Environmental Geology Spring 2018 Final Exam Study Guide
Final – Tuesday June 12, 2018 – 12 PM, NS218

The Final Exam will be in 2 parts. Part 1 is closed book with short answer and long answer essay questions. Part 2 involves the open book lab skills portion. You will be able to use your notes, conversion charts, answer keys, etc. to work on Part 2 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. Be prepared to make sketches of diagrams to illustrate your answers.

Class Notes to Review:

River Restoration
http://www.wou.edu/las/physci/taylor/g473/river_restoration_summary_notes.pdf

Intro to Groundwater
http://www.wou.edu/las/physci/taylor/g473/gwovrvw.pdf

Landfills and Waste Management
http://www.wou.edu/las/physci/taylor/g473/landfill.pdf
http://www.wou.edu/las/physci/taylor/g473/coffin_butte.pdf
http://www.wou.edu/las/physci/taylor/g473/coffnote.pdf

Text Chapters (Moodle) / Readings (Web Site – Class Handouts):

Chapter 11 - Water Pollution (Moodle Textbook Chapter)
http://www.wou.edu/las/physci/taylor/g473/Chapter11_Water_Pollution.docx

Chapter 12 - Waste Management (Moodle Textbook Chapter)
http://www.wou.edu/las/physci/taylor/g473/Chapter12_Waste_Management.docx

Summary Reading - Woodward et al., Hydrogeologic Framework of Southern Willamette Valley
http://www.wou.edu/las/physci/taylor/g473/hydrogeo_willamette_valley.pdf

Reading: Sources and Types of Ground Water Contamination (part 1)
http://www.wou.edu/las/physci/taylor/g473/gw_cont_sources.pdf

Reading: Ground Water Remediation Techniques
http://www.wou.edu/las/physci/taylor/g473/gwcont4.pdf

Supporting Video Study Content:

Solid Waste Management http://www.wou.edu/las/physci/taylor/g473/SolidWasteManagement.mpeg
River Restoration Basics https://www.youtube.com/watch?v=CsayzeejVzY
Basics of Darcy's Law https://www.youtube.com/watch?v=mb8clQdvrvo
Water Well Drilling / Systems http://www.youtube.com/watch?v=8K6V450StO4
Hanford Remediation Techniques http://www.youtube.com/watch?v=LYt9yYNJQDc

Key Words

AEG Poster / River Restoration

Anadromous fish
Salmonid
Coho-Chinook-Steelhead
Channel complexity
Channel habitat
Channel pattern (straight, meandering, braided)
Debris flow
Drainage basin
Disturbance (fire-flood-slide)
Downcutting / incision
Estuary
Fish life cycle (spawning-rearing-fry-redd)
Hydrograph
Hyporheic Zone
Peak flow
Floodplain
Large woody debris (LWD)
Low flow-high flow
Recurrence interval
Recruitment of LWD
Redd
Resident fish
Riparian zone
Critical habitat
Degraded streams
Channel narrowing
Urbanization
Ecosystem services
Nutrient cycling
Riparian vegetation
Fish passage
Culverts
Rip-rap
Side channel
Floodplain
In-Channel Modification
Wood-boulder placement
Off-channel habitat
Nutrient loading
Stream canopy/shading

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

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

Geologic Framework of Willamette Lowland Aquifer System

Cacadia subduction zone
Cascadia volcanic arc
Coast range
Willamette Valley
Arc volcanism
Accretionary uplift
Subducting slab
Juan de Fuca plate
NAM plate
Siletz river volcanics

Tyee Formation
Yamhill formation
Spencer Formation
Western Cascade Volcanism
High Cascade volcanism
Fault-fold
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
Bedrock / Basement
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
Gravel aquifer

Academic Showcase: ES407 Glaciation and Climate Change
glaciers
snowfields
snow-firn-ice
global ice budget
alpine glaciers
continental glaciers
cirque glaciers
ice sheets
ice shelf
temperate glacier
polar glacier
basal slip
internal ice flow
crevasse / fracture
transverse crevasse
longitudinal crevasse
glacial surging
snow line
zone of accumulation
zone of ablation
ice advance
ice retreat
static equilibrium
glacial erosion
u-shape valleys
v-shape valleys
hanging valleys
glacial pavement
drift
till
outwash
sorted / stratified
unsorted / unstratified
moraine
lateral moraine
medial moraine
end moraine
terminal moraine
recessional moraine
ground moraine
glacial erratics
outwash plain
glacial climate
interglacial climate
climate change
Pleistocene glaciation
Oxygen Isotope record
Laurentide Ice Sheet
Glacial / Pluvial Lakes
Milankovitch Theory

Landfills / Coffin Butte
RCRA Subtitle D
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,

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

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

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..

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

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?

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 and the Senior Seminar Presentations.

List and discuss examples of remediation technology used at Hanford