CE 473/573 Groundwater
Fall 2011

Learning objectives

While the goals of the class are quite general, the learning objectives specify what you will be able to do. They are constructed on six levels: (1) listing and defining, (2) explaining and describing, (3) calculating and solving, (4) deriving and analyzing, (5) designing and formulating, and (6) evaluating and choosing. Use these objectives to focus your study.

1. Identify contemporary issues involving groundwater; explain how solutions that use knowledge of groundwater affect problems in a global, economic, environmental, and societal context.

2. Define hydraulic conductivity, discharge (or flow), specific discharge, and average linear velocity. Explain why the average linear velocity is larger than the specific discharge. Compute travel time. List and explain the factors that affect hydraulic conductivity. Estimate hydraulic conductivity for various soil types. Explain the measurement of hydraulic conductivity. Design a permeameter. Compute effective conductivity.

3. State Darcy’s law. Explain the terms in Darcy’s law. Explain the limitations on Darcy’s law. Determine whether Darcy’s law applies to a given flow. Use Darcy’s law to explain how the head should vary in an aquifer.

4. Measure hydraulic conductivity with a permeameter. Analyze experimental data. Determine parameters by fitting a theoretical expression to experimental data. Compute measurement uncertainty, determine main contributions to the uncertainty, and suggest improvements to an experiment.


6. Derive solutions for one-dimensional steady flow in confined aquifers under various conditions. Sketch and explain profiles of piezometric head. Define homogeneous and heterogeneous and solve for the flow and head variation in homogeneous and heterogeneous aquifers.

7. Derive solutions for one-dimensional steady flow in unconfined aquifers under various conditions (homogeneous/heterogeneous, with or without recharge, etc.). Sketch and explain profiles of piezometric head. Define groundwater divide and compute its properties. Explain how to determine whether a divide exists.

8. Explain the finite-difference approach. Formulate a finite-difference model of steady groundwater flow, including the boundary conditions. Solve a groundwater problem using a spreadsheet and Modflow. Interpret the results from a groundwater model.
9. Derive solutions for simple cases of flow to a well. Explain solutions for steady flow to a well in confined and unconfined aquifers. Determine aquifer parameters from steady pump tests.