WELL HYDRAULICS EQUATION LIST

① DRAWDOWN

$$S = SWL - PWL$$

S = drawdown (UNITS = m)
SWL = STATIC WATER LEVEL ELEVATION (RELATIVE TO SEA LEVEL)
PWL = PUMPING WATER LEVEL ELEVATION (" " " ")

---

② RESIDUAL DRAWDOWN

$$R.D. = SWL - R.L.$$

R.D. = RESIDUAL DRAWDOWN (LENGTH UNITS)
S.W.L. = INITIAL STATIC WATER LEVEL ELEVATION
R.L. = RECOVERY LEVEL ELEVATION (AFTER PUMPING)

---

③ WELL YIELD - SUSTAINED WELL DISCHARGE VIA PUMPING

WELL YIELD = VOLUME DISCHARGE / TIME
(UNITS L^3/t)

---

④ SPECIFIC CAPACITY

$$S.C. = \text{WELL YIELD} / S$$

S.C. = SPECIFIC CAPACITY (UNITS $L^3/t/L = M^3/sec/dM$)
WELL YIELD: UNITS = $L^3/t = M^3/sec$
S = DRAWDOWN = LENGTH UNITS = M

⑤ TRANSMISSIVITY

$T = Kb$ Where T = transmissivity ($L L^2/t$)

K = Hydraulic Conductivity (L/t)

b = SATURATED THICKNESS (L)

---

⑥ WELL EFFICIENCY

$$\text{WELL EFFICIENCY} = \frac{\text{ACTUAL RATE OF WELL DISCHARGE}}{\text{POTENTIAL RATE OF AQUIFER DISCHARGE}} \times 100\%$$

$$\text{WELL EFFICIENCY} = \frac{m^3/sec}{m^3/sec} \times 100\%$$

---

⑦ THIEM EQUATION FOR UNCONFINED AQUIFER

(ASSUMPTIONS: EQUILIBRIUM WELL CONDITIONS & RADIAL FLOW TO WELL, HOMOGENEOUS AQUIFER CONDITIONS, CONE OF DEPRESSION STATIC AND AT EQUILIBRIUM)

ENGLISH UNITS

$$Q = \frac{K(H^2 - h^2)}{1055 \log(R/r)}$$

METRIC UNITS

$$Q = \frac{1.36 K (H^2 - h^2)}{\log(R/r)}$$

Q = PUMPING RATE (L^3/t = GAL/min, m^3/DAY)

K = Hydraulic Conductivity (L/t = M/DAY)

H = INITIAL SWL DISTANCE FROM BOTTOM OF AQUIFER (UNITS: L)

h = PWL DISTANCE FROM BOTTOM OF AQUIFER (UNITS: L)

R = RADIUS OF CONE OF DEPRESSION (UNITS: L = m)

r = RADIUS OF WELL (UNITS: L = m)

(8) THIEM EQUATION for ~~UNCON~~ CONFINED AQUIFER

(ASSUMPTIONS: EQUILIBRIUM CONDITIONS AS IN (7) ABOVE)

ENGLISH

$$Q = \frac{Kb(H-h)}{528 \log(R/r)}$$

METRIC

$$Q = \frac{Kb(H-h)}{\log(R/r)}$$

UNITS SAME AS (7) ABOVE, EXCEPT b = THICKNESS of AQUIFER

---

(9) THEIS EQUATION: NONEQUILIBRIUM WELL EQUATION for CONFINED AQUIFERS

ENGLISH

$$S^* = \frac{114.6\, Q\, (W(u))}{T}$$

METRIC

$$S^* = \left(\frac{1}{4\pi}\right)\left(\frac{Q}{T}\right)(W(u))$$

S^* = drawdown (L)

Q = DISCHARGE (L^3/t)

T = TRANSMISSIVITY (L^2/t)

r = DIST. of OBSERVATION PT. from WELL (L)

S' = STORATIVITY

$W(u)$ = WELL FUNCTION

ENGLISH

$$u = \frac{1.87 r^2 S'}{Tt}$$

METRIC

$$u = \frac{r^2 S'}{4Tt}$$

S' = STORATIVITY

t = time since PUMPING BEGAN

* $W(u)$ — APPROXIMATED from EMPIRICAL RELATIONSHIPS

(10) COOPER-JACOB METHOD — NONEQUILIBRIUM WELL EQUATION FOR CONFINED AQUIFERS (SIMPLIFIED THEIS EQUATION)

ENGLISH

$$S^* = \frac{264Q}{T} \log\left(\frac{0.3Tt}{r^2 S'}\right)$$

METRIC

$$S^* = \frac{0.183 Q}{T} \log\left(\frac{2.25Tt}{r^2 S'}\right)$$

S^* = drawdown at radius r from pumping well (L)

r = radius from pumping well (L)

Q = well discharge (L^3/t)

t = time since pumping began (sec)

S' = coefficient of storage of aquifer

T = transmissivity of aquifer (L^2/t)