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SCS-CN Method of Runoff Volume Formulas

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List of 19 SCS-CN Method of Runoff Volume Formulas

SCS-CN Method of Runoff Volume

Basic Theory

1) Actual Infiltration

Open Calculator

fx $$F = S \cdot \left(\frac{Q}{P_T - I_a} \right)$$

ex $$2.045455\text{m}^3 = 2.5\text{m}^3 \cdot \left(\frac{9\text{m}^3}{16\text{m}^3 - 5\text{m}^3} \right)$$

2) Cumulative Infiltration given Total Precipitation

Open Calculator

fx $$F = P_T - I_a - Q$$

ex $$2\text{m}^3 = 16\text{m}^3 - 5\text{m}^3 - 9\text{m}^3$$

3) Direct Surface Runoff given Total Precipitation

Open Calculator

fx $$Q = P_T - I_a - F$$

ex $$9\text{m}^3 = 16\text{m}^3 - 5\text{m}^3 - 2\text{m}^3$$

4) Equation for Potential Maximum Retention

Open Calculator

fx $$S = F \cdot \left(\frac{P_T - I_a}{Q} \right)$$

ex $$2.444444\text{m}^3 = 2\text{m}^3 \cdot \left(\frac{16\text{m}^3 - 5\text{m}^3}{9\text{m}^3} \right)$$

5) Initial Abstraction

Open Calculator

fx $$I_a = P_T - F - Q$$

ex $$5\text{m}^3 = 16\text{m}^3 - 2\text{m}^3 - 9\text{m}^3$$

6) Initial Abstraction given Ratio of Infiltration to Retention

Open Calculator

fx $$I_a = P_T - \left(Q \cdot \frac{S}{F} \right)$$

ex $$4.75\text{m}^3 = 16\text{m}^3 - \left(9\text{m}^3 \cdot \frac{2.5\text{m}^3}{2\text{m}^3} \right)$$

7) Initial Abstraction given Total Precipitation

Open Calculator

fx $$I_a = P_T - R_{max}$$

ex $$5\text{m}^3 = 16\text{m}^3 - 11\text{m}^3$$

8) Maximum Potential Runoff

Open Calculator

fx $$R_{max} = P_T - I_a$$

ex $$11\text{m}^3 = 16\text{m}^3 - 5\text{m}^3$$

9) Precipitation given Maximum Potential Runoff

Open Calculator

fx $$P_T = R_{max} + I_a$$

ex $$16\text{m}^3 = 11\text{m}^3 + 5\text{m}^3$$

10) Precipitation given Potential Maximum Retention

Open Calculator

fx $$P_T = \left(Q \cdot \frac{S}{F}\right) + I_a$$

ex $$16.25\text{m}^3 = \left(9\text{m}^3 \cdot \frac{2.5\text{m}^3}{2\text{m}^3}\right) + 5\text{m}^3$$

11) Water Balance Equation for Rainfall

Open Calculator

fx $$P_T = I_a + F + Q$$

ex $$16\text{m}^3 = 5\text{m}^3 + 2\text{m}^3 + 9\text{m}^3$$

Curve Number (CN)

12) Curve Number

Open Calculator

$$\mathrm{CN} = \frac{25400}{\mathrm{S_{CN}} + 254}$$

$$12.00378 = \frac{25400}{1862\mathrm{mm} + 254}$$

13) Curve Number for Antecedent Moisture Condition One

Open Calculator

$$\mathrm{CN} = \frac{\mathrm{CN_{11}}}{2.281 - 0.01281 \cdot \mathrm{CN_{11}}}$$

$$3.672218 = \frac{8}{2.281 - 0.01281 \cdot 8}$$

14) Curve Number for Antecedent Moisture Condition-III

Open Calculator

$$\mathrm{CN} = \frac{\mathrm{CN_{11}}}{0.427 + 0.00573 \cdot \mathrm{CN_{11}}}$$

$$16.91904 = \frac{8}{0.427 + 0.00573 \cdot 8}$$

15) Potential Maximum Retention

Open Calculator

$$S_{CN} = \left(\frac{25400}{CN}\right) - 254$$

$$1862.667\text{mm} = \left(\frac{25400}{12}\right) - 254$$

16) Potential Maximum Retention given Curve Number

Open Calculator

$$S_{CN} = 254 \cdot \left(\frac{100}{CN} - 1\right)$$

$$1862.667\text{mm} = 254 \cdot \left(\frac{100}{12} - 1\right)$$

SSC-CN Equation for Indian Conditions

17) Daily Runoff for Black Soils Type I and Soil having AMC of Type I, II and III for Indian Conditions

Open Calculator

$$Q = \frac{(P_T - 0.3 \cdot S)^2}{P_T + 0.7 \cdot S}$$

$$13.10211\text{m}^3 = \frac{(16\text{m}^3 - 0.3 \cdot 2.5\text{m}^3)^2}{16\text{m}^3 + 0.7 \cdot 2.5\text{m}^3}$$

18) Daily Runoff in Smaller Catchments under SCS

Open Calculator

fx $$Q = \frac{(P_T - 0.2 \cdot S)^2}{P_T + 0.8 \cdot S}$$

ex $$13.34722\text{m}^3 = \frac{(16\text{m}^3 - 0.2 \cdot 2.5\text{m}^3)^2}{16\text{m}^3 + 0.8 \cdot 2.5\text{m}^3}$$

19) Daily Runoff valid for Black Soils under AMC of type I and II for Indian Conditions

Open Calculator

fx $$Q = \frac{(P_T - 0.1 \cdot S)^2}{P_T + 0.9 \cdot S}$$

ex $$13.59247\text{m}^3 = \frac{(16\text{m}^3 - 0.1 \cdot 2.5\text{m}^3)^2}{16\text{m}^3 + 0.9 \cdot 2.5\text{m}^3}$$

Variables Used

- **CN** Curve Number
- **CN_{11}** Runoff Curve Number
- **F** Cumulative Infiltration *(Cubic Meter)*
- **I_a** Initial Abstraction *(Cubic Meter)*
- **P_T** Total Precipitation *(Cubic Meter)*
- **Q** Direct Surface Runoff *(Cubic Meter)*
- **R_{max}** Maximum Potential Runoff *(Cubic Meter)*
- **S** Potential Maximum Retention *(Cubic Meter)*
- **S_{CN}** Potential Maximum Retention (Curve Number) *(Millimeter)*

Constants, Functions, Measurements used

- Measurement: **Length** in Millimeter (mm)
  Length Unit Conversion
- Measurement: **Volume** in Cubic Meter (m^3)
  Volume Unit Conversion

Check other formula lists

- Empirical Equations of Runoff Volume Formulas
- SCS-CN Method of Runoff Volume Formulas

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