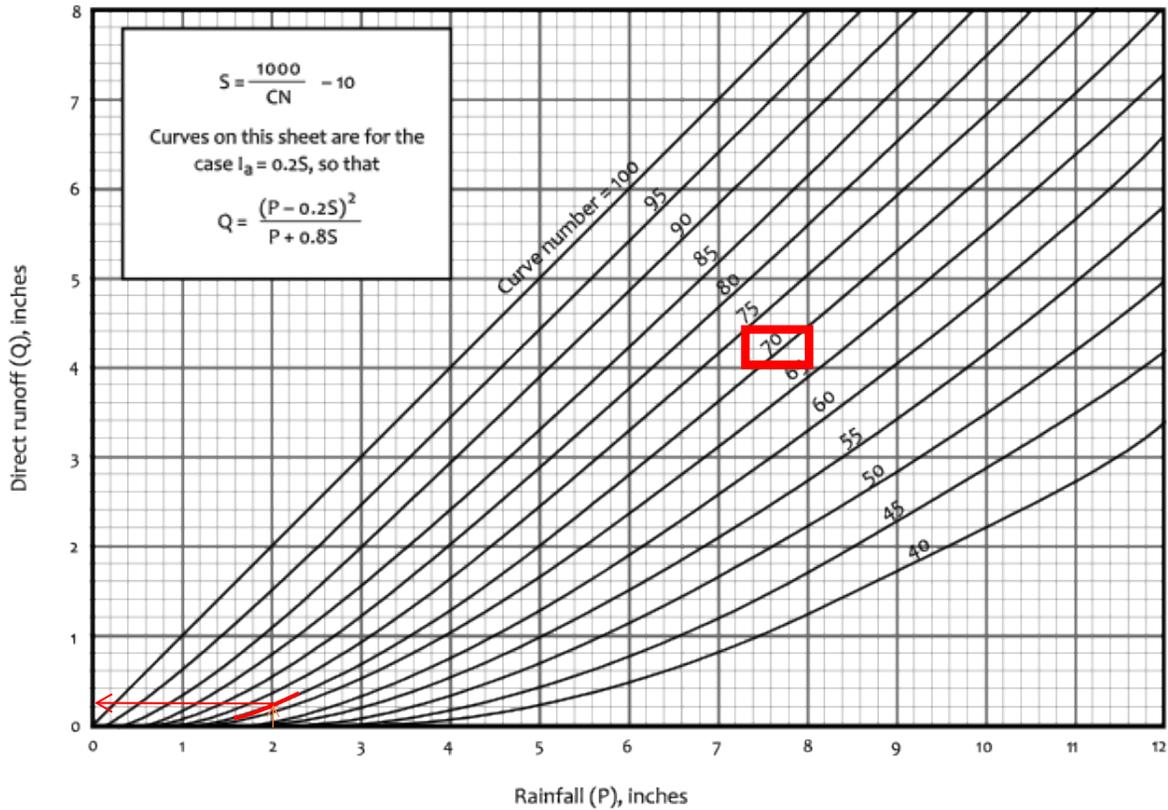
Note 3: The notation $(x)^2$ mean the quantity in the parentheses will be taken the power shown. So, in the equation above, it is 1.14 taken to the power of 2 (or "squared"). You can either use the x^2 function on the calculator (e.g. 1.14^2) or multiply the number by itself ($1.14 * 1.14$). Check this both ways and you will arrive at 1.31.

$$Q = 1.31 / 5.43$$

Solution: **Q = 0.24 inches**

Check: Using the CN value of 70, move along the curve designated 70 to 2 inches (rainfall amount given in inches). From the point where the 70 curve intersects the 2 inches rainfall, follow the gridline left using a straight edge to the direct runoff (Q) in inches

Table J: Chart for Solution of Runoff Equation



{Continued on Next Page}

Example:

Land cover: Grassland **CN:** 75 **Precipitation:** 3 inches

1. **Calculate S:** $S = (1000 / 75) - 10 \approx 3.33$ inches

2. **Calculate Q:**

$$\begin{aligned}
 Q &= \frac{(P - 0.2S)^2}{P + 0.8S} \\
 &= \frac{(3 - (0.2(3.33)))^2}{3 + (0.8 * 3.33)} \\
 &= \frac{(5.44)}{3 + (2.67)} \\
 &= 5.44 / 5.66
 \end{aligned}$$

Solution: **Q = 0.96 inches**

Table J: Chart for Solution of Runoff Equation

