Pipe Hydraulic

1. Minimum Diameter --------- 100 mm (4 inch)
2. Velocity range ---------- (0.6 – 2) m/sec

Flow in Pipes

Hazen-William's formula is the most used in the design of water distribution systems.

$$V = k * C * R^{0.63} * S^{0.54}$$

Where :
V = mean velocity in pipe (m/sec)
R = hydraulic radius (m)
S = hydraulic gradient
C = constant depend on the roughness of pipe
k = 0.85

$$Q = V * A$$

Where :
A = area of pipe (m2)
D = diameter of pipe (m)

$$A = \frac{\Pi * D^2}{4} \qquad R = \frac{D}{4}$$

$$S = \frac{hL}{L}$$

Where :
hL = head losses in (m)
L = length of pipe (m)

Hazen-William's formula will be :

$$Q = \frac{\Pi * D^2}{4} * 0.85 * C * \left(\frac{D}{4}\right)^{0.63} * \left(\frac{hL}{L}\right)^{0.54}$$

$$hL = K * Q^{1.85}$$

Where :

$$K = \frac{10.62 * L}{C^{1.85} * D^{4.87}}$$

Values of C in Hazen-William's Formula

Type of pipe	*C for new pipe*	*C for used pipe*
Cast iron	130	100
Galvanized iron > 50 mm	120	100
Galvanized iron =< 50 mm	110	90
Concrete	140	110
Asbestos cement	150	120
Plastic	150	120

Relation between Pressure in Supply Pipes and Elevation

$$AvailableHead(m) = \Pr essure(Kg/Cm^2) * 10 - Elevation(m)$$