8.60 Water flows from the nozzle attached to the spray tank shown in Fig. P8.60. Determine the flowrate if the loss coefficient for the nozzle (based on upstream conditions) is 0.75 and the friction factor for the rough hose is 0.11.

\[
\frac{\rho_1}{2g} + \frac{V_1^2}{2g} + Z_1 = \frac{\rho_2}{2g} + \frac{V_2^2}{2g} + Z_2 + (f \frac{L}{D} + K_c) \frac{V_2^2}{2g}, \quad \text{where} \quad \rho_1 = 150 kPa, \rho_2 = 0, \quad (1)
\]

\[Z_1 = 0.8 m, \quad Z_2 = L \sin 40^\circ = (1.9 m) \sin 40^\circ = 1.22 m, \quad V_1 = 0,\]

\[V = \frac{Q}{A}, \quad \text{and} \quad V_2 = \frac{Q}{A_2} = \left(\frac{A}{A_2}\right) V = \left(\frac{15 \text{mm}}{7.5 \text{mm}}\right)^2 V = 4V\]

Thus, with \( f = 0.11 \) and \( K_c = 0.75 \) Eq. (1) gives

\[
\frac{150 \times 10^3 \frac{m^3}{s}}{9.8 \times 10^3 \frac{m^3}{s^2}} + 0.8 m = 1.22 m + \left(4^2 + 0.11 \left(\frac{1.9 m}{0.015 m}\right) + 0.75\right) \frac{V^2}{2(9.81 \frac{m^3}{s^2})}
\]

or

\[V = 3.09 \frac{m}{s}\]

Thus, \[Q = AV = \frac{A}{4} (0.015 m)^2 (3.09 \frac{m}{s}) = 5.46 \times 10^{-4} m^3/s\]