

ESR 320
ENVIRONMENTAL SYSTEMS I
Problem Set 3
[DUE THURSDAY 10/29/2009]

1. A new housing development needs a culvert to divert away stormwater. The rectangular culvert is made of ordinary concrete and has a width of 6.0 ft. The slope of the culvert is 0.001. The typical roughness coefficient for concrete is 0.013.

After a heavy rainstorm, an 8-inch deep flow of water is measured in the culvert. Assume uniform, steady flow and use Manning's Equation to solve the following.

- A. What is the average velocity of the water in ft/s?
- B. What is the discharge (volumetric flow) in ft^3/s ?

2. Samples of the storm water reveal that it contains 55 ppb of Atrazine (an herbicide), 15 micrograms/L of phosphorus (P), and 1.2 mg/L of nitrogen (N). These are all believed to come from application of lawn fertilizers.

- A. What is the total mass flow for each of the three constituents in units of g/day in the culvert during the flow conditions described above?