



### **A3.0 DROWNED OUTLETS**

Refer *QUDM* Section 7.08. Drowned outlets must not be used without the approval of the Engineering Officer Development & Regulatory Services.

### **A4.0 OPEN CHANNEL HYDRAULICS**

#### **A4.1 SENSITIVITY ANALYSES AND MANNING'S N**

Refer *QUDM* Section 8.06. In the analyses of soft faced channels two roughness coefficients must be used representing the well maintained and revegetated state to check velocity and freeboard requirements respectively.

#### **A4.2 CHANNEL FREEBOARD**

Refer *QUDM* Section 8.08. In the case of creek or natural watercourse flooding a freeboard of 300 mm is added to the 100 year ARI flood level to obtain the minimum fill level. A freeboard of 500 mm is added to the 100 year ARI flood level to obtain the minimum habitable floor level. For flooding in all other channels add 300 mm to the 50 year ARI flood level to obtain minimum fill level and 500 mm to the 50 year ARI flood level to obtain the minimum habitable floor level.

#### **A4.3 MANNING'S N FOR GRASSED CHANNELS**

Manning's n for a grassed open channel is determined by a number of factors including vegetal retardance and hydraulic radius. The following table and charts provide sufficient correlation to determine Manning's n for most developments. See Reference Number 80 for higher vegetal roughness.

TABLE BA4.3.1 GUIDE TO VEGETAL ROUGHNESS (REF 80)

<b>Average Length of Vegetation (mm)</b>	<b>Degree of Retardance</b>	<b>Example</b>
150-250	C	Long grass, most grasses can be kept to this length with slashing
50-150	D	Well maintained grass eg townhouse developments
< 50	E	Lawn cut short, burnt grass or bare earth

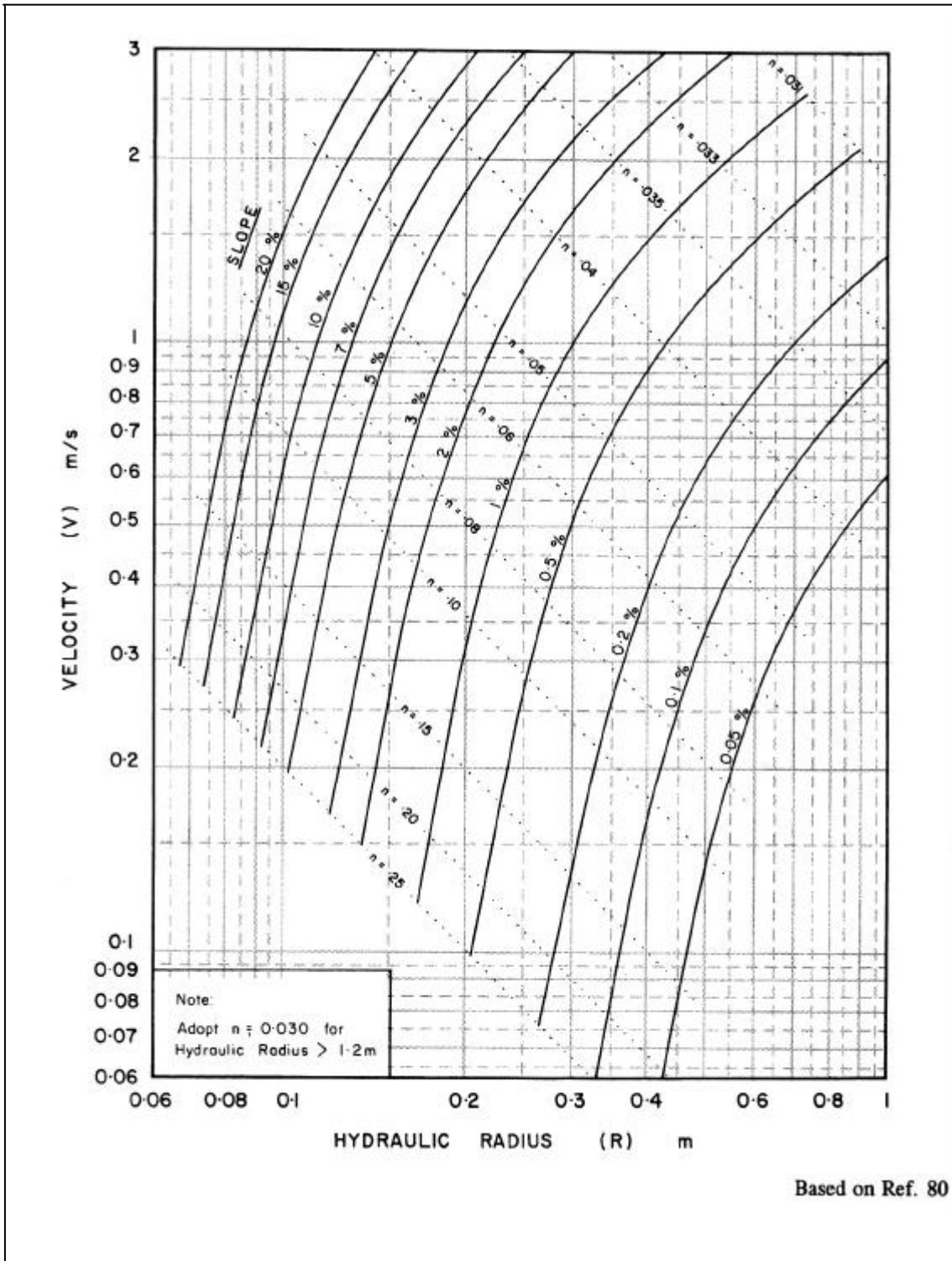


FIGURE BA4.3.1  
SOLUTION OF THE MANNING'S FORMULA FOR VEGETAL RETARDANCE C

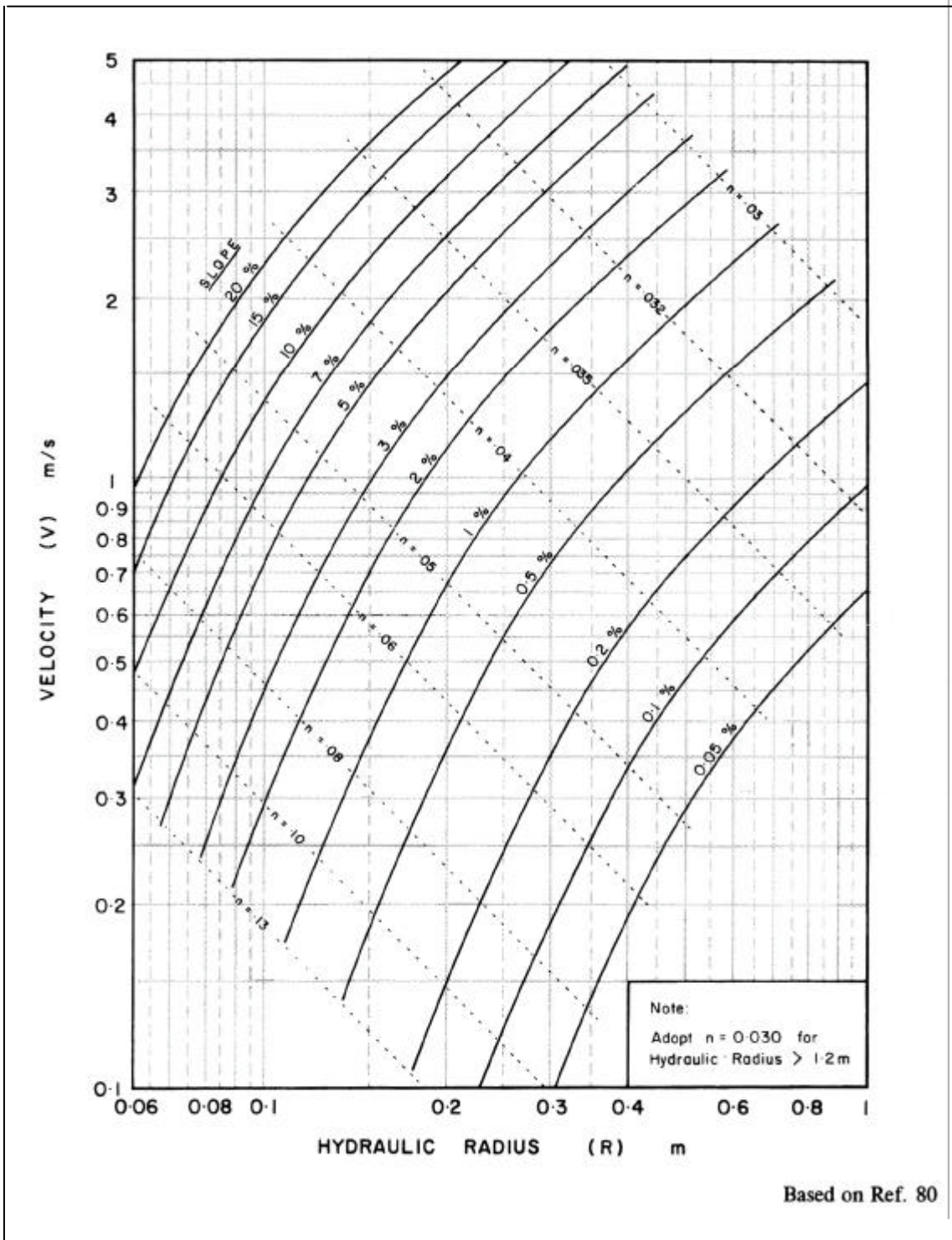


FIGURE BA4.3.2  
 SOLUTION OF THE MANNING'S FORMULA FOR VEGETAL RETARDANCE D

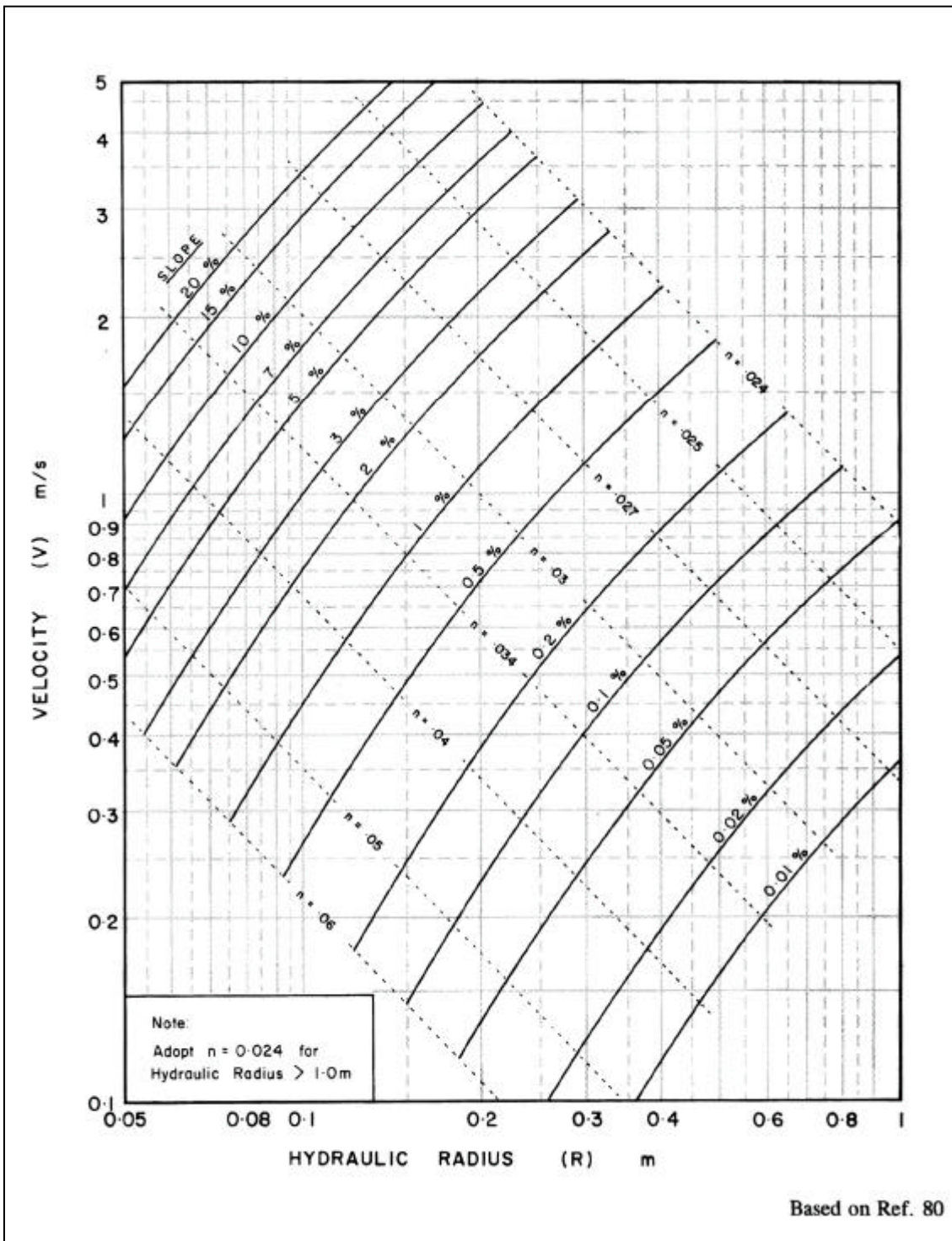


FIGURE BA4.3.3  
 SOLUTION OF THE MANNING'S FORMULA FOR VEGETAL RETARDANCE E