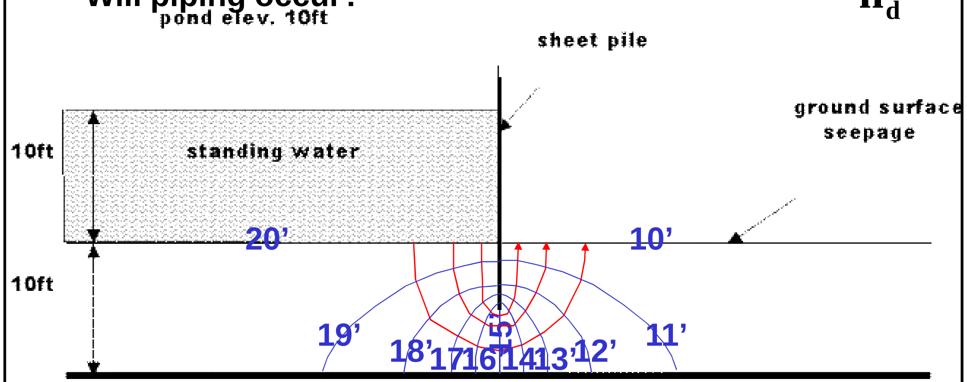
What is the flux under the sheet pile wall if K=2ft/day? Will piping occur?

$$Q = q_A n_f = KH\frac{n_f}{n_d}$$



$Q = KH(n_f/n_d)$ = 2 ft/d 10ft 4/10 = ~ 8 ft^3/day

Using: γ_t = 0.7 (165 lb/ft^3) + 0.3 (62.4 lb/ft^3) = (134 lb/ft^3)

$$i_{critical} = \frac{134\ lb/ft^3 - 62.4\ lb/ft^3}{62.4\ lb/ft^3} = 1.15$$

gradient is ~1.0 at the critical location, so it looks OK

What could change that? How could you correct it?

A PLAN VIEW FLOW NET BY CONTOURING USING FIELD HEADS AND DRAWING FLOW LINES PERPENDICULAR: can't assume constant K or b

assuming no inflow from above or below, we can evaluate relative T:

$$Q = A_A V_1 = A_B V_2$$

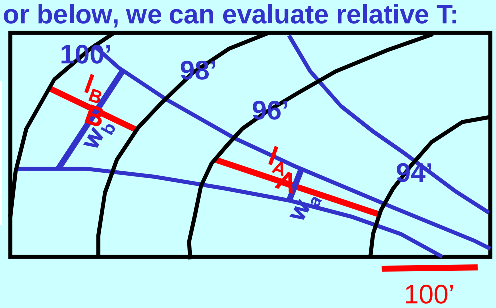
$$A_A K_A \frac{\Delta h}{l_A} = A_B K_B \frac{\Delta h}{l_B}$$

$$\frac{A_A K_A}{l_A} = \frac{A_B K_B}{l_B} \qquad \frac{K_A}{K_B} = \frac{A_B l_A}{A_A l_B}$$

$$A = wb \quad (b = \text{aquifer thickness})$$

$$\frac{K_A}{K_B} = \frac{w_B b_B l_A}{w_A b_A l_B}$$

$$\frac{K_A b_A}{K_B b_B} = \frac{w_B l_A}{w_A l_B} = \frac{T_A}{T_B}$$

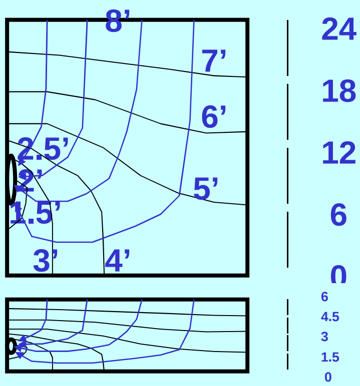


"Irregularities" in "Natural" flow nets

- varying K
- varying flow thickness
- recharge/discharge
- vertical components of flow

Nature's flow nets provide clues to geohydrologic conditions

The pond elevation is 8m, ground surface is 6m, the drain is at 2m (1.5 to 2.5), bedrock is at 0m, K_x is 16m/day, and K_z is 1m/day.



$$x' = x \quad z' = \frac{z\sqrt{K_x}}{\sqrt{K_z}}$$

~ 5 flow tubes and 6 head drops

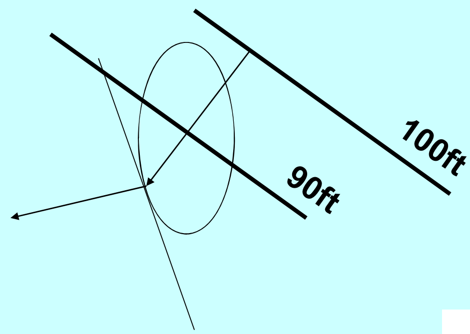
If the pond elevation is 8m, ground surface at 6m, the drain at 2m, bedrock at 0m and K_x is 16m/day and K_z is 1m/day , what is the flow at the drain? **Recall:**

$$K' = \sqrt{K_x K_z}$$

$$Q = q_A n_f = KH\frac{n_f}{n_d}$$

Q = 4 m/day 6 m 5/6 = ~ 20m^3/day per m

$try \text{ it for } K_x = 16\, ft/day \quad and \quad K_z = 4\, ft/day$



$\frac{1}{\sqrt{K_x}}$ and $\frac{1}{\sqrt{K_z}}$

1 - Draw an INVERSE K ellipse for semi-axes

2 - Draw the direction of the hydraulic gradient through the center of the ellipse and note where it intercepts the ellipse

3 - Draw the tangent to the ellipse at this point

4 - Flow direction is perpendicular to this line

Explore the Flow Net Software at

http://inside.mines.edu/~epoeter/_GW/09FlowNets/topodrive/index.html

Before leaving class use the software to simulate a regional system with similar boundary conditions as one of those presented by Toth Freeze or Witherspoon but different heterogeneity

Submit in the homework box WITH YOUR NAME ON IT:

An image of your system showing the flow pattern
(make it the active window then ALT PrintScreen then paste on MSWord)
and 2 paragraphs as follows

1st paragraph:
describing the system boundary conditions and properties

2nd paragraph
describing why the flow moves as shown in the image