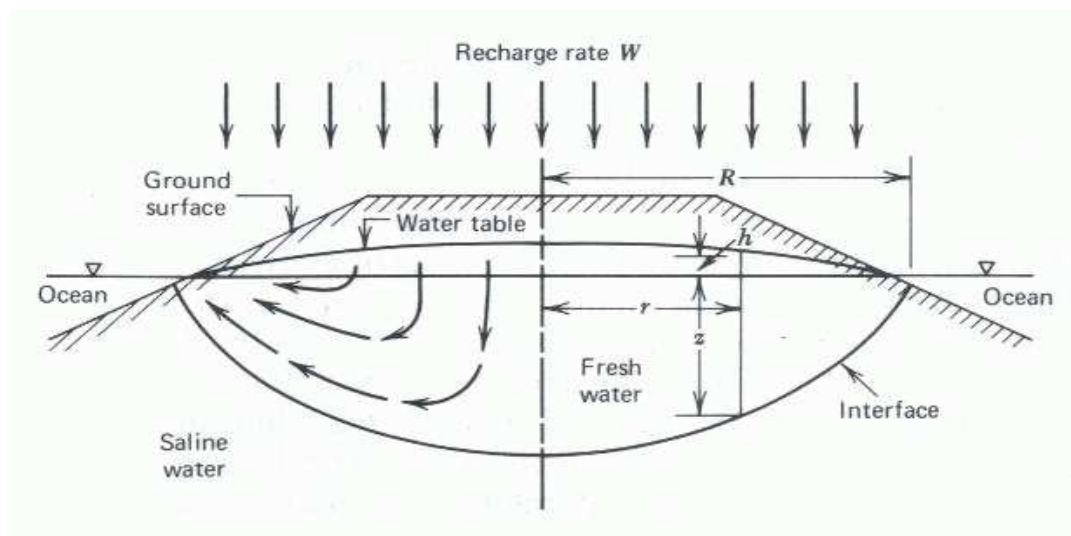


## Homework 7, ENCE 621/489G

Due 11/29/2004

1. A saltwater interface is stable at a position of about 40 ft beneath the base of a well in a formation with a hydraulic conductivity of 0.1 cm/s. Calculate the maximum pumping rate so as not to cause upconing.
2. The flow of fresh water toward the sea is  $2 \times 10^{-4} \text{ ft}^3 / \text{s}$  per foot of coastline in an aquifer that is 100 ft thick with a hydraulic conductivity of  $3.3 \times 10^{-3} \text{ ft/s}$ . Calculate the inland distance from the shoreline to the toe of the saltwater wedge. What is the new position from the shoreline if the seaward flow is reduced by one-half.
3. Note in the following figure of seawater intrusion into an aquifer underlying a circular island.



- Derive the following equation using the Dupuit assumptions and the Ghyben-Herzberg relation:

$$z^2 = \frac{W(R^2 - r^2)}{2K\left(1 + \frac{\Delta\rho}{\rho}\right)\frac{\Delta\rho}{\rho}}$$

by using the boundary condition that  $h = 0$  at  $r = R$ . In the above equation,  $\Delta\rho = \rho_s - \rho_f$ , or the difference of saline and fresh water density. The coordinate  $r$  is positive outwards from the center of the island.

- Assuming that there is a high mountain at the center of the island and the recharge rate is not uniformly  $W$ . Instead, the recharge rate is higher at the center of the island and increases linearly to the sea shore as follows:

$$W = -Cr + D,$$

where  $C$  and  $D$  are constants. Rederive the saline–fresh water interface equation.