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Streamflow Measurement Formulas

Calculators! Examples! Conversions!

List of 32 Streamflow Measurement Formulas

Streamflow Measurement

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

Open Calculator

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

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

2) Instantaneous Discharge given Instantaneous Mass Flux

Open Calculator

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

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

3) Mass Flux Computation

Open Calculator

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

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

An Introduction to River Hydraulics

Intermediate and High Flows

4) Conveyance Function determined by Chezy's Law

Open Calculator

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

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

Open Calculator

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

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

Open Calculator

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

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

Open Calculator

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

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

8) Friction Slope

Open Calculator

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

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

9) Instantaneous Discharge given Friction Slope

Open Calculator

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

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

10) Wetted Perimeter from Manning's Law

Open Calculator

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

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

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

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

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

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

Open Calculator

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

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

Open Calculator

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

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

Open Calculator

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

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

Open Calculator

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

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

17) Average Width of Stream using Mixing Length

Open Calculator

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

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

18) Constant Rate Injection Method or Plateau Gauging

Open Calculator

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

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

Open Calculator

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

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

Open Calculator

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

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

Electromagnetic Method

21) Current in Coil in Electromagnetic Method

Open Calculator

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

29) Normal Discharge at given Stage under Steady Uniform Flow

Open Calculator

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

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

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

Open Calculator

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

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

31) Normalized Value of Fall given Discharge

Open Calculator

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

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

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

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
- C_0 Initial Concentration of Tracer
- C_1 High Concentration of Tracer at Section 1
- C_2 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)*
- F_o 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
- **K_2** 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)*
- **Q_0** 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)*
- **Q^2** 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**
- **Measurement of Evapotranspiration Formulas**
- **Precipitation Formulas**
- **Streamflow Measurement Formulas**

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