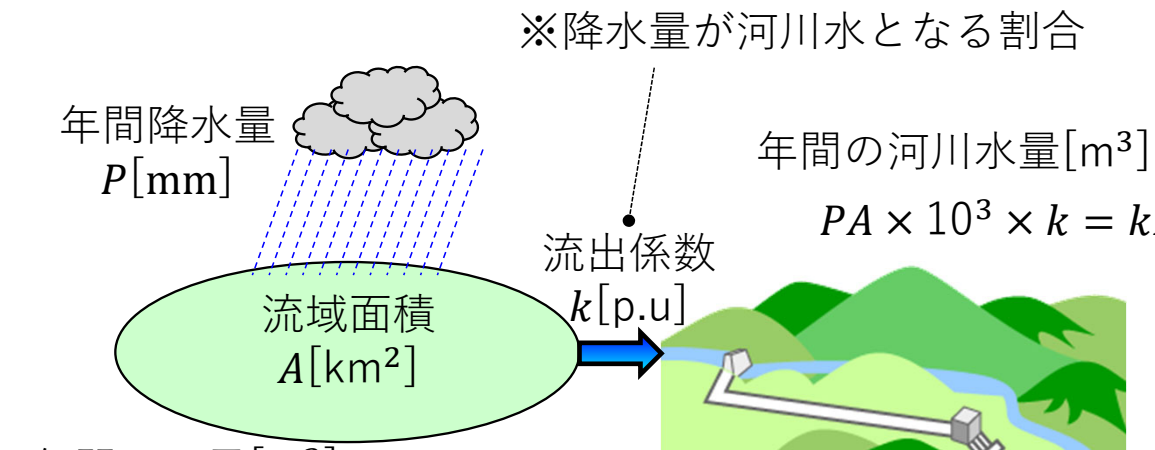
水力発電（５）－１　《河川流量と流況曲線》



年間の河川水量[m³]

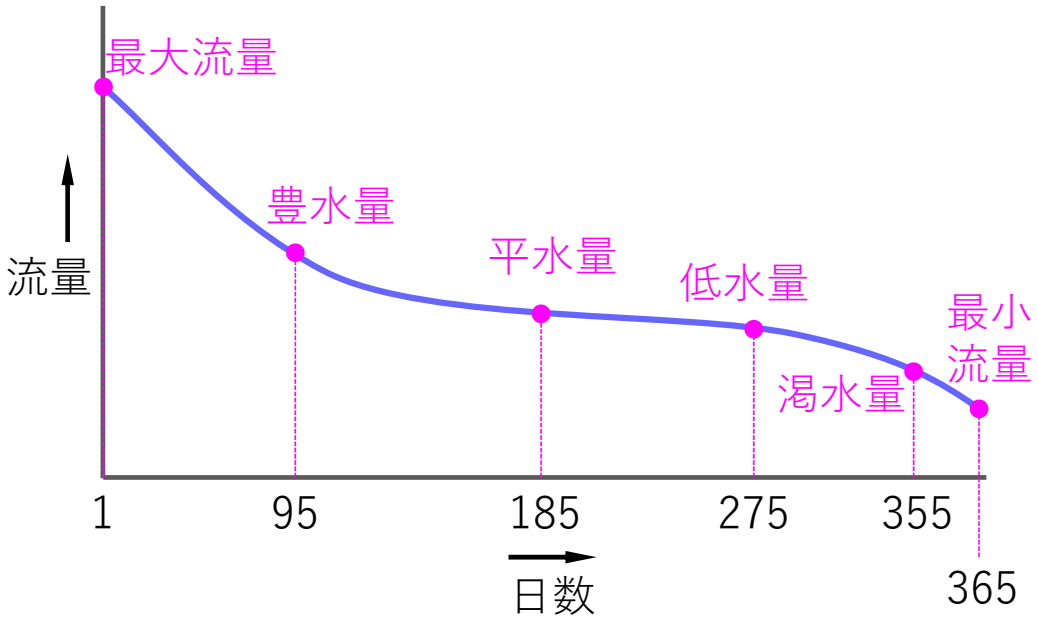
$$PA \times 10^3 \times k = kPA \times 10^3$$

1年間の雨量[m³]

$$\underset{[\mathrm{m}]}{P \times 10^{-3}} \times \underset{[\mathrm{m^2}]}{A \times 10^6} = \underset{[\mathrm{m^3}]}{PA \times 10^3}$$

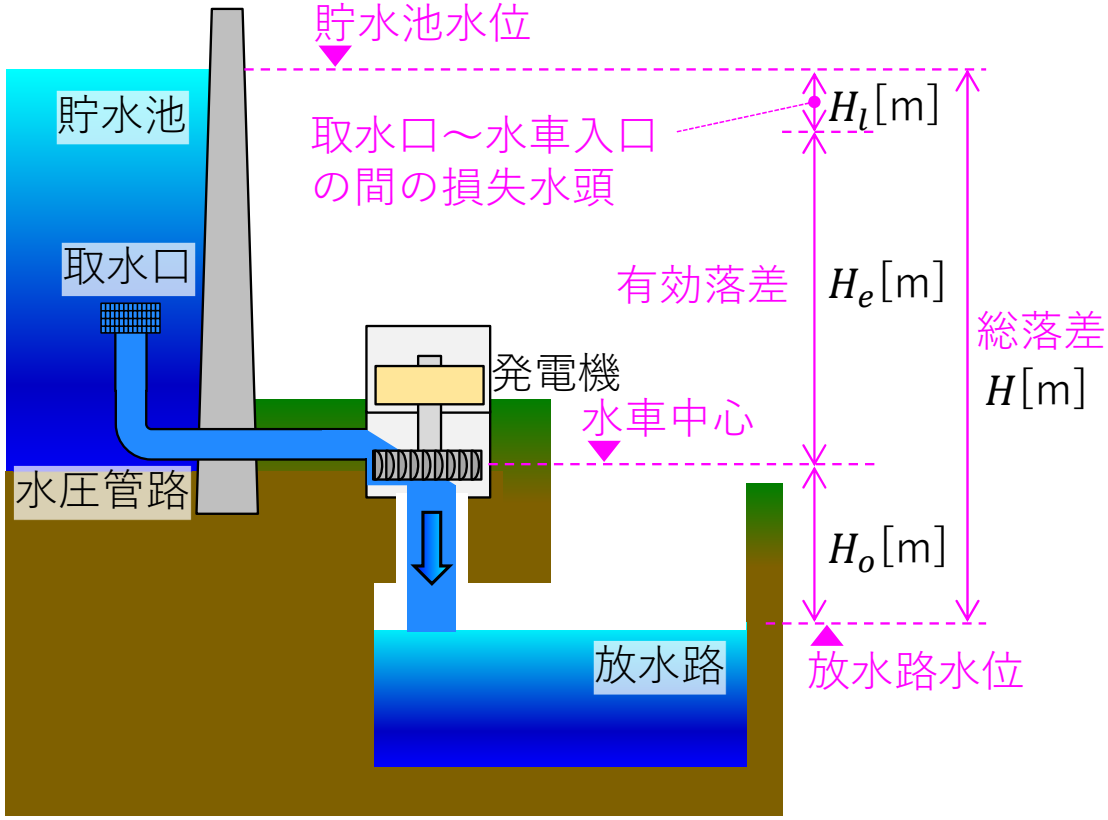
河川の年平均流量[m³/s]：$\dfrac{kPA \times 10^3}{\underset{[日]}{365} \times \underset{[時]}{24} \times \underset{[分]}{60} \times \underset{[秒]}{60}}$

流況曲線



水力発電（５）－２　《水力発電の有効落差》

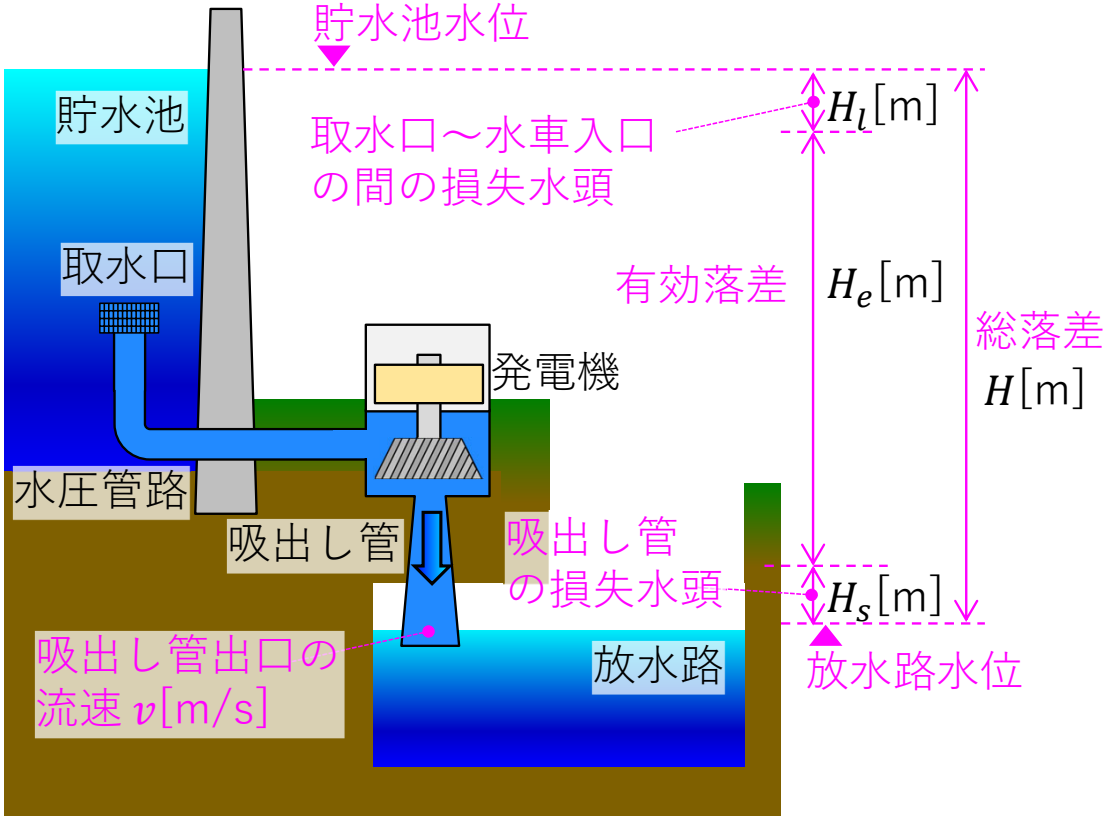
■衝動水車の有効落差　$H_e = H - H_o - H_l$



■反動水車の有効落差　$H_e = H - H_l - H_s$

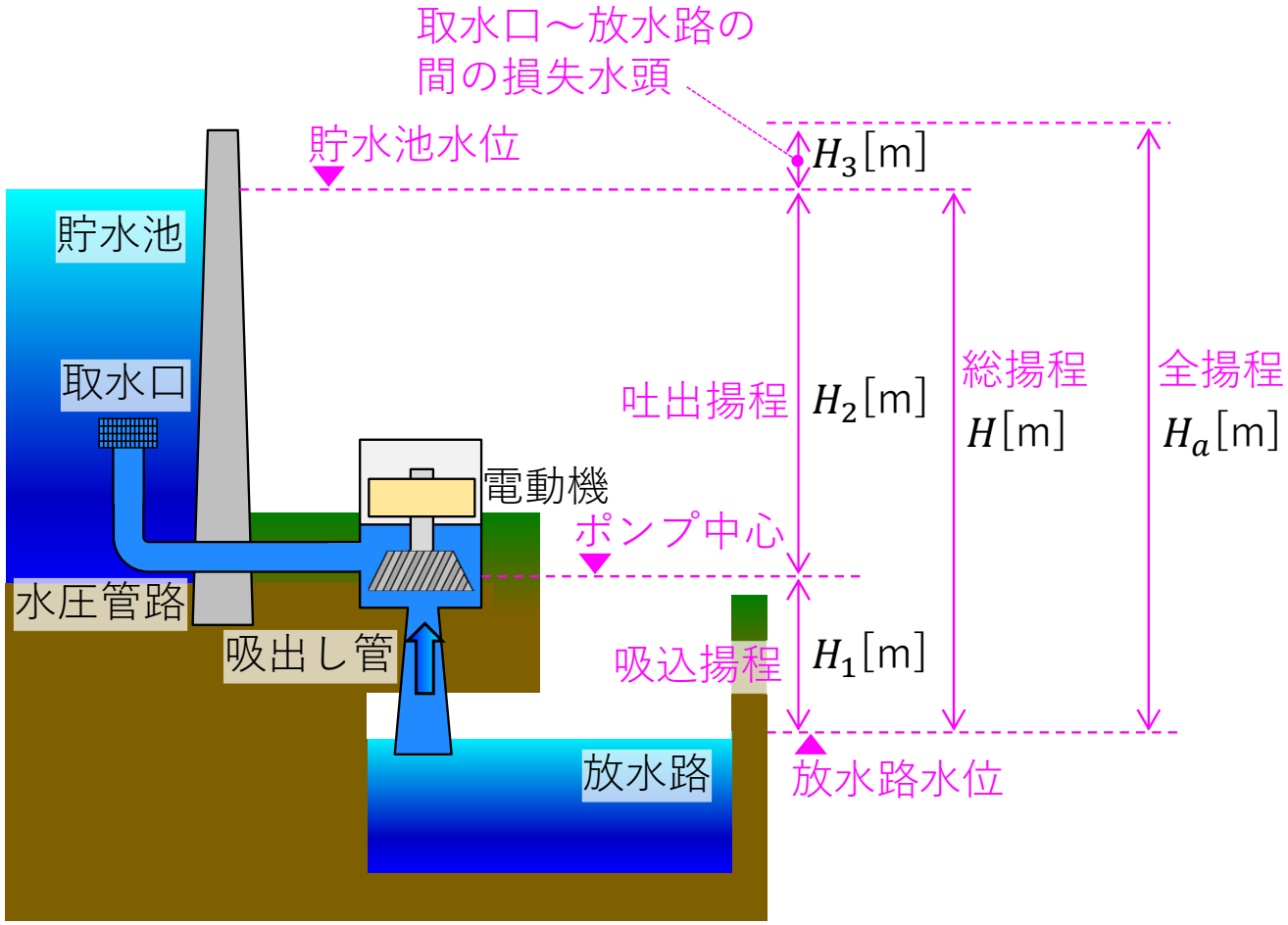
摩擦損失を無視すれば、吸出し管の損失水頭は

吸出し管出口流速より　$\frac{1}{2}mv^2 = mgH_s$　$H_s = \frac{v^2}{2g}$



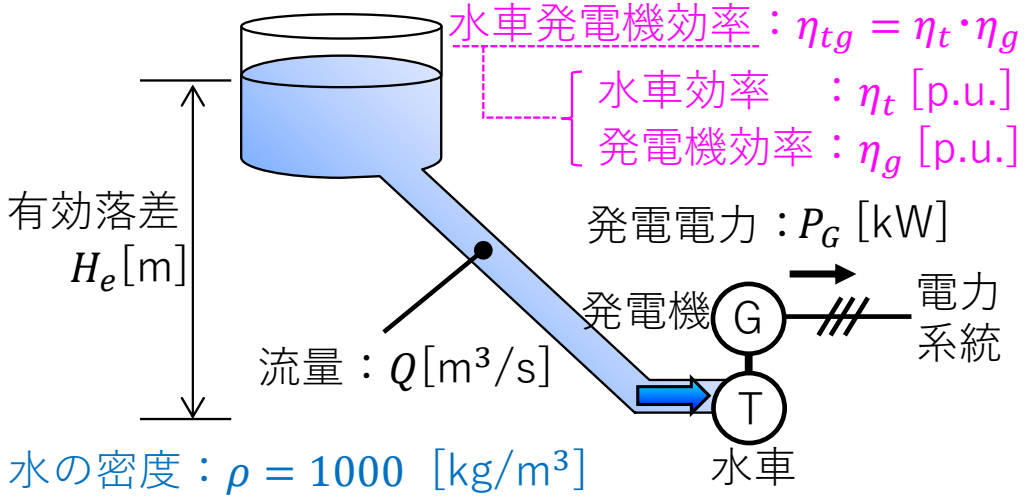
水力発電（５）－３　《揚水発電の全揚程》

■揚水運転の全揚程　　$H_a = H_1 + H_2 + H_3$



水力発電（５）－４　《水力発電の発電電力》

重力加速度：$g = 9.8$ [m/s²]



水の密度：$\rho = 1000$ [kg/m³]

1秒間に流れる水の質量[kg]：$m = \rho Q$

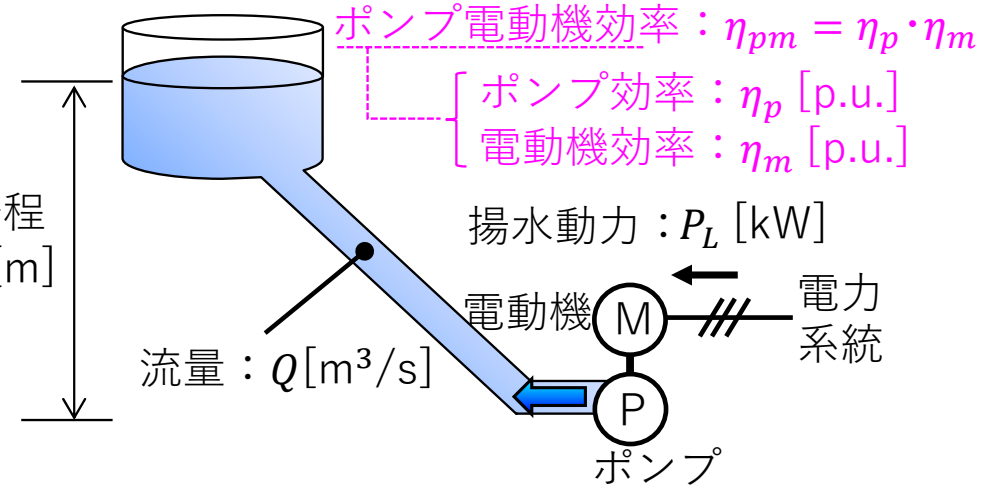
理論電力[W]：$P = mgH_e$

$= \rho Qgh = 1000 \times Q \times 9.8 \times H_e$

$= 9800QH_e$ [W]$= 9.8QH_e$ [kW]

発電電力： $P_G = \eta_t \eta_g P = 9.8\eta_{tg} QH_e$ [kW]

《揚水動力》



理論動力[W]：$P = mgH_a = 9800QH_a$[W]$= 9.8QH_a$[kW]

揚水動力： $P_L = \dfrac{P}{\eta_p \eta_m} = \dfrac{9.8QH_a}{\eta_{pm}}$ [kW]

揚水発電の総合効率[p.u.]：η

$$\eta = \frac{P_G}{P_L} = \frac{9.8\eta_{tg} QH_e}{\dfrac{9.8QH_a}{\eta_{pm}}} = \frac{H_e}{H_a} \cdot \eta_{tg} \cdot \eta_{pm}$$