Name:_____ **Lab Section:**_____

CRSS/FORS 3060, Fall semester, 2008

EXAM 4, Novmeber 20, 2008 **Total Points:** 96

I. Matching. 1 pt. each

1. ____ Crusting
2. ____ Percolation rate
3. ____ Infiltration rate
4. ____ Rating curve
5. ____ SCS Curve Number Method
6. ____ Water table
7. ____ BMPs
8. ____ Artesian Well
9. ____ Riparian zone
10. ____ Confined aquifer
11. ____ Tile drain
12. ____ Watershed
13. ____ Regional regression equations for GA
14. ____ Baseflow

A. Groundwater that flows beneath streams.
B. Estimates peak flow rates based on basin area alone
C. Calculates flow based on channel geometery
D. Stream flows that occur between rainstorms
E. Increases as rainfall continues
G. Percolated water that reaches the water table
H. A well that drives a center-pivot irrigation system
I. Necessary for permitting a clay landfill liner.
J. A well that flows without a pump
K. Fully saturated between aquitards or aquicludes
L. Used to assess soil suitability for a septic system
M. Land adjacent to streams or rivers
N. A buried perforated pipe used to lower water tables
O. Relates river flow to stage or gage height
P. 3-dimensional surface connecting water levels in wells
Q. Model for estimating runoff depths and volumes
R. Well located in a riparian zone
S. All the land that drains to a point in a stream
T. Macropore clogging by fine detached soil particles
U. Management practices that reduce pollution from land use activities

II. True or False. 1 pt. each.

15._____ Soil water pressures are positive below the water table
16._____ Water quality in an unconfined aquifer is very sensitive to land surface pollution
17._____ Pumping of groundwater has no effect on streamflows
18._____ Compaction of soil by livestock reduces infiltration rates and increases overland flow
19._____ Because of groundwater discharge, river flows remain constant between storms
20._____ Hydrologic alteration by urbanization is caused only by paved surfaces
21._____ Sediment transport is a normal function of natural rivers
22._____ Dissolved oxygen levels in rivers oscillate every day, reaching a maximum in late afternoon
23._____ Average surface erosion during the cotton farming era was less than 4 inches
24._____ Row crop agriculture accounts for most of the soil loss in the United States

I. Fill-in. Write a word, phrase, etc. in the blank that best fits the description; (2 pts. each)

25. _____ Flow that has a 10% chance of being equalled or exceeded in any year.
26. _____ Water quality parameter that measures light transmission, a surrogate for sediment
27. _____ Planting new crops through the residues of old crops
28. _____ Range of tolerable erosion rates for Piedmont soils.
29. _____ A shallow erosional channel created by concentrated overland flow
30. _____ (average velocity) x (cross sectional area) = what?
31. _____ Water quality characteristic that has little direct ecological or toxicological meaning, but is a useful indicator of water quality problems. Values are 35-45 micro-siemens/cm for forested Piedmont streams.

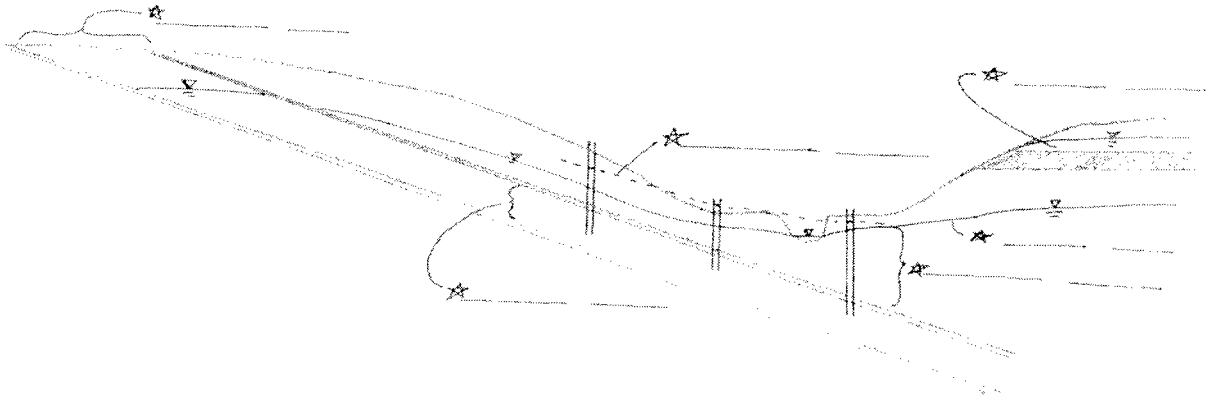
II. Short Answer

32. What is the best way to reduce erosion from a field of row crops, and what are two other ways to reduce erosion from row crops? (4 pts)

33. Why do rivers and large streams throughout the Piedmont (not just in urban areas) flow turbid most of the year? Try to list and briefly explain at least three present or historical landscape and soil characteristics that explain the high turbidity of Piedmont streams. (6 points).

34. Draw a cross-section of a Piedmont hillslope leading to a stream. Show and name the five streamflow generation processes. (6 pts)

35. Fill in the blanks on the aquifer schematic below. (6pts)



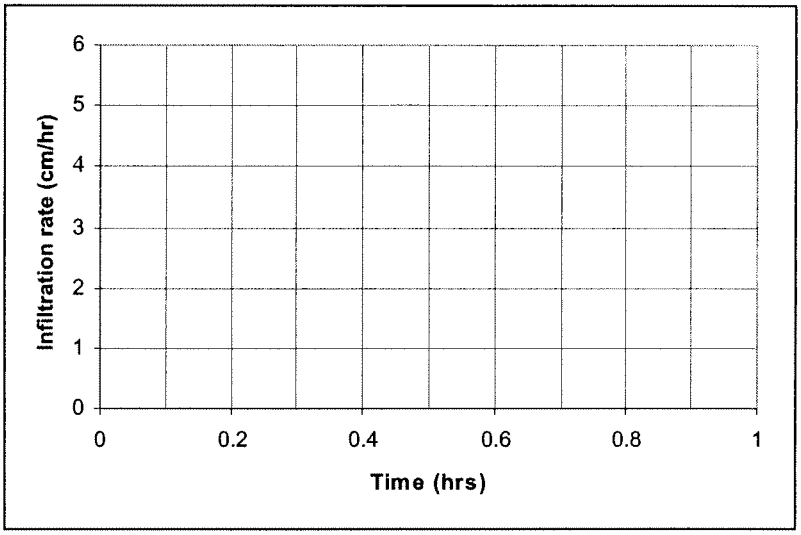
36. The Universal Soil Loss Equation (USLE) predicts average annual erosion (tons/acre/year) based on landscape characteristics and management practices. Fill in the table below with each factor in the USLE equation, whether it can be managed by humans, and, if it can be managed, how can it be managed? (9 pts)

Factor	Manageable (yes or no)?	How? (Don't answer if it can't be managed)

III. Calculations. SHOW YOUR WORK, INCLUDING EQUATIONS

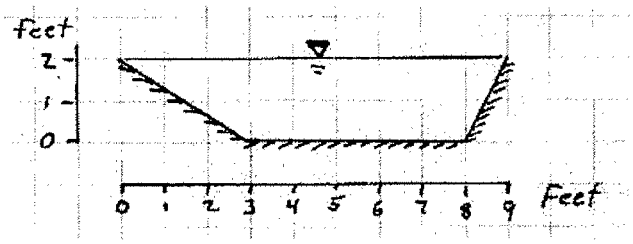
37. The data below are from a rainfall simulator experiment on a <u>mulched</u> soil. Every 0.1 hours, runoff from the soil pan is measured. The pan dimensions are 20 cm by 50 cm. The rainfall rate is 5 cm/hour. Complete the table. Draw the infiltration versus time curve on the axes below. What is the saturated hydraulic conductivity of the mulched soil? Draw another infiltration curve for the same soil without mulch (bare soil). (10 pts)

Elapsed Time (hrs)	Runoff volume (cm^3)	Runoff Rate (cm/hr)	Infiltration Rate (cm/hr)
0.1	0		
0.2	0		
0.3	80		
0.4	120		
0.5	150		
0.6	175		
0.7	190		
0.8	200		
0.9	200		



Show equations:

38. The channel below (each square is a foot) has a slope of 0.005, and a Manning's roughness coefficient of 0.04. a). What is the flow in the channel? (7 pts)



b). What is the average channel velocity? (2 pts)

39. A farmer has worn out a field in North Georgia, so he can't make any more money from crops because he has too little topsoil. The rainfall erosivity for 270. The topsoil is a sandy loam with 0.5% humus. The LS factor is 0.354. The farmer is planting the field in pine trees in order to restore the soils. a). What will be the erosion rate for a mature forest with full ground cover and canopy cover? b). What if the organic matter content increases to 2%? c). If topsoil forms at the rate of 3 tons/acre/yr, how long will it take to "grow" six inches of topsoil (first figure out the net annual soil accumulation)? Assume an AFS weighs 1000 tons. (6 pts)

Crop factors (C factors) for forest lands

canopy cover (%)	Litter cover (%)	C
20 to 40	40 to 70	0.006
45 to 70	75 to 85	0.003
75 yo 100	90 to 100	0.0005

Soil erodibility factor, K

	organic matter content (%)		
Textural class	0.5%	2.0%	4.0%
fine sand	0.16	0.14	0.10
loamy sand	0.12	0.10	0.08
sandy loam	0.27	0.24	0.19
silt loam	0.48	0.42	0.33
clay loam	0.28	0.25	0.21

40. The figure below shows the hydraulic heads in the Gordon aquifer in the vicinity of the Savannah River below Augusta. Draw or imagine a line connecting the two Zs on the map below. Using Darcy's Law, calculate the flow of groundwater crossing that line. Also, draw arrows showing the direction of groundwater flow in the vicinity of the line. Assume the thickness of the aquifer is 100 feet, and the saturated hydraulic conductivity is 0.0005 ft/sec. (7pts)