Environmental Geology Spring 2009 Final Exam Study Guide
Final – Thursday June 11, 2009 – 12-2 PM

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. You will also be using Excel spreadsheet tools.

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 and short-answer terminology. Be prepared to make sketches of diagrams to illustrate your answers.

Key Words

Earthquakes Revisited
earthquake
focus
epicenter
faults
volcanic
normal fault
revers fault
strike-slip fault
fault trace
fault zone
fault segment
rock deformation
ductile, elastic, brittle
stick-slip
aftershock
fault creep
intraplate quakes
plate bound quakes
earthquake intensity vs.
earthquake magnitude
fault slip rate
fault displacement
earthquake recurrence
paleoseismology
seismicity
fault offset
Hazard Variables
- intensity
- duration
- building design
- foundation materials
- written record
- geologic records

Earthquake Hazards Mapping
liquefaction potential
amplification potential
landslide potential

Oregon Seismic Hazards
intraplate quakes
crustal quakes
Cascadia subduction zone
Deep intraplate
shallow crustal
paleoseismic record

Landfills / Coffin Butte
landfill
solid waste
liquid waste
municipal waste
residual waste
hazardous waste
industrial waste
composting
sludge ponds
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
impermeable barrier
leachate containment
methane collection system
air pollution monitoring
vector control
erosion and sedimentation
borrow
fill
erosion / sedimentation pond,
landfill closure,
daily cover,
disposal cell,
active life,
fault / seismic activity,
seismic impact zone,
surface water,
methane monitoring system,
primary liner,
secondary liner,
drainage layer,
cover liner,
leachate treatment,
gas collection,
rock quarrying,
leachate lagoon,
waste screening,
biomedical waste,
quarterly water sampling,
monitoring wells,
wastewater treatment system,
clay liner,
fire hazard,
Coffin Butte bedrock setting /
hydrogeology (fractured basalt,
pillow basalt, regolith/soil),
methane extraction well,
leachate collection system,

E473 Posters

Shivers – Geologic Overview of Cascadia
Cascadia subduction zone
Juan de Fuca-Pacific-NAM plates
Intraplate
Megathrust
Plate locking/release
Faults
Stress fields
Ground acceleration
Holocene faults
Compressive stress

Stephenson – Surficial Geology of Western OR and WA
Surficial sediments
Unconsolidated sediments
Glacio-fluvial = Puget
Puget-Willamette Lowland
Pleistocene
Basin fill
Glacial drift
outwash

Anzalone – Cascadia subduction processes and megathrust
Cascadia subduction zone
Historic seismicity
Paleo-tsunami record
Recurrence interval
Tsunami sand
Buried forests

Moore – Intraplate / crustal faulting
Crustal fault
Intraplate faults
Seismic hazards

Stanley – Historic seismicity and neotectonics
Cascadia subducton zone
Crustal faulting
Intraplate
Megathrust
Seismicity
Active faulting
Klamath falls
Active faulting
Megathrust

VanNice – Ground shaking hazards
Ground shaking
Acceleration
Ground motion
Wave amplification
Ground motion modelling

McLeod – Coseismic Landslides
Landslide
Lidar
Ground shaking
Landslide mapping
Coseismic

Tondreau – Liquefaction hazards
Soil strength
Water table
Saturated/unsaturated
Cohesive soils
Liquefaction
Flowing sands

Wong – Seismic Hazard Reduction
Hazard reduction
Building retrofit
Hazard mapping

Vincent – Earthquake Preparedness
Preparedness
Retrofit
Community outreach
Awareness
Emergency planning

Adams – Seismic Hazards of Seattle
Seattle fault
Nisqually EQ 2001
Seattle Basin
Intraplate seismicity

Jaeger – Seismic Hazards of Tacoma
Tacoma
Fault scarps
Lidar
Bare Earth DEM
Nisqually EQ 2001
Tsunami record
Paleoseismology
Fault trench

Pratt – Seismic Hazards of Portland
Portland Basin
Portland Hills Fault
Seismic hazards mapping
Liquefaction
Coseismic landsliding
Ground shaking
Seismic modelling

Johnson – Seismic Hazards of Mid-Willamette Valley
Scotts Mills Earthquake M5.7
Crustal faults
Mt. Angel Fault

Boyer – Seismic Hazards of Klamath Falls Area
Klamath basin
Klamath Lake Fault System
1993 Klamath Falls EQ M6
Crustal Faults
Basin&Range
Isoseismal map
Building retrofit

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
static water level
depth to water
drawdown
hydraulic head
specific capacity
pumping rate

Dallas ASR/WTP Field Trip
ASR – aquifer storage recovery
WTP – water treatment plant
Settling basin
Flocculation ("flocc")
Total dissolved solid
Total suspended solids
Chlorination
Biologic contaminants
Alkalinity
pH – acidity
filtration process
water tank
water use
daily water production
MGD – million gallons / day
Public water supply
Drinking water supply
Wastewater treatment
Head
Weight density of water = 62.4 lb/cu. ft
Activated carbon
Flocculation tank
Reservoir
Rickreall watershed
Luckiamute Watershed
Dallas municiple water supply
Pumping rate
Siletz River Volcanics
Yamhill Formation
Willamette Silt
Marine sedimentary rock
Connate water
Saline conditions
Salinity
Observation well
Monitoring well
Pumping well
ASR well
Total bore hole
Borehole diameter
Aquifer storage
Aquifer recharge
Static water level
Aquifer
Confining Unit
Basement Unit
Permeability
Porosity
Fracture porosity
Pump test
Drawdown
Well testing
Well head
Drillers log
Bedrock geology
Quaternary gravel
Unconsolidated fluvial deposits
Rotary drilling / coring
Pumping rate
Discharge rate
Vol/time
Drawdown-recovery
Aquifer model

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
urbanization
Alluvial Fill
Willamette Gravels
Willamette Aquifer
Willamette Silt
Western Cascades Volcanics
High Cascades Volcanics
hydrogeologic setting
Quaternary alluvium
Quaternary older alluvium
Quaternary terrrace 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
agricultural practice
pesticide / herbicide
land use
production wells
municipal well supply
gravel aquifer

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

Possible essay questions and other concepts

What is the difference between geologic hazard and risk?

List and discuss anthropogenic vs. natural environmental geology problems.

List and discuss the types of environmental hazards (natural and manmade) in Oregon / PNW.

LANDFILLS

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 wasted 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?

Key Concepts and Lab Skills

Be able to apply basic physics and geology principles to quantitative-style problem solving.
Be able to do unit conversions from English to metric units?
Be able to problem solve using your notes and calculator.

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

Can you work volume and rate problems? Discharge and flow? Can you solve Darcy's law? Can you sketch Darcy's experiment?

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 Dallas-Monmouth area? What are the controlling factors of groundwater flow in the area? What are the aquifers?

Do you know how a monitoring and production well are constructed? Can you draw a diagram showing well construction?

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 Willamette basin?

Groundwater and Regional Planning Lab Exercise – Key Words
Groundwater, water table, slope/gradient, flooding, depth to bedrock, permeability, shale, limestone, sandstone, outwash, gravel, sand, dip, rock strength, geologic formation, shrink-swell soils (clay), septic drainage, infiltration capability

Groundwater Hydrology Lab Exercise – Key Words
Groundwater, hydrologic cycle, water quality, water quantity, primary porosity, secondary porosity, permeability, hydraulic conductivity, darcy's law, effective porosity, water table, unconfined aquifer, confined aquifer, artesian well, flowing artesian well, aquifer recharge, till, gravel, sand, clay, shale, limestone, regolith, depth, elevation, well log, water table map, geoligic map, geologic cross-section

Possible essay questions and other concepts

List and discuss the types of earthquakes associated with the Pacific Northwest

Discuss the concept of paleoseismology, it's application to hazards mitigation, and the types of records that contribute to the paleoseismic data set for Oregon.

Discuss the types of hazards associated with seismic events in the PNW.

List and discuss anthropogenic vs. natural environmental geology problems.

List and discuss the types of environmental hazards (natural and manmade) in Oregon / PNW.

List and discuss the sources of anthropogenic contaminants in the Willamette Valley