

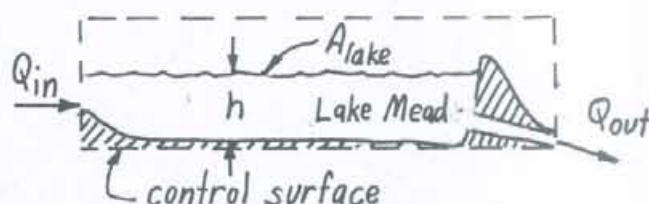
5.30

5.30 The Hoover Dam (see Video V2.4) backs up the Colorado River and creates Lake Mead, which is approximately 115 miles long and has a surface area of approximately 225 square miles. If during flood conditions the Colorado River flows into the lake at a rate of 45,000 cfs and the outflow from the dam is 8000 cfs, how many feet per 24-hour day will the lake level rise?

For the control volume shown:

$$\dot{m}_{in} - \dot{m}_{out} = \frac{\partial}{\partial t} \int_{cv} \rho dV$$

or since $\dot{m} = \rho Q$,



$$Q_{in} - Q_{out} = \frac{\partial}{\partial t} (A_{lake} h) = A_{lake} \frac{dh}{dt}$$

Thus,

$$\frac{dh}{dt} = \frac{Q_{out} - Q_{in}}{A_{lake}} = \frac{(45,000 - 8,000) \frac{ft^3}{s}}{225 mi^2 \left(5280 \frac{ft}{mi}\right)^2} = 5.90 \times 10^{-6} \frac{in.}{s}$$

$$= 5.90 \times 10^{-6} \frac{in.}{s} \left(3,600 \frac{s}{hr}\right) \left(24 \frac{hr}{day}\right) = \underline{\underline{0.510 \frac{ft}{day}}}$$