4.3 Well in a Uniform Flow

$$K = \frac{2Q}{\pi r\left(h_u + h_d\right)\left(i_u + i_d\right)} \qquad (4.30)$$

- Sloping hydraulic gradient

Fig 4.3.1

Q : pumping rate → $h_u+h_d = 2b$
h_u, h_d : saturated thickness (cq. down stream)
i_u, i_d : water table slopes (cq. down stream)
at distance r

$$-\frac{Y}{X} = \tan\left(\frac{2\pi Kbi}{Q} y\right)$$

$$y_L = +\frac{Q}{2Kbi}$$ in fluencing area

$$x_L = -\frac{Q}{2\pi Kbi}$$

4.4 Unsteady Radial Flow in a Confined Aquifer

$$\frac{\partial^2 h}{\partial r^2} + \frac{1}{r}\frac{\partial h}{\partial r} = \frac{S}{T}\frac{dh}{dt}$$

draw down
Theis equation

$$s = \frac{Q}{2\pi T}\int_u^\infty \frac{e^{-u}du}{u} \qquad 4.4.2$$

h : head
S : storage coefficient
T : Transmissivity
t : time since beginning

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

$$s = \frac{Q}{2\pi Tt}\left[0.5772 - \ln u + u - \frac{u^2}{2.21} + \ldots\right]$$

S, T from pumping test

Nonequilibrium well pumping equation

Equation 4.4.1
Simplified to equation 4.4.2 with well function W(u)

Good since 1. S from test
2. one observation as well
3. shorter prevail of pumping
4. no assumption of steady state

assumption 1. Aquifer is homogeneous, isotropic, uniform thickness
2. before pumping, peizonmetric surface is horizontal
3. well is pumped at a constant discharge rate
4. well penetrates the entire aquifer, flow is horizontal
5. well diameter is infinitesimal
6. water removed from storage is discharged instantaneously