Important Unsteady Flow in a Confined Aquifer Formulas PDF

Formulas
Examples
with Units

List of 11
Important Unsteady Flow in a Confined Aquifer Formulas

1) Distance from Pumping Well given Storage Coefficient Formula

Evaluate Formula

Formula

$$r = \sqrt{\left(2.25 \cdot T \cdot \frac{t_0}{S}\right)}$$

Example with Units

$$3.0044\,\text{m} = \sqrt{\left(2.25 \cdot 11\,\text{m}^2/\text{s} \cdot \frac{31\,\text{s}}{85}\right)}$$

2) Drawdown Formula

Evaluate Formula

Formula

$$s_t = \left(\frac{Q}{4 \cdot \pi \cdot T}\right) \cdot \ln\left(\frac{2.2 \cdot T \cdot t}{r^2 \cdot S}\right)$$

Example with Units

$$0.0307\,\text{m} = \left(\frac{3.0\,\text{m}^3/\text{s}}{4 \cdot 3.1416 \cdot 11\,\text{m}^2/\text{s}}\right) \cdot \ln\left(\frac{2.2 \cdot 11\,\text{m}^2/\text{s} \cdot 130\,\text{s}}{3\,\text{m}^2 \cdot 85}\right)$$

3) Drawdown at Time Interval 't1' Formula

Evaluate Formula

Formula

$$s_1 = s_2 - \left(\left(\frac{Q}{4 \cdot \pi \cdot T}\right) \cdot \ln\left(\frac{t_2}{t_1}\right)\right)$$

Example with Units

$$14.9939\,\text{m} = 14.94\,\text{m} - \left(\left(\frac{3.0\,\text{m}^3/\text{s}}{4 \cdot 3.1416 \cdot 11\,\text{m}^2/\text{s}}\right) \cdot \ln\left(\frac{10\,\text{s}}{120\,\text{s}}\right)\right)$$

4) Drawdown at Time Interval 't2' Formula

Evaluate Formula

Formula

$$s_2 = \left(\left(\frac{Q}{4 \cdot \pi \cdot T}\right) \cdot \ln\left(\frac{t_2}{t_1}\right)\right) + s_1$$

Example with Units

$$14.9461\,\text{m} = \left(\left(\frac{3.0\,\text{m}^3/\text{s}}{4 \cdot 3.1416 \cdot 11\,\text{m}^2/\text{s}}\right) \cdot \ln\left(\frac{10\,\text{s}}{120\,\text{s}}\right)\right) + 15.0\,\text{m}$$

5) Drawdown given Piezometric Head Formula

Evaluate Formula

Formula

$$s' = H - h$$

Example with Units

$$0.2\,\text{m} = 10.0\,\text{m} - 9.8\,\text{m}$$

6) Equation for Storage Coefficient Formula

Evaluate Formula

Formula

$$S = 2.25 \cdot T \cdot \frac{t_0}{r^2}$$

Example with Units

$$85.25 = 2.25 \cdot 11\,\text{m}^2/\text{s} \cdot \frac{31\,\text{s}}{3\,\text{m}^2}$$

7) Equation for Well Function series to number of 4 digits Formula

Evaluate Formula

Formula

$$W_u = -0.577216 - \ln(u) + u - \left(\frac{u^2}{2.2!}\right) + \left(\frac{u^3}{3.3!}\right)$$

Example

$$1.5849 = -0.577216 - \ln(0.13) + 0.13 - \left(\frac{0.13^2}{2.2!}\right) + \left(\frac{0.13^3}{3.3!}\right)$$

8) Initial Constant Piezometric Head given Drawdown Formula

Evaluate Formula

Formula

$$H = s' + h$$

Example with Units

$$10\,\text{m} = 0.2\,\text{m} + 9.8\,\text{m}$$

9) Initial Time given Pumping Well along with Storage Coefficient Formula

Evaluate Formula

Formula

$$t_0 = \frac{S \cdot r^2}{2.25 \cdot T}$$

Example with Units

$$30.9091\,\text{s} = \frac{85 \cdot 3\,\text{m}^2}{2.25 \cdot 11\,\text{m}^2/\text{s}}$$

10) Transmissivity about given Storage Coefficient Formula

Evaluate Formula

Formula

$$T = \frac{S \cdot r^2}{2.25 \cdot t_0}$$

Example with Units

$$10.9677\,\text{m}^2/\text{s} = \frac{85 \cdot 3\,\text{m}^2}{2.25 \cdot 31\,\text{s}}$$

11) Well Parameter Formula

Evaluate Formula

Formula

$$u = \frac{r^2 \cdot S}{4 \cdot T \cdot t}$$

Example with Units

$$0.1337 = \frac{3\,\text{m}^2 \cdot 85}{4 \cdot 11\,\text{m}^2/\text{s} \cdot 130\,\text{s}}$$

Variables used in list of Unsteady Flow in a Confined Aquifer Formulas above

- **h** Drawdown *(Meter)*
- **H** Initial Constant Piezometric Head *(Meter)*
- **Q** Discharge *(Cubic Meter per Second)*
- **r** Distance from Pumping Well *(Meter)*
- **s'** Possible Drawdown in Confined Aquifer *(Meter)*
- **S** Storage Coefficient
- s_1 Drawdown at Time Interval t1 *(Meter)*
- s_2 Drawdown at Time Interval t2 *(Meter)*
- s_t Total Drawdown *(Meter)*
- **t** Time Period *(Second)*
- **T** Transmissivity *(Square Meter per Second)*
- t_0 Starting Time *(Second)*
- t_1 Time of Drawdown (t1) *(Second)*
- t_2 Time of Drawdown (t2) *(Second)*
- **u** Well Parameter
- W_u Well Function of u

Constants, Functions, Measurements used in list of Unsteady Flow in a Confined Aquifer Formulas above

- constant(s): **pi**, 3.14159265358979323846264338327950288 *Archimedes' constant*
- Functions: **ln**, ln(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: **Time** in Second (s) *Time Unit Conversion*
- Measurement: **Volumetric Flow Rate** in Cubic Meter per Second (m^3/s) *Volumetric Flow Rate Unit Conversion*
- Measurement: **Kinematic Viscosity** in Square Meter per Second (m^2/s) *Kinematic Viscosity Unit Conversion*

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