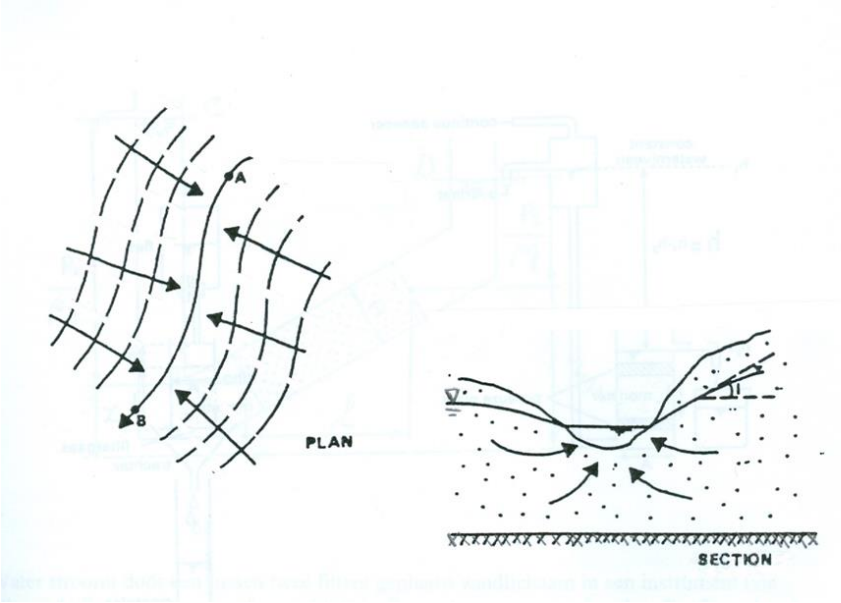
Exercise 5.4.3

The discharge of a river at an upstream measuring station A equals 100 $m^3 s^{-1}$.

The discharge at a downstream measuring station B equals 120 $m^3 s^{-1}$.

In one hour, the storage in the river between these two stations reduces by 45000 m^3.

The discharge at the upstream station A after one hour is 110 $m^3 s^{-1}$.



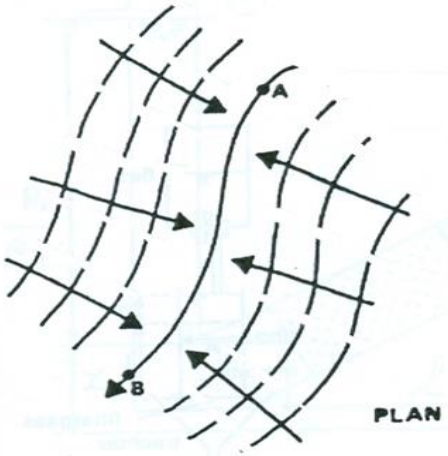
Assuming a linear change of the discharge with time, determine the discharge in $m^3 s^{-1}$ at the downstream station B after one hour.

Surface water hydraulics

Answer 5.4.3

Set up a water balance for the river in-between A and B

for the time interval Δt = 1 hour: $\overline{Q}_{IN} = \overline{Q}_{OUT} + \frac{\Delta S}{\Delta t}$



Q_A at start = 100 $m^3 s^{-1}$; Q_A after one hour = 110 $m^3 s^{-1}$

Average Q_{IN} during Δt = 1 hour equals 105 $m^3 s^{-1}$

Q_B at start = 120 $m^3 s^{-1}$; Q_B after one hour = Q_B $m^3 s^{-1}$

Average Q_{OUT} during Δt = 1 hour equals (120 + Q_B) / 2 $m^3 s^{-1}$ = 60 + ½ Q_B $m^3 s^{-1}$

Change in storage $\Delta S/\Delta t$ = –45000 m^3 / 3600 s = –12.5 $m^3 s^{-1}$

105 = 60 + ½ Q_B – 12.5 ½ Q_B = 57.5 $m^3 s^{-1}$

Answer: Q_B = 115 $m^3 s^{-1}$