Introduction
- What is hydrogeology?
- Why study hydrogeology
- History of physical hydrogeology
- History of contaminant hydrogeology
- Purpose and organization of this course

What is hydrogeology?
- Geological roots
  - Groundwater occurs in geological media; major subfields of geology, e.g., petrology, stratigraphy, structure, geochemistry, all play key roles in controlling movement and quality of groundwater
- Hydrology and hydraulics
  - Water is the subject of study; closely related to hydrology and hydraulics
- Environmental science
  - Groundwater pollution is a major environmental concern; protection and management of groundwater is a vital part of environmental science.

Why study hydrogeology?
- Groundwater is one of the most important natural resources:
  - 40% of the Nation’s public water supply, in addition, 40 million people supply their own drinking water from domestic wells
  - Source of much of the water used for irrigation
  - Major contributor to flow in many streams and rivers and has a strong influence on river and wetland habitats for plants and animals
  - Principal reserve of freshwater and represent much of the potential future water supply

Percentage of population using groundwater as drinking water in each state of the U.S.
Where is water?

Freshwater is an essential resource for sustainable development of the world economy.

Tuscaloosa News story on the long-running border water dispute between Alabama and Georgia (11/2007)

Here Closer to Home

Georgia Gov. Sonny Perdue and his wife prayed for rain and a favorite ruling for Georgia?

A dead fish rests on the bottom of Lake Allatoona, GA

History of physical hydrogeology

- Henry Darcy, 1856, Darcy's Law
- T.C. Chamberlin, 1885, Artesian wells
- O.E. Meinzer, 1923, Treatise on groundwater
- C.V. Theis, 1935, Transient flow
- Jacob and Hantush, 1950 & 60s, Well hydraulics
- Toth (1962 & 63), Flow system concepts
- Post-1960, Widespread use of digital computers
- Since the 1990s, emphasis on multidisciplinary approach

Darcy's Law, 1856

\[ Q = k \cdot i \cdot A \]

Henry Darcy
T.C. Chamberlin, 1885, Discussion of Artesian Wells

Toth (1962, 1963)
Flow system concepts

Groundwater basin

History of chemical hydrogeology

- Pre-1960, mainly analysis and determination of water quality
- Post-1960, particularly since 1970, tremendous interest in fate and transport of contaminants in groundwater

Estimated Remaining Soil and GW Remediation Costs in 1996 Dollars (EPA, 1997)

Total = $187 Billion

Billions of US Dollars

- DOE
- RCRA
- DOD
- UST
- CFA
- States
- NPL
PG&E was required to:
1) compensate all the named plaintiffs in the amount of $333 million
2) clean up the environment
3) stop using chromium 6.
Purpose and organization

- Fundamental concepts and theories
  - aquifers, Darcy's law, flow systems
- Well hydraulics and aquifer test analysis
  - aquifer test, resource evaluation
- Groundwater development and management
  - regional flow, basin yield, sustainable development
- Chemical properties and contamination
  - water quality, transport mechanisms, protection and remediation

Groundwater Related Journals

- Ground Water
- Water Resources Research
- Journal of Hydrology
- Journal of Contaminant Hydrology
- Advances in Water Resources
- Hydrological Processes

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GROUNDWATER

It's One Word!