

Environmental Geology Spring 2011 Final Exam Study Guide

Final – Tuesday June 7, 2011 – 3-5 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.

Make sure you go over the groundwater problem 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

Hydrologic Cycle / Water

Budget

hydrology
spatial scale
temporal scale
mass
energy
flux
mass transfer functions
evaporation
condensation
precipitation
runoff
infiltration
transpiration
deterministic vs. stochastic processes
hydrologic cycle (sketch it)
convection
advection
groundwater
surface water
global water storage
residence time
compartments
oceans
groundwater
lakes
glaciers
ice caps
transpiration
evapotranspiration
runoff
infiltration
vegetative interception
ice sheets
oceans
springs

soil moisture
atmospheric moisture
fresh water storage

Tectonic Framework of the Willamette Valley

Cascadia subduction zone
Cascadia volcanic arc
Coast range
Willamette Valley
Forearc basin
Oblique convergence
Clockwise rotation
Arc volcanism
Accretionary uplift
Subducting slab
Juan de Fuca plate
NAM plate
Siletz river volcanics
Tyee Formation
Yamhill formation
Western Cascade Volcanism
High Cascade volcanism
Fault-folds

Physiographic Framework of Willamette Lowland Aquifer System

Willamette Aquifer System
Basement confining unit
Columbia river basalt
Willamette confining
Willamette Aquifer
Willamette Silt
Unconsolidated valley fill
Valley-fill alluvium
Fractured basalt aquifer

Gravel aquifers
Missoula flood silt

Quaternary Geology and Geomorphology

Bedrock
Basin-fill sediment
Floodplain sediment
Terrace sediment
Active channels
Holocene
Quaternary
Missoula flood deposits
Terrace gravels
Willamette alluvium
Isopach maps
Willamette Silt
Portland Basin Gravels
Central-Southern Valley silts

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

Monmouth-Independence Hydrogeology(field trip)

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

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 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
agricultural practice
pesticide / herbicide
land use
production wells
municipal well supply
gravel aquifer

Water Wells / Drilling

Hollow stem auger
Cable tool drilling
Air rotary drilling
“Casing”
“Well Screen”
Grout
Slotted screen
Riser pipe
Sand pack
Tri-cone rotary bit
Well log
Drillers log
Total depth
Bore-hole diameter
Annular diameter
SWL
TD
Static water level
DTW
Depth to water
Datum

know what a well installation
looks like (be able to sketch it)

drill rig
hollow stem auger
well screen
well riser
well diameter
static water level
pumping water level

**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

**Overview of Site
Investigations and
Groundwater Remediation**

Site history
Site geology
Site hydrogeology
Aquifer characterization
Contamination assessment
Contaminant characterization
Contaminant distribution
LNAPLs
DNAPLs
Soil sampling
Water sampling
Monitoring well construction
Contaminant plume
Groundwater plume
Vapor phase
Liquid phase
Soluble phase
“free product”
Analysis
Risk assessment
Remediation study
Passive vs. active remediation
Source removal
Plume confinement
Bioremediation
Chemical treatment

Natural attenuation
Waste Isolation
Pump-and-treat systems
Capping and isolation
Bioremediation
Soil vapor extraction

AEG Student Night Posters –

Prepare to answer a ½-1 page essay question on your top 5 favorite poster topics encountered at AEG student night. Use the web resources and meeting abstracts to prepare to answer this question.

**The Oregon Water
Conference –**

Prepare to answer a ½-1 page essay question on your top 5 favorite topics encountered at the Oregon Water Conference. Use the web resources and meeting abstracts to prepare to answer this question.

WOU Academic Showcase

Prepare to answer a ½-1 page essay question on your top 5 favorite showcase topics encountered at WOU academic showcase. Use the web resources and meeting abstracts to prepare to answer this question.

**Jeff McDonnell Presentation:
“Where does water go when it rains”**

Water cycle
hydrology
spatial scale
temporal scale
mass
energy

flux
mass transfer functions
evaporation
condensation
precipitation
runoff
infiltration
transpiration

Rainfall-runoff
Hydrograph

Bedrock aquifers
Catchments
Headwater
Watersheds
Drainage basins
Stable isotopes
Oxygen 18/16
Residence time
“old water problem”
Western cascades storage times
Georgia storage times
New Zealand storage times
Bedrock controls
Porosity
Permeability
Surface-ground water blending
Percentage surface runoff

Focus: use notes, web resources, readings to answer an essay question on the “old water problem”

Key Concepts / Skills / 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

What are the range and types of anthropogenic groundwater and soil contaminant sources in the western Oregon region..

What is the nature of the Willamette Valley “nitrate problem”, where does it occur and why? What are the geologic controls?

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 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, geologic map, geologic cross-section

Possible essay questions and other concepts

Describe, sketch, map, draw cross-sections of the regional hydrogeologic setting of the Willamette Valley. Include concepts of Willamette Aquifer, Willamette Confining Unit, Willamette Silts, Basement Confining Unit, CRB's, Marine Sedimentary Units.

Identify, list, and describe the major aquifer / aquitard units in the Willamette Valley. Discuss the Missoula Flood history and deposits of the Willamette Valley.

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

Expect a summary essay questions from the AEG student night, WOU Academic Showcase, the Oregon Water Conference, and the presentation by Jeff McDonnell from OSU. How do any and all of these related to "Environmental Geology"?