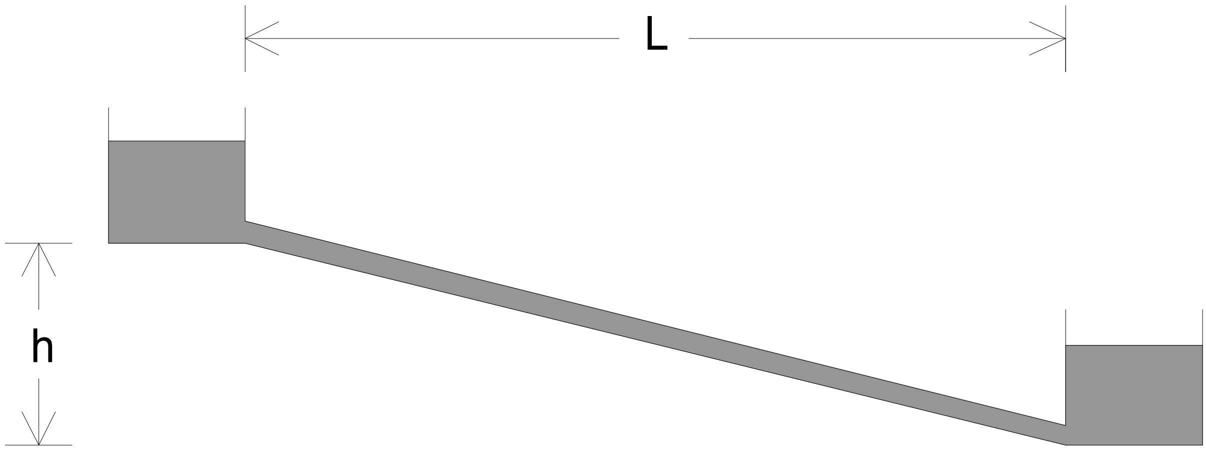
GEODOMISI Ltd. - Dr. Costas Sachpazis Civil & Geotechnical Engineering Consulting Company for Structural Engineering, Soil Mechanics, Rock Mechanics, Foundation Engineering & Retaining Structures.	Project: Design of a Surface Water Drain				Job Ref.	
	Section Civil & Geotechnical Engineering				Sheet no./rev. 1	
	Calc. by Dr.C.Sachpazis	Date 10/11/2013	Chk'd by -	Date	App'd by	Date

DESIGN OF A SURFACE WATER DRAIN



Drain design details

Design flow rate; Q_{design} = **5.00** m^3/s

Length of the drain; L = **250.0** m

Fall along length of drain; h = **25.0** m

Gradient of drain; i = h / L = **0.100**; **(1 in 10)**

Minimum flow velocity; V_{min} = **0.750** m/s

Minimum pipe diameter; D_{min} = **200** mm

Surface roughness; k_s = **0.6** mm

Mean hydraulic depth factor; m = **0.25**

Kinematic viscosity of fluid; ν = **1.31×10^{-6}** m^2/s

Using the Chezy equation

Constant; c = 56

Diameter of pipe required; $D = ((Q_{design}^2 \times 16) / (\pi^2 \times m \times c^2 \times i \times 1m/s^2))^{0.2}$ = **876** mm

Nearest pipe diameter; D_{chezy} = **900** mm

Flow velocity using Chezy; $V_{chezy} = c \times \sqrt{(m \times D_{chezy} \times i \times 1m/s^2)}$ = **8.400** m/s

Using the Escritt equation

Diameter of pipe required; $D = (Q_{design} \times 1000 \times \sqrt{(1 / i)} / 0.00035\ m^3/s)^{0.382} \times 1mm$ = **840** mm

Nearest pipe diameter; $D_{escritt}$ = **900** mm

Flow velocity using Escritt; $V_{escritt} = 26.738 \times (D_{escritt} / 1mm)^{0.62} \times 1\ m/s / (\sqrt{(1 / i)} \times 60)$ = **9.563** m/s

Using the Colebrook-White Equation for pipe running full and partially full

Design pipe diameter; $D_{design} = max(D_{chezy}, D_{escritt}, D_{min})$ = **900** mm

Constant; $Z = \sqrt{(2 \times (g_{acc} / 1m/s^2) \times (D_{design} / 1000mm) \times i)}$ = **1.329**

Flow velocity; $V_{full} = -2 \times Z \times log((k_s/(3.7 \times D_{design})) + ((2.51 \times \nu)/(D_{design} \times Z \times 1m/s))) \times 1m/s$

V_{full} = **9.932** m/s

Flow rate running full; $Q_{full} = V_{full} \times \pi \times D_{design}^2 / 4$ = **6.32** m^3/s

PASS - Maximum flow rate is greater than design flow rate

From Hydraulics Research Tables 35 and 36

Depth as proportion of D; x = **0.673**

Flow velocity at design flow rate; V_{design} = **10.986** m/s

PASS - Design velocity is greater than 0.750 m/s