IN-CLASS CHANNEL FLOW PROBLEM KEY
NOVEMBER, 2014

$$Q = 150\ A_d^{0.8}$$

(cfs) (m_i^2)

Concrete = 0.001
Channel drop of 72 ft over 13.6 miles

$A_d = 100\ m_i^2$

$V_{EL} = ?$ m/sec

Channel cross-section

$d = 4$ in

$w = 20$ in

$$S = \frac{\text{rise}}{\text{run}} = \frac{72\text{ ft}}{13.6\text{ mi}}\left(\frac{5280\text{ ft}}{\text{mi}}\right) = \left(\frac{72\text{ ft}}{71808\text{ ft}}\right) = 0.001$$

Power = ?

$Q = V \cdot A$

$$Q = 150\,(100\,m_i^2)^{0.8} = 5972\ \frac{ft^3}{sec}$$

$\Omega = QS\gamma$

$\gamma = 9800\ \frac{N}{m^3}$

$S = 0.001$

$$Q = 5972\ \frac{ft^3}{sec}\left(\frac{1\,m}{3.28\,ft}\right)^3 = \frac{57.8}{35.29} = 169\ \frac{m^3}{sec}$$

$$Q = VA = V \cdot w \cdot d \quad V = \frac{Q}{w \cdot d} \Longrightarrow V = \frac{Q}{d \cdot w} = \frac{169\ m^3/sec}{(4\,m)(20\,m)} = 2\ \frac{m}{sec}$$

$$V = \left(2\ \frac{m}{sec}\right)\left(\frac{3.28\,ft}{m}\right) = 7\ \frac{ft}{sec} = 5\ \frac{mi}{hr}$$

$\Omega = QS\gamma$

$$\Omega = \left(169\ \frac{m^3}{sec}\right)(0.001)\left(9800\ \frac{N}{m^3}\right) = 1656\text{ watts}$$