



a)  $Q = 3,6 \text{ m}^3/\text{s}$

$$F_2 = 1 \quad B = 2h_c \quad \frac{Q^2 \cdot B}{g \cdot A^3} = 1$$

$$Q^2 \cdot B = g \cdot A^3$$

$$3,6^2 \cdot 2h_c = g \cdot h_c^3$$

$$h_c = \frac{3,6^2 \cdot 2}{9,81} = 2,64$$

$$h_c = 1,214 \text{ m} \quad \checkmark$$

b)  $h_2 = \left(1 + \frac{2,4}{30}\right) \cdot h_c = 2,1852 \text{ m}$

$$I_1 + P_1 = I_2 + P_2$$

$$\rho \cdot Q \cdot v_1 + \rho \cdot h_1 \cdot A_1 = \rho \cdot Q \cdot v_2 + \rho \cdot h_2 \cdot A_2 \quad v_1 = \frac{Q}{A_1} \quad v_2 = \frac{Q}{A_2}$$

$$\rho \cdot \frac{Q^2}{A_1} + \rho \cdot g \cdot h_1 \cdot A_1 = \rho \cdot \frac{Q^2}{A_2} + \rho \cdot g \cdot h_2 \cdot A_2 \quad \checkmark$$

$$\rho \frac{Q^2}{h_1^2} + \frac{1}{3} \rho g h_1 h_1^2 = \rho \frac{Q^2}{h_2^2} + \frac{1}{3} \rho g h_2 h_2^2 \quad | : \rho g$$

$$\frac{Q^2}{g h_1^2} + \frac{h_1^3}{3} = \frac{Q^2}{g h_2^2} + \frac{h_2^3}{3} = \frac{3,6^2}{9,81 \cdot 2,185^2} + \frac{2,185^3}{3} = 3,7548$$

$$\frac{3,6^2}{9,81 h_1^2} + \frac{h_1^3}{3} = 3,7548$$

$$\frac{1,3211}{h_1^2} + \frac{h_1^3}{3} = 3,7548$$

$$h_1 = \sqrt{\frac{1,3211}{3,7548 - h_1^3/3}}$$

$$h_1 = \phi \Rightarrow h_1 = 0,5932 \text{ m} \Rightarrow h_1^2 = 0,5984 \text{ m} \Rightarrow h_1^3 = 0,5986 \text{ m}$$

$$\boxed{h_1 = 0,599 \text{ m}}$$

$$c) E_1 = E_2 + \Delta E_{1-2}$$

$$Z_{\text{dru}} = \phi$$

$$E_1 = h_1 + \frac{V_1^2}{2g} = h_1 + \frac{Q^2}{2g h_1^3} = 0,599 + \frac{3,6^2}{2 \cdot 9,81 \cdot 0,599^3} = 5,730 \text{ m}$$

$$E_2 = h_2 + \frac{V_2^2}{2g} = h_2 + \frac{Q^2}{2g h_2^3} = 2,185 + \frac{3,6^2}{2 \cdot 9,81 \cdot 2,185^3} = 2,214 \text{ m}$$

$$\Delta E = E_1 - E_2 = 5,730 - 2,214 = \boxed{3,516 \text{ m}}$$

$$d) F_R = \frac{Q^2 B}{g A^3} = \frac{Q^2 \cdot 2h}{g \cdot h^5} = \frac{2Q^2}{g h^5}$$

$$F_{R1} = \frac{2 \cdot 3,6^2}{9,81 \cdot 0,599^5} = \boxed{34,26} > 1$$

$$F_{RKR} = \frac{2 \cdot 3,6^2}{9,81 \cdot 1,214^5} = \boxed{1,00}$$

$$F_{R2} = \frac{2 \cdot 3,6^2}{9,81 \cdot 2,185^5} = \boxed{0,0531} < 1$$