

**Environmental Geology Final Lab Portfolio Contents:  
Final Lab Portfolio Due Tuesday June 10, 2003 4:00 PM**

In the order listed, include the following lab and writing exercises in a neat package:

**Lab Work**

Monmouth-Independence In-Class Groundwater Exercise  
Print Outs from Surfer Tutorial Exercise  
Surfer Groundwater Contour Map from Monmouth-Independence In-Class Exercise  
Mtn Fir Lab Part A - Well Log Interpretation  
Mtn Fir Lab Part B - Site Project  
Mass Wasting / Landslide Physics Problem Set

**Presentation Summaries**

Michael Fernandez, "Case Study: Groundwater Remediation at Caltrans Railyard"  
Dan Hafley, "Overview of Voluntary Environmental Remediation Projects"  
Roy Haggerty, "Impacts of the Missoula Floods on Hydrogeology in the Willamette Valley"  
Field Trip to Coffin Butte Landfill near Corvallis  
Dave Montgomery, "Fluvial Disturbance Regimes in Active Volcaniclastic and Glacial Terrains"

**PRELIMINARY – FINAL COPY WILL BE AVAILABLE THURSDAY 6/5/03  
Environmental Geology Spring 2003 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**

*Mass Wasting Hazards*  
force, weight, stress, strength  
normal stress  
shear stress  
cohesive vs. noncohesive  
safety factor  
colluvium  
regolith  
angle of repose  
rock-debris-earth  
slide-fall-flow-topple  
driving mechanisms

*Debris Flow Hazards*

debris flow  
hyperconcentrated flow  
diamicton  
debris slide

newtonian vs. non-newtonian  
fluid  
debris flow vs. lahar  
debris flow hazard in OR

*Landfills / Coffin Butte*

landfill  
solid waste  
liquid waste  
municipal waste  
residual waste  
hazardous waste  
industrial waste  
composting  
sludge ponds  
injection wells  
leachate  
soil contamination

water contamination  
seepage  
surface runoff  
sediment erosion  
erosion control  
air emissions  
fugitive dust  
methane generation  
anerobic bacterial decay  
methane  
groundwater monitoring system  
upgradient  
downgradient  
liner system  
double liner system  
geomembrane  
geotextile  
impermeable barrier  
leachate containment

methane collection system  
fugitive dust control  
air pollution monitoring  
vector control  
erosion and sedimentation  
borrow  
fill  
landfill closure  
remedial action plan  
erosion / sedimentation pond,  
landfill closure,  
daily cover,  
disposal cell,  
buffer zone,  
active life,  
fault / seismic activity,  
seismic impact zone,  
surface water,  
methane monitoring system,  
corrective action,  
primary liner,  
secondary liner,  
drainage layer,  
cover liner,  
leachate treatment,  
gas collection,  
rock quarrying,  
leachate lagoon,  
waste screening,  
radioactive waste,  
permitted and non-permitted  
types of waste,  
biomedical waste,  
geomembrane,  
quarterly water sampling,  
split samples,  
nested monitoring wells,  
wastewater treatment system,  
direct osmosis, reverse osmosis,  
clay liner,  
fire hazard,  
Coffin Butte bedrock setting /  
hydrogeology (fractured basalt,  
pillow basalt, regolith/soil),  
methane extraction well,  
leachate collection system,  
"the bubble",  
sediment ponds

### *Groundwater*

groundwater  
meteoric water  
connate water  
juvenile water  
porosity  
permeability  
horizontal permeability  
vertical permeability  
intergranular porosity  
fracture porosity  
solution cavities  
pendular water  
effective porosity  
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  
unconsolidated aquifer  
consolidated aquifer  
infiltration  
groundwater contamination  
contaminant plume  
well  
monitoring well  
well hydraulics  
total depth  
screened interval  
sand pack  
well casing  
riser pipe  
static water level

depth to water  
drawdown  
hydraulic head  
specific capacity  
pumping rate

### *Monmouth-Independence Hydrogeology*

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

### *Fernandez Case Study Talk*

Community impact  
Community outreach  
Hazardous substances  
Chlorinated solvents  
TCE, perchlorate  
Heavy metals

Cd, Pb, Hg, As  
Loma Prieta Earthquake  
Highway alignment  
Parts per million, mg/kg  
Benzene  
DDT  
MCL (maximum conc. Level)  
RI/FS  
ROD  
Remedial Action  
Risk Assessment  
Cancer Risk =  $1 \times 10^{-4}$   
Industrial Contamination  
sources

*Dan Hafley Talk*

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

*Roy Haggerty / Willamette  
Aquifer*

Willamette silt  
Willamette aquifer  
Gravel aquifer  
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

*Montgomery / Fluvial Talk*

Fluvial disturbance  
Mt. Pinatubo  
Lahar  
Lahar terrace  
Pyroclastic eruption  
Sediment overloading  
Channel aggradation / incision  
Mass wasting  
Channel roughness  
River recovery  
Vegetative recovery  
Geomorphic recovery  
Lahar hazard  
Ecological impact  
Neotectonic uplift  
Neoglaciation  
Glacial outwash  
Glacial dams  
Moraine dammed lakes  
Vertical erosion rates  
Sediment supply  
Catastrophic outburst floods

## Key Concepts and Lab Skills

Know how to work the groundwater well and aquifer equations

Do you know the basics and surfer and what the software does?

What are the primary elements of a Subtitle D landfill? How does the liner system work? How is methane managed? How is leachate managed? Why are the active landfill cells covered with plastic? What is a groundwater monitoring system and how does it work? Why are some types of waste accepted at Coffin Butte, but others are not? What is a monitoring well and why is it important to measure water depth? Do you think it a good idea to actively excavate in old, unknown, military waste? What would be some alternative approaches to determining the type of military waste at Coffin Butte? Why are the basalts underlying Coffin Butte so fractured, faulted, and folded? What is the primary source of permeability in the basalts underlying Coffin Butte?

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? How does the Mon-Ind area relate to the Haggerty and Arendt presentations?

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 physics of landslides 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 Roy Haggerty's presentation to Jack Arendt's presentation, particularly with respect to Willamette Valley Hydrogeology and nitrate distribution?