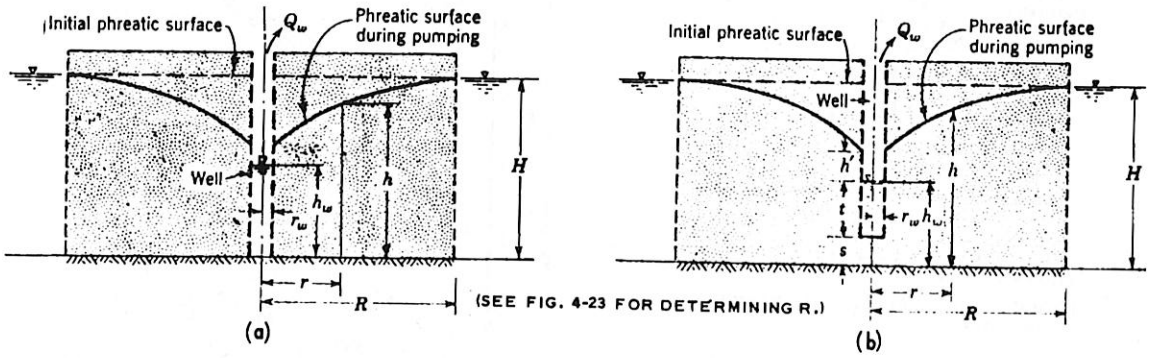

(SEE FIG. 4-23 FOR DETERMINING R.)

FULLY PENETRATING WELL

FLOW, Q_w, OR DRAWDOWN, $H^2 - h^2$, NEGLECTING HEIGHT OF FREE DISCHARGE, h' (CONDITION (a)).

$$Q_w = \frac{\pi k (H^2 - h^2)}{\ln (R/r)} \quad (1) \qquad \text{OR} \qquad Q_w = \frac{\pi k \left(H^2 - h_w^2\right)}{\ln (R/r_w)} \quad (2)$$

FLOW, Q_w, TAKING h' INTO ACCOUNT (b) CAN BE ESTIMATED ACCURATELY FROM EQ 2 USING HEIGHT OF WATER, $h_w + s$ (s = 0 FOR FULLY PENETRATING WELL), FOR THE TERM h_w.

FULLY OR PARTIALLY PENETRATING WELL

FLOW, Q_w, FOR ANY GRAVITY WELL WITH A CIRCULAR SOURCE

$$Q_w = \frac{\pi k [(H - s)^2 - t^2]}{\ln (R/r_w)} \left[1 + (0.30 + \frac{10 r_w}{H}) \sin \frac{1.8 s}{H}\right] \quad (3)$$

DRAWDOWN, $H - h$ OR $H^2 - h^2$, WHERE h' IS ACCOUNTED FOR (OBTAIN Q_w FROM EQ 3)

WHERE $r > 1.5H$,

$$H^2 - h^2 = \frac{Q_w}{\pi k} \ln \frac{R}{r} \quad (4)$$

WHERE $r < 1.5H$,

FOR $r/h > 1.5$, USE EQ 4

FOR $r/h < 1.5$,

$$H - h = \frac{Q_w P \ln (10R/H)}{\pi k H \left[1 - 0.8 (s/H)^{1.5}\right]} \quad (5)$$

FOR $0.3 < r/h < 1.5$,

$$P = 0.13 \ln R/r \quad (6)$$

FOR $r/h < 0.3$,

$$P = \bar{C}_x + \Delta C \quad (7)$$

WHERE

$$\bar{C}_x = 0.13 \ln \frac{R}{r} - 0.0123 \ln^2 \frac{R}{10r} \quad (8)$$

AND

$$Ac = \frac{s}{h} \left[\left(\frac{1}{2.3} \ln \frac{R}{10r}\right) \left(1.2 \frac{s}{H} - 0.48\right) + 0.113 \ln \frac{2.4H}{R} \ln \frac{R}{34r}\right] \quad (9)$$

(Modified from "Foundation Engineering," G. A. Leonards, ed., 1962, McGraw-Hill Book Company. Used with permission of McGraw-Hill Book Company.)

Figure 4-11. Flow and drawdown for fully and partially penetrating single wells; circular source; gravity flow.