

SECTION 24 – DESIGN OF PIPE DRAINS AND OPEN CHANNEL

Pipe Drain and Culverts

0515. Manning's formula (see para 106) applies equally to pipe and open channels.

For pipe of concrete or vitrified clay the value of the coefficient n is taken as 0.105.
For corrugated metal pipe the value of n is 0.021.

Given the slope of the pipe drain or culvert and the maximum amount of water in cusecs to be removed the required pipe diameter can be read off from Figure 5.2, which is a graphic solution of Manning's formula. Slopes for the two alternative values of n are given and it is assumed that at maximum of discharge, the pipe will be flowing full.

Open Channels

0516. The capacity of any open channel is given by the expression:-

$$Q=av$$

Where Q =capacity (cu ft per sec)

a =cross sectional area of the waterway (sqft)

v =velocity of flow (ft per sec)

The cross sectional area required may be calculated from Manning's formula. The special case of open drains in very flat areas is dealt with in RESPB No.51.

0517. It should be noted that in practice the permissible velocity of flow is often the limiting factor (see Table 5.2). However the size of channel may have been determined the velocity of flow at maximum discharge should be checked. Otherwise serious erosion may occur.

0518. The shape of cross section adopted and the minimum practicable size of channel depend upon the type and size of plant used in construction (See Section 65).

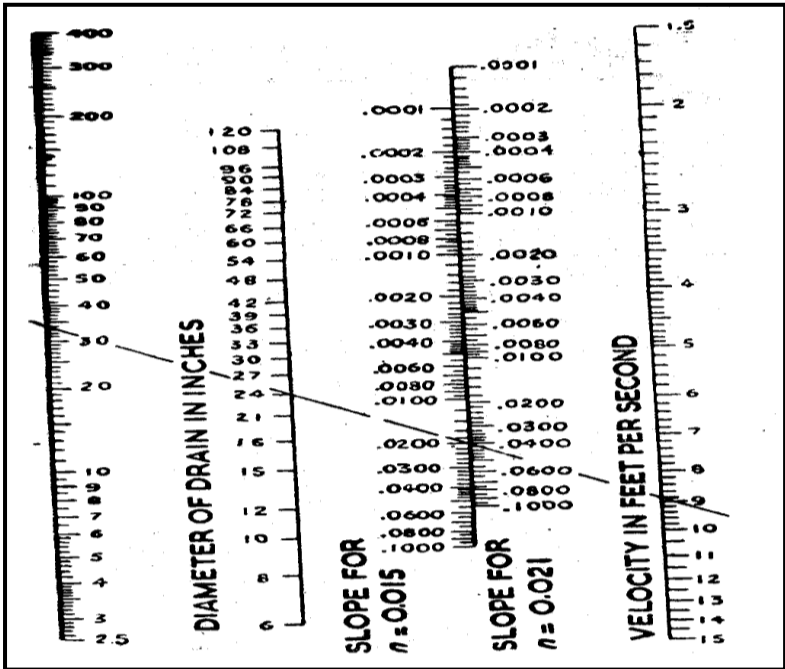


Figure 5-2: Graphic solution of Manning's formula for pipes (The marked example shows that a 24 inch concrete pipe ($n=0.015$) at a slope of 2 percent (1 in 50) will discharge 34 cft per sec (approximately) at a velocity of 8.9 ft per sec).

**TABLE 5.3– MAXIMUM VELOCITIES PERMISSIBLE
TO AVOID SCOUR IN OPEN DITCHES**

Ser No.	Nature of soil	Permissible velocity (ft per sec)
(a)	(b)	(c)
1	Uniformly graded sand and non-cohesive silt	1.00
2	Well-graded sand	1.50
3	Well-graded sand or city sand	2.50
4	Silty sand or clay	3.00
5	Clay	3.50
6	Coarse gravel or cobbles or with protection against scour by turf or other means	4.50