Important Recuperation Test Formulas PDF

Formulas
Examples
with Units

List of 34
Important Recuperation Test Formulas

1) Constant Depending upon Base Soil Formulas

1.1) Constant Depending upon Soil at Base of Well Formula

Evaluate Formula

Formula

$$K = \left(\frac{A_{cs}}{t}\right) \cdot \log\left(\left(\frac{h_d}{h_{w2}}\right), e\right)$$

Example with Units

$$5.034 = \left(\frac{20\,\text{m}^2}{4\,\text{h}}\right) \cdot \log\left(\left(\frac{27\,\text{m}}{10\,\text{m}}\right), e\right)$$

1.2) Constant Depending upon Soil at Base of Well given Clay Soil Formula

Evaluate Formula

Formula

$$K = 0.25 \cdot A_{cs}$$

Example with Units

$$5 = 0.25 \cdot 20\,\text{m}^2$$

1.3) Constant Depending upon Soil at Base of Well given Fine Sand Formula

Evaluate Formula

Formula

$$K = 0.5 \cdot A_{csw}$$

Example with Units

$$6.5 = 0.5 \cdot 13\,\text{m}^2$$

1.4) Constant Depending upon Soil at Base of Well given Specific Capacity Formula

Evaluate Formula

Formula

$$K = A_{sec} \cdot S_{si}$$

Example with Units

$$4.99 = 2.495\,\text{m}^2 \cdot 2.0\,\text{m/s}$$

1.5) Constant Depending upon Soil at Base of Well with Base 10 Formula

Evaluate Formula

Formula

$$K = \left(\frac{A_{sec} \cdot 2.303}{t}\right) \cdot \log\left(\left(\frac{h_d}{h_{w2}}\right), 10\right)$$

Example with Units

$$3.3301 = \left(\frac{2.495\,\text{m}^2 \cdot 2.303}{4\,\text{h}}\right) \cdot \log\left(\left(\frac{27\,\text{m}}{10\,\text{m}}\right), 10\right)$$

1.6) Constant Depression Head given Discharge and Time in Hours Formula

Evaluate Formula

Formula

$$H' = \frac{Q}{\frac{2.303 \cdot A_{csw} \cdot \log\left(\left(\frac{h_d}{h_{w2}}\right), 10\right)}{t}}$$

Example with Units

$$0.0571 = \frac{0.99\,\text{m}^3/\text{s}}{\frac{2.303 \cdot 13\,\text{m}^2 \cdot \log\left(\left(\frac{27\,\text{m}}{10\,\text{m}}\right), 10\right)}{4\,\text{h}}}$$

1.7) Constant Depression Head given Discharge from Well Formula

Evaluate Formula

Formula

$$H' = \frac{Q}{K}$$

Example with Units

$$0.198 = \frac{0.99\,\text{m}^3/\text{s}}{5.0}$$

1.8) Discharge in Well Formulas

1.8.1) Discharge in Well given Constant Depression Head and Area of Well Formula

Evaluate Formula

Formula

$$Q = \frac{2.303 \cdot A_{csw} \cdot H' \cdot \log\left(\left(\frac{h_d}{h_{w2}}\right), 10\right)}{t}$$

Example with Units

$$0.0002\,\text{m}^3/\text{s} = \frac{2.303 \cdot 13\,\text{m}^2 \cdot 0.038 \cdot \log\left(\left(\frac{27\,\text{m}}{10\,\text{m}}\right), 10\right)}{4\,\text{h}}$$

1.8.2) Discharge in Well under Constant Depression Head Formula

Evaluate Formula

Formula

$$Q = K \cdot H'$$

Example with Units

$$0.19\,\text{m}^3/\text{s} = 5.0 \cdot 0.038$$

2) Cross Sectional Area of Well Formulas

2.1) Cross-sectional Area of Well given Constant Depending upon Soil at Base Formula

Evaluate Formula

Formula

$$A_{csw} = \frac{K_b}{\left(\frac{1}{t}\right) \cdot \log\left(\left(\frac{h1'}{h_{w2}}\right), e\right)}$$

Example with Units

$$13.8352\,\text{m}^2 = \frac{4.99\,\text{m}^3/\text{hr}}{\left(\frac{1}{4\,\text{h}}\right) \cdot \log\left(\left(\frac{20.0\,\text{m}}{10\,\text{m}}\right), e\right)}$$

2.2) Cross-sectional Area of Well given Constant Depending upon Soil at Base with Base 10 Formula

Evaluate Formula

Formula

$$A_{sec} = \frac{K_b}{\left(\frac{2.303}{t}\right) \cdot \log\left(\left(\frac{h1'}{h_{w2}}\right), 10\right)}$$

Example with Units

$$2.609\,m^2 = \frac{4.99\,m^3/hr}{\left(\frac{2.303}{4\,h}\right) \cdot \log\left(\left(\frac{20.0\,m}{10\,m}\right), 10\right)}$$

2.3) Cross-sectional Area of Well given Discharge from Well Formula

Evaluate Formula

Formula

$$A_{csw} = \frac{Q}{S_{si} \cdot H'}$$

Example with Units

$$13.0263\,m^2 = \frac{0.99\,m^3/s}{2.0\,m/s \cdot 0.038}$$

3) Depression Head after Pumping Stopped Formulas

3.1) Depression Head in Well at Time T after Pumping Stopped Formula

Evaluate Formula

Formula

$$h_d = \frac{h1'}{\exp\left(K_a \cdot t\right)}$$

Example with Units

$$19.9556\,m = \frac{20.0\,m}{\exp\left(2\,m/h \cdot 4\,h\right)}$$

3.2) Depression Head in Well at Time T after Pumping Stopped and Clay Soil is Present Formula

Evaluate Formula

Formula

$$h_{dp} = \frac{h_{w1}}{10^{\left(0.25 \cdot \frac{t}{3600}\right)}}$$

Example with Units

$$0.3\,m = \frac{3\,m}{10^{\left(0.25 \cdot \frac{4\,h}{3600}\right)}}$$

3.3) Depression Head in Well at Time T after Pumping Stopped and Fine Sand is Present Formula

Evaluate Formula

Formula

$$h_{dp} = \frac{h_{w1}}{10^{\left(\frac{0.5}{2.303}\right) \cdot \frac{t}{3600}}}$$

Example with Units

$$0.4062\,m = \frac{3\,m}{10^{\left(\frac{0.5}{2.303}\right) \cdot \frac{4\,h}{3600}}}$$

3.4) Depression Head in Well at Time T after Pumping Stopped with Base 10 and Clay soil is Present Formula

Evaluate Formula

Formula

$$h_{dp} = \frac{h_{w1}}{10^{\frac{0.25 \cdot \frac{t}{3600}}{2.303}}}$$

Example with Units

$$1.1038\,m = \frac{3\,m}{10^{\frac{0.25 \cdot \frac{4\,h}{3600}}{2.303}}}$$

3.5) Depression Head in Well at Time T after Pumping Stopped with Base 10 and Fine Sand is Present Formula

Evaluate Formula

Formula

$$h_{dp} = \left(\frac{h_{w1}}{10^{\left((0.5) \cdot \frac{t}{\frac{3600}{2.303}} \right)}} \right)$$

Example with Units

$$0.4062\,\text{m} = \left(\frac{3\,\text{m}}{10^{\left((0.5) \cdot \frac{4\,\text{h}}{\frac{3600}{2.303}} \right)}} \right)$$

3.6) Depression Head in Well at Time T given Pumping Stopped and Constant Formula

Evaluate Formula

Formula

$$h_{dp} = \frac{h_{w1}}{\exp\left(\frac{K_b \cdot t}{A_{csw}} \right)}$$

Example with Units

$$0.6461\,\text{m} = \frac{3\,\text{m}}{\exp\left(\frac{4.99\,\text{m}^3/\text{hr} \cdot 4\,\text{h}}{13\,\text{m}^2} \right)}$$

3.7) Depression Head in Well at Time T given Pumping Stopped and Constant with Base 10 Formula

Evaluate Formula

Formula

$$h_{dp} = \frac{h_{w1}}{10^{\frac{K_b \cdot t}{A_{csw} \cdot 2.303}}}$$

Example with Units

$$0.6463\,\text{m} = \frac{3\,\text{m}}{10^{\frac{4.99\,\text{m}^3/\text{hr} \cdot 4\,\text{h}}{13\,\text{m}^2 \cdot 2.303}}}$$

4) Depression Head when Pumping Stopped Formulas

4.1) Depression Head in well given pumping stopped and clay soil is present Formula

Evaluate Formula

Formula

$$h_d = h_{w2} \cdot \exp\left(0.25 \cdot \Delta t \right)$$

Example with Units

$$34.9034\,\text{m} = 10\,\text{m} \cdot \exp\left(0.25 \cdot 5\,\text{s} \right)$$

4.2) Depression Head in Well given Pumping Stopped and Coarse Sand is Present Formula

Evaluate Formula

Formula

$$h_d = h_{w2} \cdot \exp\left(1 \cdot \Delta_t \right)$$

Example with Units

$$27.456\,\text{m} = 10\,\text{m} \cdot \exp\left(1 \cdot 1.01\,\text{s} \right)$$

4.3) Depression Head in Well given Pumping Stopped and Constant Formula

Evaluate Formula

Formula

$$h_d = h_{w2} \cdot \exp\left(\frac{K \cdot t}{A_{cs}} \right)$$

Example with Units

$$27.1828\,\text{m} = 10\,\text{m} \cdot \exp\left(\frac{5.0 \cdot 4\,\text{h}}{20\,\text{m}^2} \right)$$

4.4) Depression Head in Well given Pumping Stopped and Constant with Base 10 Formula

Evaluate Formula

Formula

$$h_d = h_{w2} \cdot 10^{\frac{K \cdot t}{A_{cs} \cdot 2.303}}$$

Example with Units

$$27.1779\,\text{m} = 10\,\text{m} \cdot 10^{\frac{5.0 \cdot 4\,\text{h}}{20\,\text{m}^2 \cdot 2.303}}$$

4.5) Depression Head in Well given Pumping Stopped and Fine Sand is Present Formula

Evaluate Formula

Formula

$$h_d = h_{w2} \cdot \exp\left(0.5 \cdot \Delta_t\right)$$

Example with Units

$$16.5699\,\text{m} = 10\,\text{m} \cdot \exp\left(0.5 \cdot 1.01\,\text{s}\right)$$

4.6) Depression Head in Well given Pumping Stopped with Base 10 and Clay soil is Present Formula

Evaluate Formula

Formula

$$h_d = h_{w2} \cdot 10^{\frac{0.25 \cdot \Delta t}{2.303}}$$

Example with Units

$$34.8956\,\text{m} = 10\,\text{m} \cdot 10^{\frac{0.25 \cdot 5\,\text{s}}{2.303}}$$

4.7) Depression Head in Well given Pumping Stopped with Base 10 and Coarse Sand is Present Formula

Evaluate Formula

Formula

$$h_d = h_{w2} \cdot 10^{\frac{1 \cdot \Delta_t}{2.303}}$$

Example with Units

$$27.451\,\text{m} = 10\,\text{m} \cdot 10^{\frac{1 \cdot 1.01\,\text{s}}{2.303}}$$

4.8) Depression Head in Well given Pumping Stopped with Discharge Formula

Evaluate Formula

Formula

$$h_d = h_{w2} \cdot 10^{\frac{Q \cdot \Delta_t}{A_{cs} \cdot H' \cdot 2.303}}$$

Example with Units

$$37.2632\,\text{m} = 10\,\text{m} \cdot 10^{\frac{0.99\,\text{m}^3/\text{s} \cdot 1.01\,\text{s}}{20\,\text{m}^2 \cdot 0.038 \cdot 2.303}}$$

5) Recuperate Time Formulas

5.1) Time in Hours given Clay Soil Formula

Evaluate Formula

Formula

$$t = \left(\frac{1}{0.25}\right) \cdot \log\left(\left(\frac{h_d}{h_{w2}}\right), e\right)$$

Example with Units

$$4.0272\,\text{h} = \left(\frac{1}{0.25}\right) \cdot \log\left(\left(\frac{27\,\text{m}}{10\,\text{m}}\right), e\right)$$

5.2) Time in Hours given Coarse Sand Formula

Evaluate Formula

Formula

$$t = \log\left(\left(\frac{h_d}{h_{w2}}\right), e\right)$$

Example with Units

$$1.0068\,\text{h} = \log\left(\left(\frac{27\,\text{m}}{10\,\text{m}}\right), e\right)$$

5.3) Time in Hours given Constant Depending upon Soil at Base Formula

Evaluate Formula

Formula

$$t = \left(\frac{A_{csw}}{K}\right) \cdot \log\left(\left(\frac{h_d}{h_{w2}}\right), e\right)$$

Example with Units

$$2.6177\,\text{h} = \left(\frac{13\,\text{m}^2}{5.0}\right) \cdot \log\left(\left(\frac{27\,\text{m}}{10\,\text{m}}\right), e\right)$$

5.4) Time in Hours given Constant Depression Head and Area of Well Formula

Evaluate Formula

Formula

$$t = \frac{2.303 \cdot A_{csw} \cdot H' \cdot \log\left(\left(\frac{h_d}{h_{w2}}\right), 10\right)}{Q}$$

Example with Units

$$2.664\,\text{h} = \frac{2.303 \cdot 13\,\text{m}^2 \cdot 0.038 \cdot \log\left(\left(\frac{27\,\text{m}}{10\,\text{m}}\right), 10\right)}{0.99\,\text{m}^3/\text{s}}$$

5.5) Time in Hours given Fine Sand Formula

Evaluate Formula

Formula

$$t = \left(\frac{1}{0.5}\right) \cdot \log\left(\left(\frac{h_d}{h_{w2}}\right), e\right)$$

Example with Units

$$2.0136\,\text{h} = \left(\frac{1}{0.5}\right) \cdot \log\left(\left(\frac{27\,\text{m}}{10\,\text{m}}\right), e\right)$$

5.6) Time in Hours with Base 10 given Coarse Sand Formula

Evaluate Formula

Formula

$$t = \left(\frac{2.303}{1}\right) \cdot \log\left(\left(\frac{h_d}{h_{w2}}\right), 10\right)$$

Example with Units

$$5.3389\,\text{h} = \left(\frac{2.303}{1}\right) \cdot \log\left(\left(\frac{27\,\text{m}}{10\,\text{m}}\right), 10\right)$$

5.7) Time in Hours with Base 10 given Fine Sand Formula

Evaluate Formula

Formula

$$t = \left(\frac{2.303}{0.5}\right) \cdot \log\left(\left(\frac{h_d}{h_{w2}}\right), 10\right)$$

Example with Units

$$10.6778\,\text{h} = \left(\frac{2.303}{0.5}\right) \cdot \log\left(\left(\frac{27\,\text{m}}{10\,\text{m}}\right), 10\right)$$

Variables used in list of Recuperation Test Formulas above

- A_{cs} Cross Sectional Area *(Square Meter)*
- A_{csw} Cross-Sectional Area of Well *(Square Meter)*
- A_{sec} Cross-Sectional Area given Specific Capacity *(Square Meter)*
- **H'** Constant Depression Head
- h_d Depression Head *(Meter)*
- h_{dp} Depression Head after Pumping Stopped *(Meter)*
- h_{w1} Depression Head in Well 1 *(Meter)*
- h_{w2} Depression Head in Well 2 *(Meter)*
- **h1'** Depression Head in Well *(Meter)*
- **K** Constant
- K_a Specific Capacity *(Meter per Hour)*
- K_b Constant Dependent on Base Soil *(Cubic Meter per Hour)*
- **Q** Discharge in Well *(Cubic Meter per Second)*
- S_{si} Specific Capacity in SI unit *(Meter per Second)*
- **t** Time *(Hour)*
- Δ_t Time Interval *(Second)*
- **Δt** Total Time Interval *(Second)*

Constants, Functions, Measurements used in list of Recuperation Test Formulas above

- constant(s): **e**, 2.71828182845904523536028747135266249 *Napier's constant*
- Functions: **exp**, exp(Number) *n an exponential function, the value of the function changes by a constant factor for every unit change in the independent variable.*
- Functions: **log**, log(Base, Number) *Logarithmic function is an inverse function to exponentiation.*
- Measurement: **Length** in Meter (m) *Length Unit Conversion*
- Measurement: **Time** in Hour (h), Second (s) *Time Unit Conversion*
- Measurement: **Area** in Square Meter (m²) *Area Unit Conversion*
- Measurement: **Speed** in Meter per Second (m/s), Meter per Hour (m/h) *Speed Unit Conversion*
- Measurement: **Volumetric Flow Rate** in Cubic Meter per Second (m³/s), Cubic Meter per Hour (m³/hr) *Volumetric Flow Rate Unit Conversion*

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