

CE440
Homework #4
Due Monday, Oct. 3, 2005

Please state and briefly discuss or justify any necessary assumptions.

Problem 1.

Using the USLE, estimate the annual erosion from a 100 ha. forested catchment in central Colorado assuming the following:

- the forest is in fair condition with 40% cover;
- the slope is 3%;
- the catchment consists of 25 source areas of identical characteristics--each is approximately 200 m square
- the soils are clay loam in hydrologic group C.

Problem 2.

Estimate the annual sediment delivery to the outlet of a 1000 ha watershed comprised of multiple 100 ha source areas, each with the characteristics listed above for Problem 1. Assume that the topography of each source area has the form of Figure 4.22(a) in the text.

Problem 3.

Estimate the runoff in cm and in m^3 , average depth of infiltration in cm, and erosion in kg from a single 6-cm rainfall event occurring in 1.5 hours on the catchment described above in Problem 1. There was no rainfall on the catchment in the week preceding the 6-cm rain.

Investigate how the single-event erosion changes depending on the assumed shape of the rainfall hyetograph (hydrograph) by comparing the erosion from the constant-intensity storm above to a storm of 6 cm/hour for the first half hour, 4 cm/hour for the next half hour, and 2.0 cm/hour for the last half hour. Briefly discuss your findings.

Problem 4.

A two hour rainfall event steadily delivers 2.5 cm/hr to a 150 hectare watershed with the following characteristics:

- 50 hectares are ½ acre residential lots, hydrologic soil group B, 25% imperviousness
- 100 hectares are row crops (corn, contoured, good condition, hydrologic group C)
- Antecedent soil moisture condition is AMC II
- The soils are loam with 2% organic matter
- The slope is 2% with slope length 100m → Assume LS factor = 0.25

a) Use a weighted average CN to estimate the average excess rainfall (Q) in mm over the entire 150 ha area for:

- i) the first 30 minutes of the storm, and
- ii) the entire storm.

b) Estimate the **gross** erosion from the **row crops** (not the residential area) during this event

in metric tonnes / ha.

- c) Estimate the clay enrichment ratio if the sediment transported in the storm runoff is composed of 40% clay.
- d) Assuming a sediment delivery ratio of 45%, provide a **rough** estimate of the average sediment concentration delivered from the row crops to the watershed outlet during this event. Express your answer in mg/liter.

Problem 5.

Determine the annual soil loss for a field a few miles east of Fort Collins if the soil is silty clay loam, 2% organic matter, field length = 150m, slope = 4 percent, C = 0.25, and up and down the slope farming is practiced. What conservation practice(s) could be adopted if the soil loss is to be reduced by at least 50%? 70%?

Reference for some of the above problems

Soil and Water Conservation Engineering

by G. O. Schwab, R. K. Frevert, T. W. Edminster, and K. K. Barnes
John Wiley and Sons