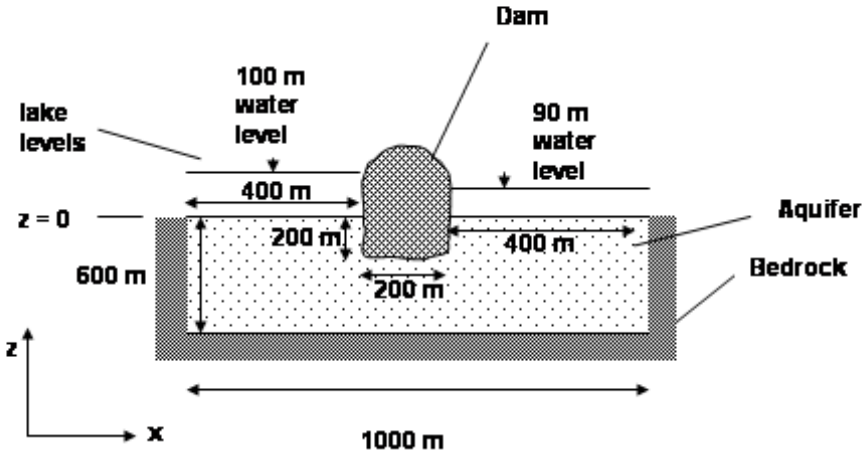
Groundwater homework: Flow Net.

One way to solve Laplace's equation, which was common prior to computers, was to draw a flow net. The value here is to provide an intuitive feel for the problem prior to solving the equation numerically.

Like usual, homework is to be neat and on time. Drawings and hand-lettered labels are to be clear and neat. Homework must be stapled prior to submission or else will not be accepted.

Consider the following situation.




The goal is to determine the steady-state distribution of pressure in terms of water head and to determine discharge.

1. (20pts) To obtain a sense of the flow pattern and pattern of pressure, draw the flow lines and equipotential lines. Draw an equipotential line for each unit difference (1) in head and identify the head in the plot. Follow the directions provided in the book (Fetter, 4th Ed 132-136). Be sure to identify the boundary conditions and include a scale. Note that the datum (z = 0) is at the surface of the aquifer.

2. (10pts) What is the total groundwater discharge, per unit width, downstream of the dam? Use only the boxes at the downstream boundary of the aquifer to calculate ?h and ?z. Use Darcy's Law for each box and sum the discharge flowing out of each box at the downstream boundary. Do not use the flow tubes and the equation in the book. Assume a hydraulic conductivity of $10^{-6}$ m/s and express your result in $m^2\ day^{-1}$.

3. (8pts) Fetter pg 148
    a. Problem number 7. Keep track of units and show your work.
    b. Problem number 8. Keep track of units and show your work.