

Specific capacity **SC**

$$SC = Q \div s$$

Q pumping rate (gpm). **s** drawdown (ft) = pumping level – static level.

Trend it only at the same rate and the same time into pumping; both change the answer.

Example: 1,200 gpm with 48 ft of drawdown → 25 gpm/ft.

From specific capacity

rule of thumb

$$T \approx 2,000 \times SC_{\text{confined}}$$

$$T \approx 1,500 \times SC_{\text{unconfined}}$$

An estimate only (Driscoll). Well loss lowers SC, so it reads low on an inefficient well and cannot tell the aquifer from the screen.

Energy per acre-foot

$$\text{kWh/AF} = 1.024 \times \text{TDH} \div \eta$$

1.024 kWh lifts one acre-foot one foot at 100% efficiency. Multiply by your \$/kWh for cost per acre-foot.

Example: 300 ft at $\eta = 0.617 \rightarrow$ about 498 kWh/AF.

Transmissivity, straight line

Cooper-Jacob

$$T = 264 \times Q \div \Delta s$$

T in gpd/ft. **Δs** = feet the drawdown rises over one log cycle of time (10 → 100 min, or 100 → 1,000), read from the straight late-time part of the plot.

Well loss shifts the line up but not its slope, so the slope reads the aquifer.

Example: 1,200 gpm and 6.3 ft per cycle → about 50,300 gpd/ft.

Step test **Jacob**

$$s = B \cdot Q + C \cdot Q^2$$

$$E = B \cdot Q \div s \times 100\%$$

Plot **s ÷ Q** against **Q** for three or more steps: the intercept is **B** (aquifer loss), the slope is **C** (well loss). **E** is well efficiency at that rate.

C rising test over test with **B** steady points at the screen, not the aquifer.

Slowing a pump down

affinity laws

$$Q_2 = Q_1 \times (N_2 \div N_1)$$

$$H_2 = H_1 \times (N_2 \div N_1)^2$$

$$P_2 = P_1 \times (N_2 \div N_1)^3$$

These move the pump curve, not the operating point. A well's static lift does not scale with speed, so the new flow comes from where the slowed curve meets the system curve.

Transmissivity, recovery **Theis**

$$T = 264 \times Q \div \Delta s'$$

Δs' = residual drawdown per log cycle of **t ÷ t'** (time since pumping began ÷ time since it stopped). **Q** is the rate the well ran at.

Head and horsepower

$$\text{ft of head} = \text{psi} \times 2.31$$

$$\text{TDH} \approx \text{PWL} + \text{psi} \times 2.31$$

$$\text{water hp} = Q \times \text{TDH} \div 3,960$$

PWL pumping water level, ft below the discharge gauge; **psi** read at the wellhead.

Wire-to-water efficiency **η**

$$\eta = Q \times \text{TDH} \div (5,308 \times \text{kW})$$

kW is measured input power at the motor. $5,308 = 3,960 \div 0.746$.

Example: 1,200 gpm, 300 ft TDH, 110 kW → $\eta = 61.7\%$.

Conversions

1 acre-foot	325,851 gal
1 gpm	1,440 gpd
1 MGD	694.4 gpm
1 cfs	448.8 gpm
1 AF per year, continuous	0.62 gpm
1 psi	2.31 ft of water
1 hp	0.746 kW

Put this in the well file, every test

- ☐ Date, who ran it, and the pump setting
- ☐ Rate, and how it was measured (meter, orifice, totalizer)
- ☐ Static level, and how long the well had been off
- ☐ Pumping levels with the time of each reading
- ☐ Discharge pressure at the wellhead
- ☐ Input kW (or volts, amps and power factor)
- ☐ Recovery readings after shutdown
- ☐ Anything unusual: sand, air, cascading water, noise