

# ESM 223

## Lecture 2 – Overview of Soil and Groundwater Resource Management

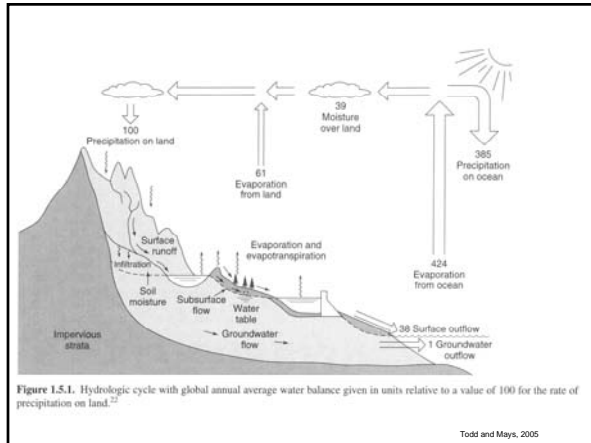
### Administrative Reminders:

Office Hours BH3408 – 11.50-13.30 MW or by appointment

Duplicate posting of lecture notes and other digital documents: [waterresourcescience.com](http://waterresourcescience.com)

Email: nnbrown@gmail.com

Library Reference Materials: Watts; Reader



## Summary

- Water Quality Constituents Managed
  - Chemistry
  - Operations and Management Strategies
  - Spatial Distribution & Migration
- Differences between soil, vadose and drinking water supply aquifer wrt management options
- Localized v. Distributed
- Risk and Cost Issues
  - Risk Assessment and Risk-based Action (intro)
- Examples

## Summary (continued)

### Management Goals

- Focus on end result: Monitoring, Prevention, Load Reduction, Waste Management, Remediation, Restoration
- Focus on supply: Monitoring, Supply utilization and efficiency, Reliability

Water Quality Management integrates defined contaminant and supply goals with financial, legal & institutional considerations. Adaptive management.

Timeframes, sustainability and energy implications

## Summary (continued)

### Getting it done: Who takes the lead?

- Different parties with different problems and goals
- Authorities and institutional mechanisms
- Technical considerations

Addressing uncertainty

## Water Quality Standards

- Drinking water standards
- Maximum contaminant levels
- National recommended water quality criteria
- California Toxics Rule
- Goals v. Standards
- Testing requirements
  - Different classes of site or water use

7

## Water Quality Constituents

### Natural - Anthropogenic

- Major Classes
- Concentrations
  - TDS, Chloride, Manganese etc
  - Radiation, Arsenic, Nitrate etc
- VOCs
- Pharmaceuticals and Personal Care Products

8

## Water Quality Constituents

### Localized – Distributed

- Distribution
  - Areally
  - Relative to geology, infrastructure
  - Gradients
- Calculating migration times
  - Transport retardation, degradation
  - Tracers and Proxies
- What happens when there is interchange between surface and groundwater (hyporheic zone)?

9

## Water Quality Constituents

- Soil, Vadose, Aquifer Zones
  - Interchange and cross-boundary flow
  - Tailoring water quality management to the hydrologic conditions
  - Risk-Cost comparisons
    - Risk Analysis (First of several parts)
  - Classes of Management Options
    - Operational; e.g., blending
    - Remedial
    - Substitution
    - Divisions in end users (and infrastructure requirements)  
[cf recycled water]

10

## Examples & Case Studies

- TDS
- Arsenic
- Nitrate
- TCE
- MTBE
- Estrogen

What are the *Risks, Costs and Benefits*?

11