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Streamflow Measurement Formulas

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List of 32 Streamflow Measurement Formulas

Streamflow Measurement

1) Concentration of Variable of Interest given Instantaneous Discharge and Mass Flux

$$\text{fx } c = \frac{Q_m}{Q_{\text{instant}}}$$

[Open Calculator !\[\]\(a870788d6ed9b8fd294b7654a8c8526b_img.jpg\)](#)

$$\text{ex } 4 = \frac{120\text{m}^3/\text{s}}{30\text{m}^3/\text{s}}$$

2) Instantaneous Discharge given Instantaneous Mass Flux

$$\text{fx } Q_{\text{instant}} = \frac{Q_m}{c}$$

[Open Calculator !\[\]\(c50c8b7b2cc2cf9ff925edec0ee94c0d_img.jpg\)](#)

$$\text{ex } 30\text{m}^3/\text{s} = \frac{120\text{m}^3/\text{s}}{4}$$

3) Mass Flux Computation

$$\text{fx } Q_m = c \cdot Q_{\text{instant}}$$

[Open Calculator !\[\]\(f60b7a900783ac3fd531bfd9c111be6d_img.jpg\)](#)

$$\text{ex } 120\text{m}^3/\text{s} = 4 \cdot 30\text{m}^3/\text{s}$$

An Introduction to River Hydraulics



Intermediate and High Flows

4) Conveyance Function determined by Chezy's Law

$$\text{fx } K = C \cdot \left(\frac{A^{\frac{3}{2}}}{P^{\frac{1}{2}}} \right)$$

[Open Calculator !\[\]\(a03a7eb2f4046e1d3c76772003e549ea_img.jpg\)](#)

$$\text{ex } 6.97137 = 1.5 \cdot \left(\frac{(12.0\text{m}^2)^{\frac{3}{2}}}{(80\text{m})^{\frac{1}{2}}} \right)$$

5) Conveyance Function Determined by Manning's Law

$$\text{fx } K = \left(\frac{1}{n} \right) \cdot \frac{(A)^{\frac{5}{3}}}{(P)^{\frac{2}{3}}}$$

[Open Calculator !\[\]\(5361750c22c4e047a52f4eac1ec2d4cc_img.jpg\)](#)

$$\text{ex } 8.222645 = \left(\frac{1}{0.412} \right) \cdot \frac{(12.0\text{m}^2)^{\frac{5}{3}}}{(80\text{m})^{\frac{2}{3}}}$$

6) Cross-sectional Area using Chezy's Law

$$\text{fx } A = \left(\frac{K \cdot P^{\frac{1}{2}}}{C} \right)^{\frac{2}{3}}$$

[Open Calculator !\[\]\(b792654f2cef9719eabeb6c5be00811e_img.jpg\)](#)

$$\text{ex } 13.15313\text{m}^2 = \left(\frac{8 \cdot (80\text{m})^{\frac{1}{2}}}{1.5} \right)^{\frac{2}{3}}$$



7) Cross-sectional Area using Manning's Law

$$\text{fx } A = \left(K \cdot n \cdot P^{\frac{2}{3}} \right)^{\frac{3}{5}}$$

[Open Calculator !\[\]\(e78f798d4ea5c530c9db49e7d26e6b95_img.jpg\)](#)

$$\text{ex } 11.80398\text{m}^2 = \left(8 \cdot 0.412 \cdot (80\text{m})^{\frac{2}{3}} \right)^{\frac{3}{5}}$$

8) Friction Slope

$$\text{fx } S_f = \frac{Q_{\text{instant}}^2}{K^2}$$

[Open Calculator !\[\]\(05be7c7a8995decd503647c99211f7c2_img.jpg\)](#)

$$\text{ex } 14.0625 = \frac{(30\text{m}^3/\text{s})^2}{(8)^2}$$

9) Instantaneous Discharge given Friction Slope

$$\text{fx } Q_{\text{instant}} = \sqrt{S_f \cdot K^2}$$

[Open Calculator !\[\]\(fe3aebe81acea8d45108cd2768939da7_img.jpg\)](#)

$$\text{ex } 29.93326\text{m}^3/\text{s} = \sqrt{14 \cdot (8)^2}$$



10) Wetted Perimeter from Manning's Law [Open Calculator](#) 

$$\text{fx } P = \left(\left(\frac{1}{n} \right) \cdot \left(\frac{A^{\frac{5}{3}}}{K} \right) \right)^{\frac{3}{2}}$$

$$\text{ex } 83.3628\text{m} = \left(\left(\frac{1}{0.412} \right) \cdot \left(\frac{(12.0\text{m}^2)^{\frac{5}{3}}}{8} \right) \right)^{\frac{3}{2}}$$

11) Wetted Perimeter using Chezy's Law [Open Calculator](#) 

$$\text{fx } P = \left(C \cdot \left(\frac{A^{\frac{3}{2}}}{K} \right) \right)^2$$

$$\text{ex } 60.75\text{m} = \left(1.5 \cdot \left(\frac{(12.0\text{m}^2)^{\frac{3}{2}}}{8} \right) \right)^2$$

Low Flow 12) Cease to Flow Depth given Depth at Gauging Station [Open Calculator](#) 

$$\text{fx } h_{\text{csf}} = h_G - H_c \cdot (Q) - Q^2 \wedge 2$$

$$\text{ex } 0.1\text{m} = 6.01\text{m} - 0.05\text{m} \cdot (3.0\text{m}^3/\text{s}) - (2.4)^2$$



13) Depth at Gauging Station

$$\text{fx } h_G = h_{\text{csf}} + H_c \cdot (Q) + Q^2 \wedge 2$$

[Open Calculator !\[\]\(d3fb9f94af8b26d1c844efa9a98805b0_img.jpg\)](#)

$$\text{ex } 6.01\text{m} = 0.1\text{m} + 0.05\text{m} \cdot (3.0\text{m}^3/\text{s}) + (2.4)^2$$

14) Discharge given Depth at Gauging Station

$$\text{fx } Q = \frac{h_G - h_{\text{csf}} - Q^2 \wedge 2}{H_c}$$

[Open Calculator !\[\]\(e1d6102fe77919492c04879c8450f1f5_img.jpg\)](#)

$$\text{ex } 3\text{m}^3/\text{s} = \frac{6.01\text{m} - 0.1\text{m} - (2.4)^2}{0.05\text{m}}$$

15) Head at Control given Depth at Gauging Station

$$\text{fx } H_c = \frac{h_G - h_{\text{csf}} - Q^2 \wedge 2}{Q}$$

[Open Calculator !\[\]\(ab4e2b3fc7e7887b7a72f548aa6f5e60_img.jpg\)](#)

$$\text{ex } 0.05\text{m} = \frac{6.01\text{m} - 0.1\text{m} - (2.4)^2}{3.0\text{m}^3/\text{s}}$$



Dilution Technique of Streamflow Measurements

16) Average Depth of Stream given Length of Reach

$$\text{fx } d_{\text{avg}} = \frac{0.13 \cdot B^2 \cdot C \cdot (0.7 \cdot C + 2 \cdot \sqrt{g})}{L \cdot g}$$

[Open Calculator !\[\]\(83f22ed94ec5517769dd76d702c6bfd8_img.jpg\)](#)

$$\text{ex } 15.15352\text{m} = \frac{0.13 \cdot (50\text{m})^2 \cdot 1.5 \cdot (0.7 \cdot 1.5 + 2 \cdot \sqrt{9.8\text{m/s}^2})}{24\text{m} \cdot 9.8\text{m/s}^2}$$

17) Average Width of Stream using Mixing Length

$$\text{fx } B = \sqrt{\frac{L \cdot g \cdot d_{\text{avg}}}{0.13 \cdot C \cdot (0.7 \cdot C + 2 \cdot \sqrt{g})}}$$

[Open Calculator !\[\]\(3cb60d42b10e53f9522bb0b392c1c4cd_img.jpg\)](#)

$$\text{ex } 49.74608\text{m} = \sqrt{\frac{24\text{m} \cdot 9.8\text{m/s}^2 \cdot 15\text{m}}{0.13 \cdot 1.5 \cdot (0.7 \cdot 1.5 + 2 \cdot \sqrt{9.8\text{m/s}^2})}}$$

18) Constant Rate Injection Method or Plateau Gauging

$$\text{fx } Q_f = Q_s \cdot \frac{C_2 - C_0}{C_1 - C_2}$$

[Open Calculator !\[\]\(0d7ca0919e6c47bbd874bfa0189fe22e_img.jpg\)](#)

$$\text{ex } 20\text{m}^3/\text{s} = 60\text{m}^3/\text{s} \cdot \frac{6 - 4}{12 - 6}$$



19) Discharge in Stream by Constant Rate Injection Method

$$\text{fx } Q_s = Q_f \cdot \left(\frac{C_1 - C_2}{C_2 - C_0} \right)$$

[Open Calculator !\[\]\(6605b201d6f14d9b3bcb8ab5f274d107_img.jpg\)](#)

$$\text{ex } 60\text{m}^3/\text{s} = 20\text{m}^3/\text{s} \cdot \left(\frac{12 - 6}{6 - 4} \right)$$

20) Length of Reach

$$\text{fx } L = \frac{0.13 \cdot B^2 \cdot C \cdot (0.7 \cdot C + 2 \cdot \sqrt{g})}{g \cdot d_{\text{avg}}}$$

[Open Calculator !\[\]\(e8fb589d58dad1692debababa5e928b6_img.jpg\)](#)

$$\text{ex } 24.24563\text{m} = \frac{0.13 \cdot (50\text{m})^2 \cdot 1.5 \cdot (0.7 \cdot 1.5 + 2 \cdot \sqrt{9.8\text{m}/\text{s}^2})}{9.8\text{m}/\text{s}^2 \cdot 15\text{m}}$$

Electromagnetic Method

21) Current in Coil in Electromagnetic Method

$$\text{fx } I = E \cdot \frac{d}{\left(\frac{Q_s}{k} \right)^{\frac{1}{n_{\text{system}}}} - K_2}$$

[Open Calculator !\[\]\(e9474ce1d70442456f8fe9c393ea149c_img.jpg\)](#)

$$\text{ex } 50.11304\text{A} = 10 \cdot \frac{3.23\text{m}}{\left(\frac{60\text{m}^3/\text{s}}{2} \right)^{\frac{1}{2.63}} - 3}$$



22) Depth of Flow in Electromagnetic Method

[Open Calculator !\[\]\(5ebcf382a6ee952d6c5b8b948415801e_img.jpg\)](#)

$$\text{fx } d = \frac{\left(\left(\frac{Q_s}{k} \right)^{\frac{1}{n_{\text{system}}}} - K_2 \right) \cdot I}{E}$$

$$\text{ex } 3.229804\text{m} = \frac{\left(\left(\frac{60\text{m}^3/\text{s}}{2} \right)^{\frac{1}{2.63}} - 3 \right) \cdot 50.11\text{A}}{10}$$

23) Measurement for Discharge in Electromagnetic Method

[Open Calculator !\[\]\(a69696d69cfd88b51cbd02e5288eca32_img.jpg\)](#)

$$\text{fx } Q_s = k \cdot \left(\left(E \cdot \frac{d}{I} \right) + K_2 \right)^{n_{\text{system}}}$$

$$\text{ex } 60.00169\text{m}^3/\text{s} = 2 \cdot \left(\left(10 \cdot \frac{3.23\text{m}}{50.11\text{A}} \right) + 3 \right)^{2.63}$$

Stage-Discharge Relationship

24) Actual Discharge from Backwater Effect on Rating Curve Normalized Curve

[Open Calculator !\[\]\(d5831b2ac75eb48b4c49d27e61d24c03_img.jpg\)](#)

$$\text{fx } Q_a = Q_0 \cdot \left(\frac{F}{F_o} \right)^m$$

$$\text{ex } 9.001029\text{m}^3/\text{s} = 7\text{m}^3/\text{s} \cdot \left(\frac{2.5\text{m}}{1.512\text{m}} \right)^{0.5}$$



25) Actual Fall at Stage given Actual Discharge [Open Calculator !\[\]\(6e934896f25e6ce1b0dbb50c23abc197_img.jpg\)](#)

$$\text{fx } F = F_o \cdot \left(\frac{Q_a}{Q_0} \right)^{\frac{1}{m}}$$

$$\text{ex } 2.499429\text{m} = 1.512\text{m} \cdot \left(\frac{9\text{m}^3/\text{s}}{7\text{m}^3/\text{s}} \right)^{\frac{1}{0.5}}$$

26) Diffusion Coefficient in Advection Diffusion Flood Routing [Open Calculator !\[\]\(f80254b170d0ecdc443847276e625120_img.jpg\)](#)

$$\text{fx } D = \frac{K}{2} \cdot W \cdot \sqrt{S}$$

$$\text{ex } 800\text{m}^2/\text{s} = \frac{8}{2} \cdot 100\text{m} \cdot \sqrt{4.0}$$

27) Gauge Height given Discharge for Non-Alluvial Rivers [Open Calculator !\[\]\(ac13c516668a3b529e385da83084b241_img.jpg\)](#)

$$\text{fx } G = \left(\frac{Q_s}{C_r} \right)^{\frac{1}{\beta}} + a$$

$$\text{ex } 10.20546\text{m} = \left(\frac{60\text{m}^3/\text{s}}{1.99} \right)^{\frac{1}{1.6}} + 1.8$$



28) Measured Unsteady Flow

[Open Calculator !\[\]\(0cc5c4c18dd72a91e21b90220aef9c5d_img.jpg\)](#)

$$\text{fx } Q_M = Q_n \cdot \sqrt{1 + \left(\frac{1}{v_W \cdot S_o} \right) \cdot dh/dt}$$

$$\text{ex } 14.4\text{m}^3/\text{s} = 12\text{m}^3/\text{s} \cdot \sqrt{1 + \left(\frac{1}{50.0\text{m/s} \cdot 0.10} \right) \cdot 2.2}$$

29) Normal Discharge at given Stage under Steady Uniform Flow

[Open Calculator !\[\]\(3b71157eab31889e641f7620692f0b92_img.jpg\)](#)

$$\text{fx } Q_n = \frac{Q_M}{\sqrt{1 + \left(\frac{1}{v_W \cdot S_o} \right) \cdot dh/dt}}$$

$$\text{ex } 12\text{m}^3/\text{s} = \frac{14.4\text{m}^3/\text{s}}{\sqrt{1 + \left(\frac{1}{50.0\text{m/s} \cdot 0.10} \right) \cdot 2.2}}$$

30) Normalized Discharge of Backwater Effect on Rating Curve Normalized Curve

[Open Calculator !\[\]\(94480c799e843c3a4dcfaf8c99e6db79_img.jpg\)](#)

$$\text{fx } Q_0 = Q_a \cdot \left(\frac{F_o}{F} \right)^m$$

$$\text{ex } 6.9992\text{m}^3/\text{s} = 9\text{m}^3/\text{s} \cdot \left(\frac{1.512\text{m}}{2.5\text{m}} \right)^{0.5}$$



31) Normalized Value of Fall given Discharge

[Open Calculator !\[\]\(5ecd0a8be72909e00a43c3de93c00f44_img.jpg\)](#)

$$\text{fx } F_o = F \cdot \left(\frac{Q_o}{Q_a} \right)^{\frac{1}{m}}$$

$$\text{ex } 1.512346\text{m} = 2.5\text{m} \cdot \left(\frac{7\text{m}^3/\text{s}}{9\text{m}^3/\text{s}} \right)^{\frac{1}{0.5}}$$

32) Relationship between Stage and Discharge for Non-Alluvial Rivers

[Open Calculator !\[\]\(f1ee6d81bdeaf50ad3989e9a2b0d9b21_img.jpg\)](#)

$$\text{fx } Q_s = C_r \cdot (G - a)^\beta$$

$$\text{ex } 59.93768\text{m}^3/\text{s} = 1.99 \cdot (10.2\text{m} - 1.8)^{1.6}$$



Variables Used








- **a** Constant of Gauge Reading
- **A** Cross-Sectional Area (*Square Meter*)
- **B** Average Width of Stream (*Meter*)
- **c** Concentration of Variable of Interest
- **C** Chézy's Coefficients
- **C₀** Initial Concentration of Tracer
- **C₁** High Concentration of Tracer at Section 1
- **C₂** Concentration Profile of Tracer at Section 2
- **C_r** Rating Curve Constant
- **d** Depth of Flow (*Meter*)
- **D** Diffusion Coefficient (*Square Meter Per Second*)
- **d_{avg}** Average Depth of Stream (*Meter*)
- **dh/dt** Rate of Change of Stage
- **E** Signal Output
- **F** Actual Fall (*Meter*)
- **F₀** Normalized Value of Fall (*Meter*)
- **g** Acceleration due to Gravity (*Meter per Square Second*)
- **G** Gauge Height (*Meter*)
- **H_c** Head at Control (*Meter*)
- **h_{csf}** Cease-to-Flow Depth (*Meter*)
- **h_G** Depth at Gauging Station (*Meter*)
- **I** Current in Coil (*Ampere*)



- **k** System Constant k
- **K** Conveyance Function
- **K₂** System Constant K2
- **L** Mixing Length (Meter)
- **m** Exponent on Rating Curve
- **n** Manning's Roughness Coefficient
- **n_{system}** System Constant n
- **P** Wetted Perimeter (Meter)
- **Q** Discharge (Cubic Meter per Second)
- **Q₀** Normalized Discharge (Cubic Meter per Second)
- **Q_a** Actual Discharge (Cubic Meter per Second)
- **Q_f** Constant Discharge Rate at C1 (Cubic Meter per Second)
- **Q_{instant}** Instantaneous Discharge (Cubic Meter per Second)
- **Q_m** Instantaneous Mass Flux (Cubic Meter per Second)
- **Q_M** Measured Unsteady Flow (Cubic Meter per Second)
- **Q_n** Normal Discharge (Cubic Meter per Second)
- **Q_s** Discharge in Stream (Cubic Meter per Second)
- **Q²** Terms of Order
- **\bar{S}** Bed Slope
- **S_f** Friction Slope
- **S_o** Channel Slope
- **v_W** Velocity of Flood Wave (Meter per Second)
- **W** Width of Water Surface (Meter)
- **β** Rating Curve Constant Beta






Constants, Functions, Measurements used

- **Function:** **sqrt**, sqrt(Number)
A square root function is a function that takes a non-negative number as an input and returns the square root of the given input number.
- **Measurement:** **Length** in Meter (m)
Length Unit Conversion 
- **Measurement:** **Electric Current** in Ampere (A)
Electric Current Unit Conversion 
- **Measurement:** **Area** in Square Meter (m^2)
Area Unit Conversion 
- **Measurement:** **Speed** in Meter per Second (m/s)
Speed Unit Conversion 
- **Measurement:** **Acceleration** in Meter per Square Second (m/s^2)
Acceleration Unit Conversion 
- **Measurement:** **Volumetric Flow Rate** in Cubic Meter per Second (m^3/s)
Volumetric Flow Rate Unit Conversion 
- **Measurement:** **Diffusivity** in Square Meter Per Second (m^2/s)
Diffusivity Unit Conversion 



Check other formula lists

- **Abstractions from Precipitation Formulas** 
- **Area-Velocity and Ultrasonic Method of Streamflow Measurement Formulas** 
- **Discharge Measurements Formulas** 
- **Indirect Methods of Streamflow Measurement Formulas** 
- **Losses from Precipitation Formulas** 
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