

1 Problem Class, 5 Dec

1.1 Question 1

The floor of a channel of width d_1 is slowly rising with an amount of $D > 0$ and its width is slowly increasing or decreasing to a width d_2 . The incoming flow has velocity U_1 , water surface height H_1 and changing to U_2, H_2 .

(a) Show that if the total surface level remains unchanged (i.e. $H_1 = H_2 + D$), then the velocity is also unchanged. Show that the width of the channel must increase in such a scenario.

(b) Show that in the limit where the flow enters an ‘infinite reservoir’ (i.e. $d_2 \rightarrow \infty$), the height of the water column rises (i.e. $H_1 < H_2$) if and only if $\frac{U_1}{\sqrt{2gD}} > 1$.