Environmental Geology (Spring 2006) Final Lab Portfolio Contents:

In the order listed, include the following lab and writing exercises in a neat 3-ring binder package, with index tabs:

1. Reading Summary

2. Surfer Tutorial / 8 pts

3. Groundwater Flow Problem Set / 10 pts

4. Well Log Cost Analysis Problem / 8 pts

5. Mountain Fir Case Study Project Analysis / 15 pts

6. Mountain Fir Hydrogeologic Report / 10 pts

7. Klamath Basin Posters / 20 pts

Total / 80 pts

Environmental Geology Spring 2006 Final Exam Study Guide

The Final Exam will be in 2 parts, the lab skills portion will be open book. You will be able to use your notes, conversion charts, answer keys, etc. to work on lab-style problems. Make sure you go over the answer keys before the exam, if you are still uncertain how to solve the problems, see me ASAP. The second part of the exam will be closed book, and consist of long-answer essay questions, short-answer terminology, perhaps some true/false.

Key Words

Groundwater

- groundwater
- meteoric water
- connate water
- juvenile water
- porosity
- permeability
- horizontal permeability
- vertical permeability
- intergranular porosity
- fracture porosity
- solution cavities
- total porosity
- yield porosity
- primary vs. secondary porosity
- Darcy's law
- Q=KIA
- hydraulic gradient
- cross-sectional area
- specific yield
- specific retention
- zone of aeration
- vadose zone

- zone of saturation
- phreatic zone
- water table
- groundwater flow
- cone of depression
- aquifer
- aquitard
- artesian aquifer
- water table aquifer
- confined aquifer
- unconfined aquifer
- water table
- potentiometric surface
- piezometer
- unconsolidated aquifer
- consolidated aquifer
- infiltration
- groundwater contamination
- contaminant plume
- well
- monitoring well
- well hydraulics
- total depth
- screened interval

- sand pack
- well casing
- riser pipe
- casing
gROUT
- bentonite seal
- static water level
drawdown
- hydraulic head
- specific capacity
- pumping rate

- Willamette Valley
- Hydrogeology

- Coast Range marine volcanics
- and sed. Rocks
- Landuse
- Forest land
- Agricultural land
- Forested upland
- Field crops
- Tree farming
Grass crops
Nursery products
ubranization
Alluvial Fill
Willamette Gravels
Willamette Aquifer
Willamette Silt
Western Cascades Volcanics
High Cascades Volcanics
hydrogeologic setting
Quaternary alluvium
Quaternary older alluvium
Quaternary terrace deposits
Missoula Flood Deposits
Willamette Silts
gravel aquifer
unconfined aquifer
regional hydraulic gradient
Spencer Formation
Columbia River Basalts
Isopach Map
Groundwater Contour Map
salinity concentration
specific conductivity
contaminant sources
underground storage tank
environmental release
double-wall tank
vapor detection system
monitoring well
environmental property
assessment
tank leakage
tank farm
agricultural practice
pesticide / herbicide
land use
production wells
municipal well supply
gravel aquifer

Voluntary cleanup, DEQ
Contamination sources
Soil / water contamination
VOC’s
Metals
PCB’s
Chlorinated solvents
Human risk
Risk-based cleanup
Passive vs. active remediation
In-situ treatments
Chemical treatment
Thermal treatment
Biological treatment
Hydrocarbon release
“free product”
Phase I, II, III site assessment
Water table
Chemical oxidation

Gravel aquifers
DNAPL
Vapor extraction

Willamette Aquifer—Willamette Silts Case Study (Nitrate Problem)
Willamette silt
Willamette aquifer
Gravel aquifer
Willamette Confining Unit
Aquifer vs. aquitard
“buffer”
basalt aquifers
river alluvium
alluvial aquifers
Missoula flood gravels
Erratics
Pumping / drawdown
Pump tests
Slug test
Permeability
Storativity
Chemical buffer
Oxidation / reductions
Denitrification
Denitrifying bacteria
Sources of Ground Water Contamination Reading
Heavy metals
Organic chemicals
Chlorinated solvents
Industrial processes
Agricultural pesticides /herbicides
Underground storage tanks
Petroleum hydrocarbons
Land fills
Migration pathways
Risk assessment
Surface impoundments
Deep disposal wells
Septic / sewage wastes
NAPL’s
DNAPL’s
LNAPL’s

Monmouth-Independence Hydrogeology (field trip)
Overview of Hydrogeologic Site Investigations Reading

Site history
Site geology
Site hydrogeology
Aquifer characterization
Contamination assessment
Contaminant characterization
Contaminant distribution
Analysis
Risk assessment
Remediation study
Test borings / monitoring wells
Groundwater flow analysis
Groundwater flow gradients

Groundwater Remediation Reading

Passive vs. active remediation
Source removal
Plume confinement
Bioremediation
Chemical treatment
Natural attenuation
Groundwater flow barriers
Pump-and-treat systems
Capping and isolation
Interceptor trench
Capture zone
Bioremediation
Oxidation
Soil vapor extraction

Upland timber harvesting
Streambank stabilization
In-stream projects
Upland projects
Riparian projects
Klamath basin description
Cascades – Great Basin
Elevation range (high)
Volcanic landscape
Pleistocene lakes
Pluvial lakes
European settlers
Hydroelectric dams
Wetlands vs. uplands
Riparian alteration
Water quality conditions
High nitrogen and phosphorous
High temperatures
Eutrophic conditions
Algal blooms
Fisheries
Klamath sucker
Fisheries decline
Bull trout
Agricultural irrigation projects
Drainage diversion
Over-grazing
Endangered species Act

**Review posters – online for summary of setting and issues associated with Klamath basin**

Klamath Basin Restoration
US Fish and Wildlife Summary
Ecosystem restoration
Riparian habitat
Upland habitat
Wetland restoration
Invasive plant removal
Stream restoration
Fish passages
Habitat enhancement
Upper Klamath location
Lower Klamath location
Water quality degradation
Key Concepts and Lab Skills

Know how to work the groundwater well and aquifer equations. Can you calculate seepage velocity? Porosity? Permeability? Hydraulic gradient?

Can you determine direction of groundwater flow from well records and water depths? Can you identify confined and unconfined aquifers from well records?

Do you know the basics and surfer and what the software does? Can you use surfer to solve a problem and create a groundwater map?

Can you contour groundwater elevation data? If given the depth to water and stick-up elevation, can you determine the groundwater elevation? Can you draw groundwater flow lines once you have a groundwater contour map?

What is the difference between a "confined aquifer" and "unconfined aquifer"? How are porosity and permeability related? What types of earth materials are associated with what types of porosity and permeability? (unconsolidated vs. bedrock?, examples (e.g. gravel vs. clay)).

What are the sources of environmental contamination in the Monmouth-Independence area? What are the controlling factors of groundwater flow in the Mon-Ind area? What are the aquifers?

Do you know how a monitoring well is constructed? Can you draw a diagram showing monitor well construction?

Can you operate surfer, contour data, create a vector map, overlay it on a contour map?

Do you know how to work the groundwater flow problems?

Can you list and discuss the sources of contaminants, types of contaminants, and remediation strategies as applied to the Willamette Valley?

Can you discuss (in an essay question) the hydrogeologic setting of the mid-Willamette Valley?

Can you discuss the geologic setting associated with the Missoula floods?

Can you relate Willamette Valley Hydrogeology to nitrate contamination problems?

Can you discuss the environmental setting and issues associated with the Klamath basin.