

**Forest Service Handbook National
Headquarters - Washington Office
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**Forest Service Handbook 7409.11 – Sanitary Engineering and Public Health Handbook
Chapter 50 - Wastewater**

Amendment: 7409.11-Amendment-10

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Superseded Directive:

Approved by:

Date approved:

Responsible Staff:

Explanation of changes:

53.44b – Table 9

*-TABLE 9

MINIMUM/MAXIMUM GRADE IN PERCENT

PIPE	4"		6"	
	1/4 Flow (.3D)	1/2 Full & Full	1/4 Flow(.3D)	1/2 Full & Full
n=0.011				
PVC	1	0.6	0.6	0.35
ABS	24	15	15	9
n=0.015				
AC	1.8	1.1	1.1	0.7
VC	45	28	28	16
CI				
DI				
CONC.				

Note: Based on Manning's Formula for Circular Pipes:

$$S = \left[\frac{V n}{1.486 \frac{2}{3} R} \right]^2$$

S = Hydraulic Gradient

V = Velocity; min = 2 fps, max = 10 fps.

n = Roughness coefficient; values shown above are higher than found in manufacturers literature.

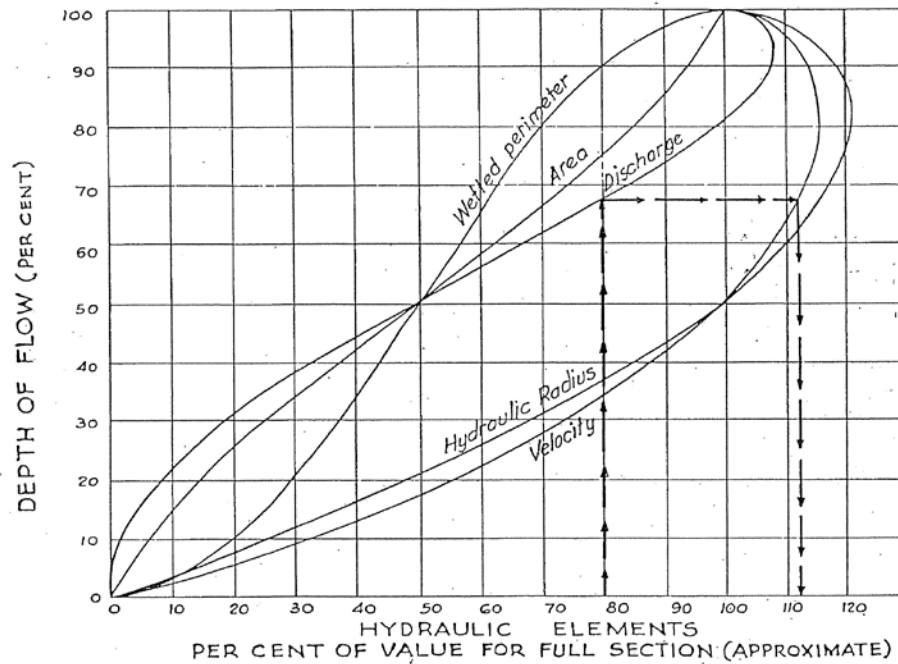
R = Hydraulic Radius; fluid cross section area
wetted perimeter

D = Diameter

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53.44b - Figure 1

*- Figure 1: Values of Hydraulic Elements of a Circular Section



EXAMPLE: Given: Discharge = 12 c.f.s. through a pipe which has capacity-flowing of 15 c.f.s. at a velocity of 7.0 ft. per sec. Required to find V for Q = 12 c.f.s. Percentage of full discharge = $\frac{12}{15} = 80\%$. Enter chart at 80% of value for full section of Hydraulic Elements, find $V = 112.5\% \times 7 = 7.9$ ft. per sec. -*