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1.061 / 1.61 Transport Processes in the Environment  
Fall 2008

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**Problem 8.1**

Describe the following processes: diffusion, advection and dispersion

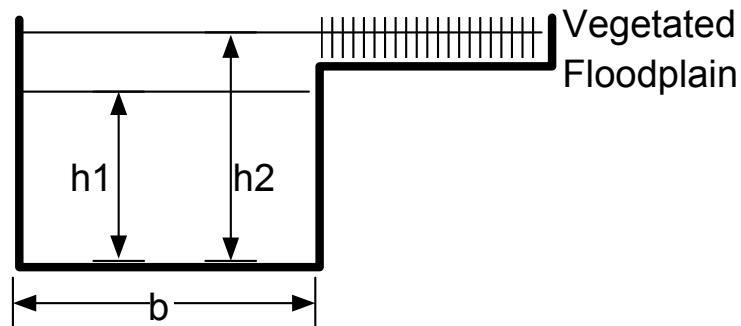
**Problem 8.2**

The bed slope of a wide river changes from  $S_1$  to  $S_2$ , where  $S_2 < S_1$ . Assume the channel substrate is the same in both sections. For steady, uniform flow in both reaches, determine which section has the greater longitudinal dispersion? Consider two cases,

- a) the channel depth is constant
- b) the channel width is constant

**Problem 8.3**

The cross-section below corresponds to a long, straight river, and is identical along the entire river. When the flow depth is  $h_1$ , the channel cross-section is rectangular. When the flow depth is  $h_2$ , the flood plain becomes part of the channel. Assume that the same flow rate,  $Q$ , is observed under both conditions. Will the longitudinal dispersion change as the flow depth changes from  $h_1$  to  $h_2$ ? Provide an explanation with sketches.



**Problem 8.4**

A small slug of tracer is released at mid-channel, shown below. The channel is very deep, such that vertical shear and vertical domain limits can be neglected. The channel width is  $B$ , and isotropic diffusivity  $D$ . Describe the evolution of this cloud at  $t_1 \ll B^2/4D$  and  $t_2 \gg 0.4 B^2/D$ . For each time period, describe the shape of the cloud and the rate at which its length increases.

