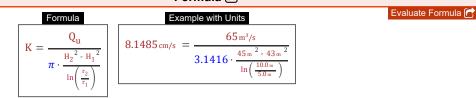
Important Unconfined Flow Formulas PDF



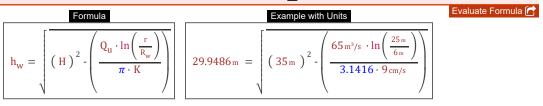
Formulas Examples with Units

List of 27 Important Unconfined Flow Formulas

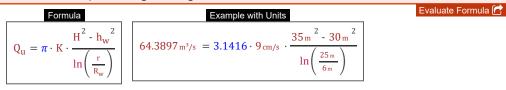
1) Coefficient of Permeability when Equilibrium Equation for Well in Unconfined Aquifer Formula



2) Depth of Water in Pumping Well when Steady Flow in Unconfined Aquifer is Considered Formula



3) Discharge at Edge of Zone of Influence Formula 🕝

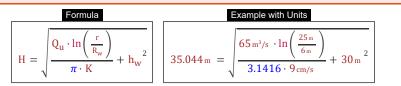


4) Equilibrium Equation for Well in Unconfined Aquifer Formula 🕝





5) Saturated Thickness of Aquifer when Steady Flow of Unconfined Aquifer is Considered Formula



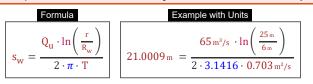
6) Approximate Equations Formulas 🕝

6.1) Discharge when Drawdown at Pumping Well is Considered Formula

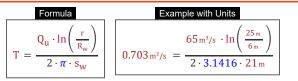
FormulaExample with UnitsEvaluate Formula
$$Q_u = 2 \cdot \pi \cdot T \cdot \frac{s_w}{\ln\left(\frac{r}{R_w}\right)}$$
 $64.9973 \, \text{m}^3/\text{s} = 2 \cdot 3.1416 \cdot 0.703 \, \text{m}^2/\text{s} \cdot \frac{21 \, \text{m}}{\ln\left(\frac{25 \, \text{m}}{6 \, \text{m}}\right)}$



6.3) Drawdown when Steady Flow of Unconfined Aquifer Formula 🕝

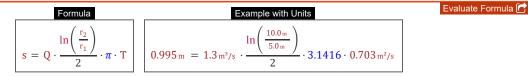


6.4) Transmissivity when Discharge at Drawdown is Considered Formula 🕝 👘



7) Unconfined Flow by Dupit's Assumption Formulas 🕝

7.1) Change in Drawdown given Discharge Formula 🕝

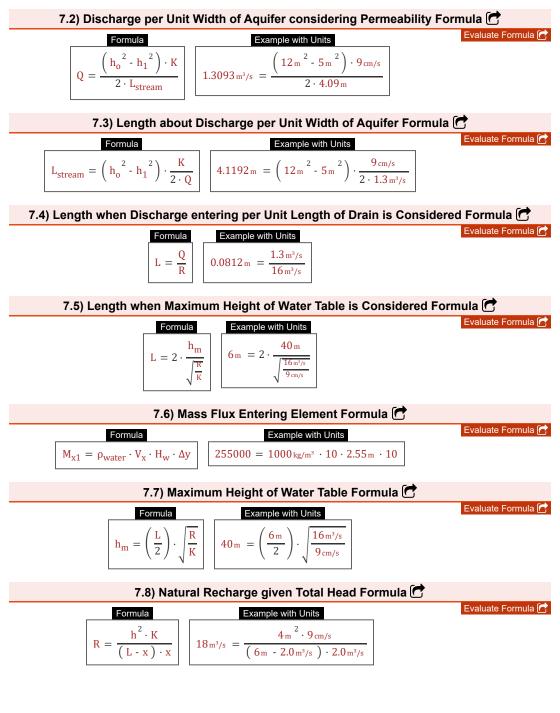




Evaluate Formula 🦳

Evaluate Formula

Evaluate Formula





7.9) Recharge when Maximum Height of Water Table Formula 🕝

Example with Units

$$R = \left(\frac{h_m}{\frac{L}{2}}\right)^2 \cdot K \qquad 16 \text{ m}^3/\text{s} = \left(\frac{40 \text{ m}}{\frac{6 \text{ m}}{2}}\right)^2 \cdot 9 \text{ cm/s}$$

Formula

7.10) Water Table Profile Neglecting Depths of Water in Drains Formula

FormulaExample with UnitsEvaluate Formula (*
$$h = \sqrt{\left(\frac{R}{K}\right) \cdot (L - x) \cdot x}$$
 $3.7712 \text{ m} = \sqrt{\left(\frac{16 \text{ m}^3/\text{s}}{9 \text{ cm/s}}\right) \cdot (6 \text{ m} - 2.0 \text{ m}^3/\text{s}) \cdot 2.0 \text{ m}^3/\text{s}}$ $2.0 \text{ m}^3/\text{s}$

7.11) One Dimensional Dupit's Flow with Recharge Formulas 🕝

7.11.1) Coefficient of Aquifer Permeability considering Discharge per Unit Width of Aquifer

FormulaExample with Units
$$K = \frac{Q \cdot 2 \cdot L_{stream}}{\left(h_0^2\right) - \left(h_1^2\right)}$$
 $8.9361 \text{ cm/s} = \frac{1.3 \text{ m}^3/\text{s} \cdot 2 \cdot 4.09 \text{ m}}{\left(12 \text{ m}^2\right) - \left(5 \text{ m}^2\right)}$

7.11.2) Coefficient of Aquifer Permeability given Maximum Height of Water Table Formula 🕝

Formula Example with Units
$$K = \frac{R \cdot L^{2}}{(2 \cdot h_{m})^{2}} \qquad 9 \text{ cm/s} = \frac{16 \text{ m}^{3}/\text{s} \cdot 6 \text{ m}^{2}}{(2 \cdot 40 \text{ m})^{2}}$$

7.11.3) Coefficient of Aquifer Permeability given Water Table Profile Formula 🗹 👘

FormulaExample with UnitsEvaluate Formula
$$K = \left(\left(\frac{R}{h^2} \right) \cdot (L - x) \cdot x \right)$$
 $8 \text{ cm/s} = \left(\left(\frac{16 \text{ m}^3/\text{s}}{4 \text{ m}^2} \right) \cdot (6 \text{ m} - 2.0 \text{ m}^3/\text{s}) \cdot 2.0 \text{ m}^3/\text{s} \right)$

7.11.4) Discharge at Downstream Water Body of Catchment Formula

Evaluate Formula

Evaluate Formula

Evaluate Formula (

Evaluate Formula (

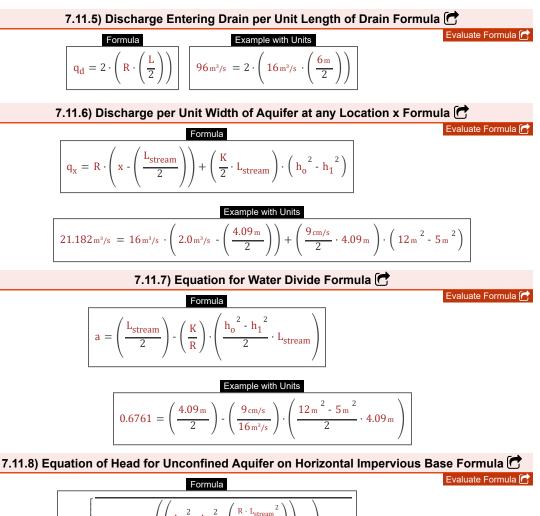
$$q_{1} = \left(\frac{R \cdot L_{stream}}{2}\right) + \left(\left(\frac{K}{2 \cdot L_{stream}}\right) \cdot \left(h_{0}^{2} - h_{1}^{2}\right)\right)$$

Formula

Example with Units

$$34.0293 \,\mathrm{m^{3}/s} = \left(\frac{16 \,\mathrm{m^{3}/s} \cdot 4.09 \,\mathrm{m}}{2}\right) + \left(\left(\frac{9 \,\mathrm{cm/s}}{2 \cdot 4.09 \,\mathrm{m}}\right) \cdot \left(12 \,\mathrm{m^{2} - 5 \,m^{2}}\right)\right)$$





$$h = \sqrt{\left(\frac{-R \cdot x^{2}}{K}\right) \cdot \left(\left(\frac{h_{0}^{2} \cdot h_{1}^{2} \cdot \left(\frac{R \cdot L_{stream}^{2}}{K}\right)}{L_{stream}}\right) \cdot x\right) + h_{0}^{2}}$$

Example with Units

$$28.791 \text{ m} = \sqrt{\left(\frac{-16 \text{ m}^3/\text{s} \cdot 2.0 \text{ m}^3/\text{s}}{9 \text{ cm/s}}^2\right) \cdot \left(\left(\frac{12 \text{ m}^2 \cdot 5 \text{ m}^2 \cdot \left(\frac{16 \text{ m}^3/\text{s} \cdot 4.09 \text{ m}^2}{9 \text{ cm/s}}\right)}{4.09 \text{ m}}\right) \cdot 2.0 \text{ m}^3/\text{s}}\right) + 12 \text{ m}^2}$$



Variables used in list of Unconfined Flow Formulas above

- a Water Divide
- h Water Table Profile (Meter)
- H Saturated Thickness of the Aquifer (Meter)
- h₁ Piezometric Head at Downstream End (Meter)
- H₁ Water Table Depth (Meter)
- H₂ Water Table Depth 2 (Meter)
- h_m Maximum Height of Water Table (Meter)
- ho Piezometric Head at Upstream End (Meter)
- hw Depth of Water in the Pumping Well (Meter)
- H_w Head (Meter)
- K Coefficient of Permeability (Centimeter per Second)
- L Length between Tile Drain (Meter)
- Length between Upstream and
 Downstream (Meter)
- M_{x1} Mass Flux Entering the Element
- **Q** Discharge (Cubic Meter per Second)
- **q**₁ Discharge at Downstream Side (*Cubic Meter per Second*)
- **q**_d Discharge per unit Length of the Drain (*Cubic Meter per Second*)
- **Q**_u Steady Flow of an Unconfined Aquifer (*Cubic Meter per Second*)
- **q**_X Discharge of Aquifer at any Location x (Cubic Meter per Second)
- **r** Radius at the Edge of Zone of Influence (Meter)
- **R** Natural Recharge (Cubic Meter per Second)
- **r**₁ Radial Distance at Observation Well 1 (Meter)
- r2 Radial Distance at Observation Well 2 (Meter)
- Rw Radius of the Pumping Well (Meter)
- S Change in Drawdown (Meter)
- Sw Drawdown at the Pumping Well (Meter)
- **T** Transmissivity of an Unconfined Aquifer (Square Meter per Second)

Constants, Functions, Measurements used in list of Unconfined Flow Formulas above

- constant(s): pi,
 3.14159265358979323846264338327950288
 Archimedes' constant
- Functions: In, In(Number) The natural logarithm, also known as the logarithm to the base e, is the inverse function of the natural exponential function.
- Functions: 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: Speed in Centimeter per Second (cm/s)
 - Speed Unit Conversion 🕝
- Measurement: Volumetric Flow Rate in Cubic Meter per Second (m³/s) Volumetric Flow Rate Unit Conversion
- Measurement: Kinematic Viscosity in Square Meter per Second (m²/s) Kinematic Viscosity Unit Conversion
- Measurement: Density in Kilogram per Cubic Meter (kg/m³) Density Unit Conversion

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- V_x Gross Velocity of Groundwater
- **X** Flow in 'x' Direction (Cubic Meter per Second)
- **∆y** Change in 'y' Direction
- **P**water Water Density (Kilogram per Cubic Meter)



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- Important Steady Flow into a Well Formulas Important
- Important Unconfined Flow Formulas (*)
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- 🔣 Percentage change 🕝
- 🎆 LCM of two numbers 🕝

Image: Second sec

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