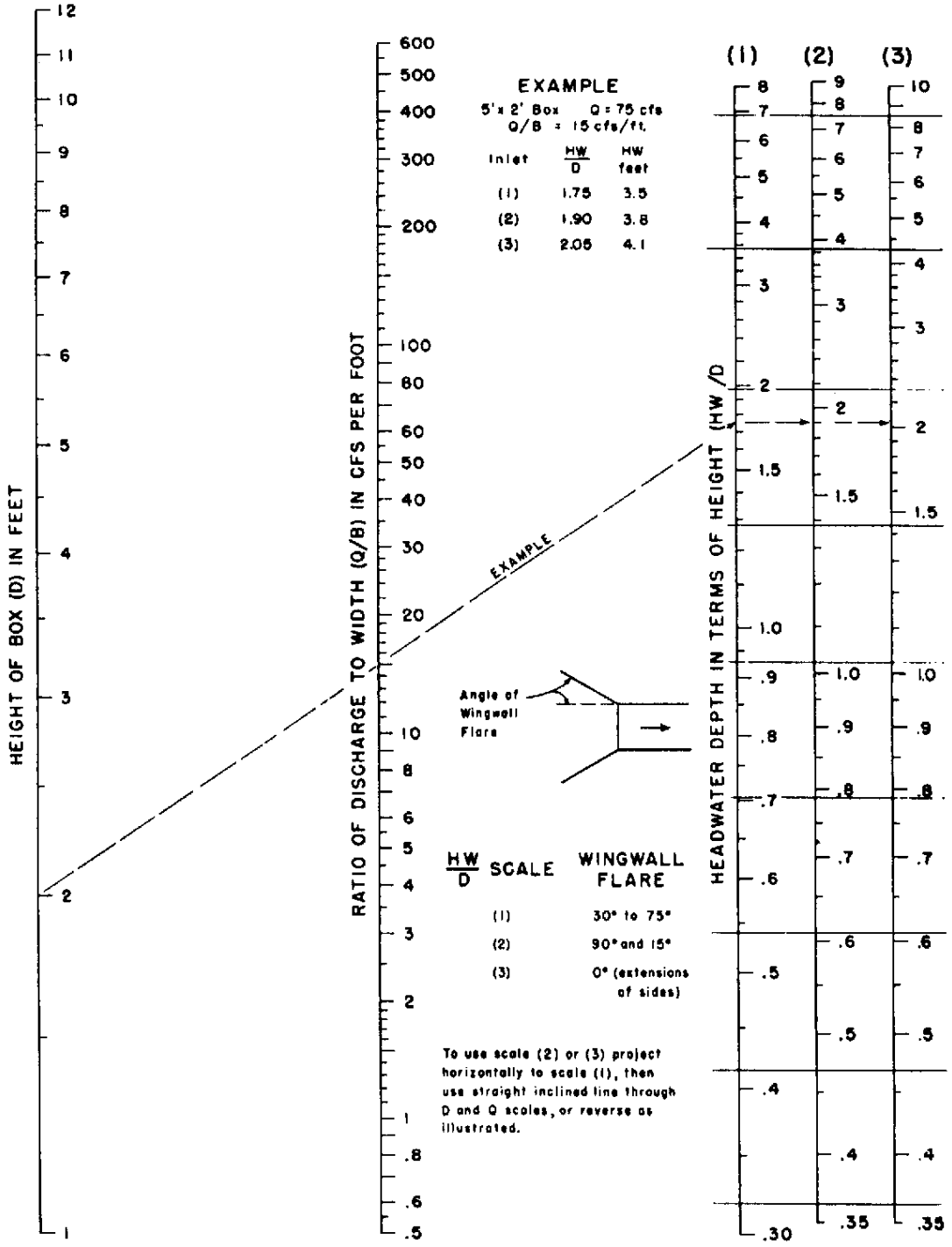
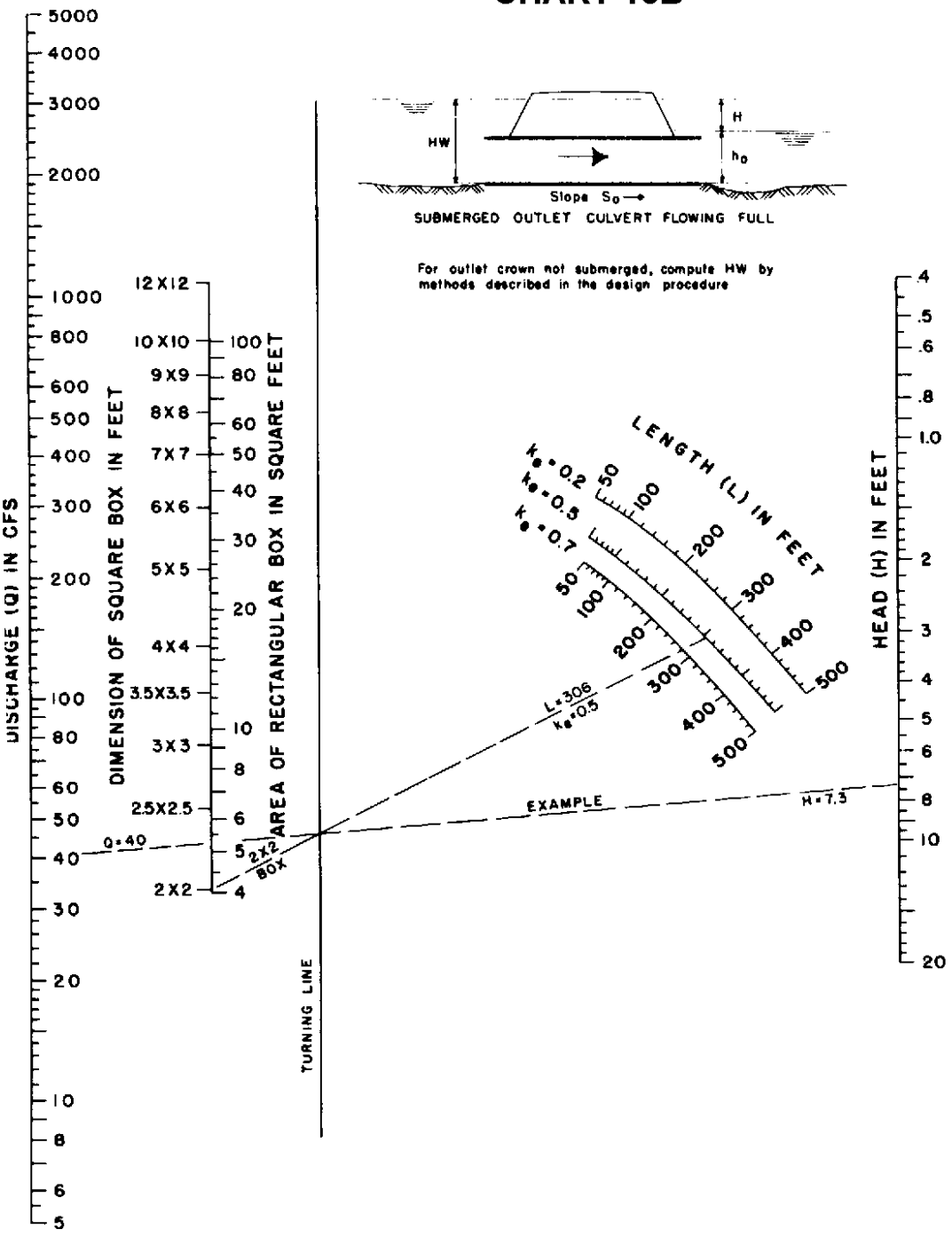
CHART 8B



HEADWATER DEPTH FOR BOX CULVERTS WITH INLET CONTROL

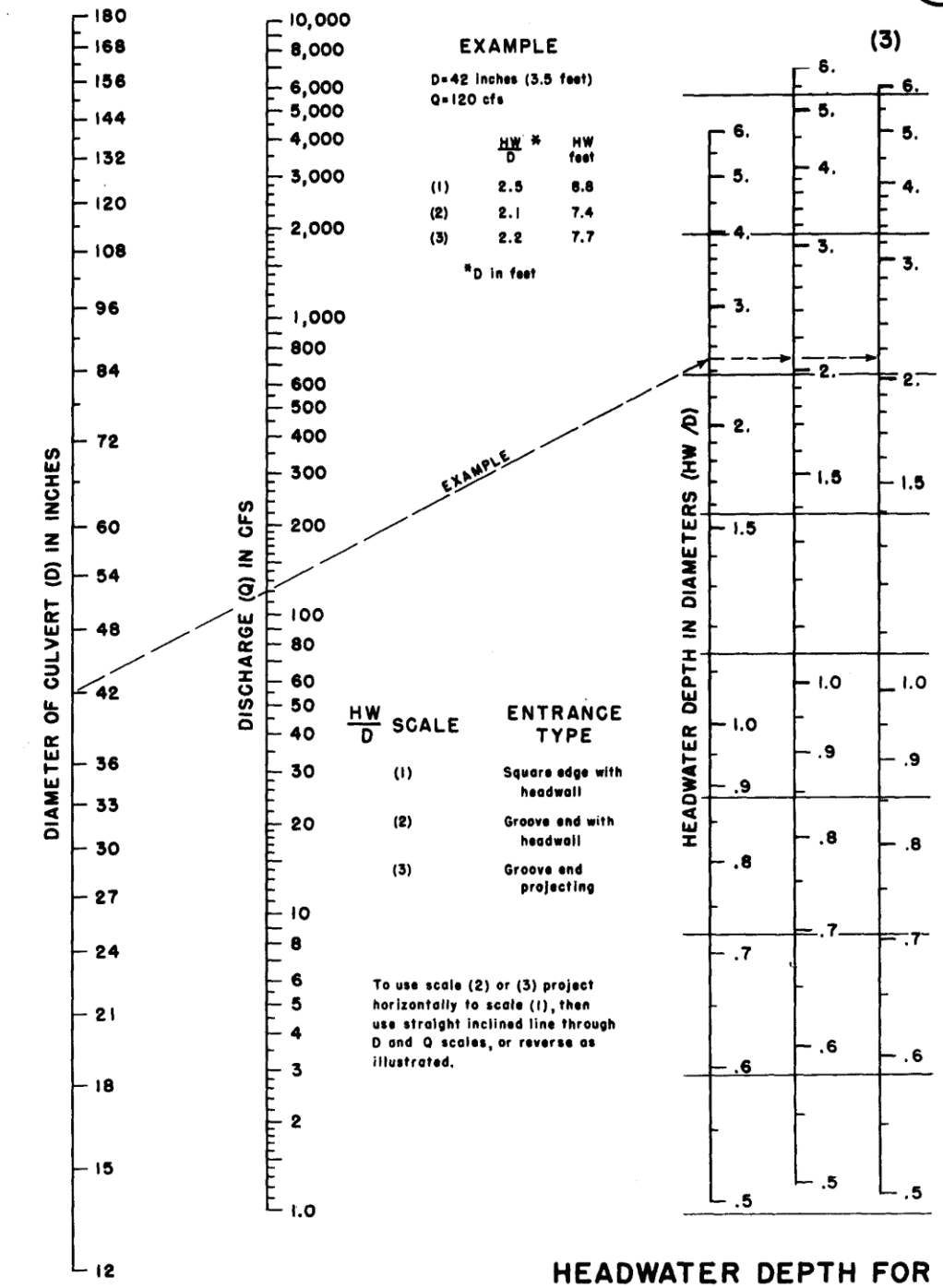
BUREAU OF PUBLIC ROADS JAN. 1963

CHART 15B



HEAD FOR CONCRETE BOX CULVERTS FLOWING FULL n = 0.012

CHART 1B

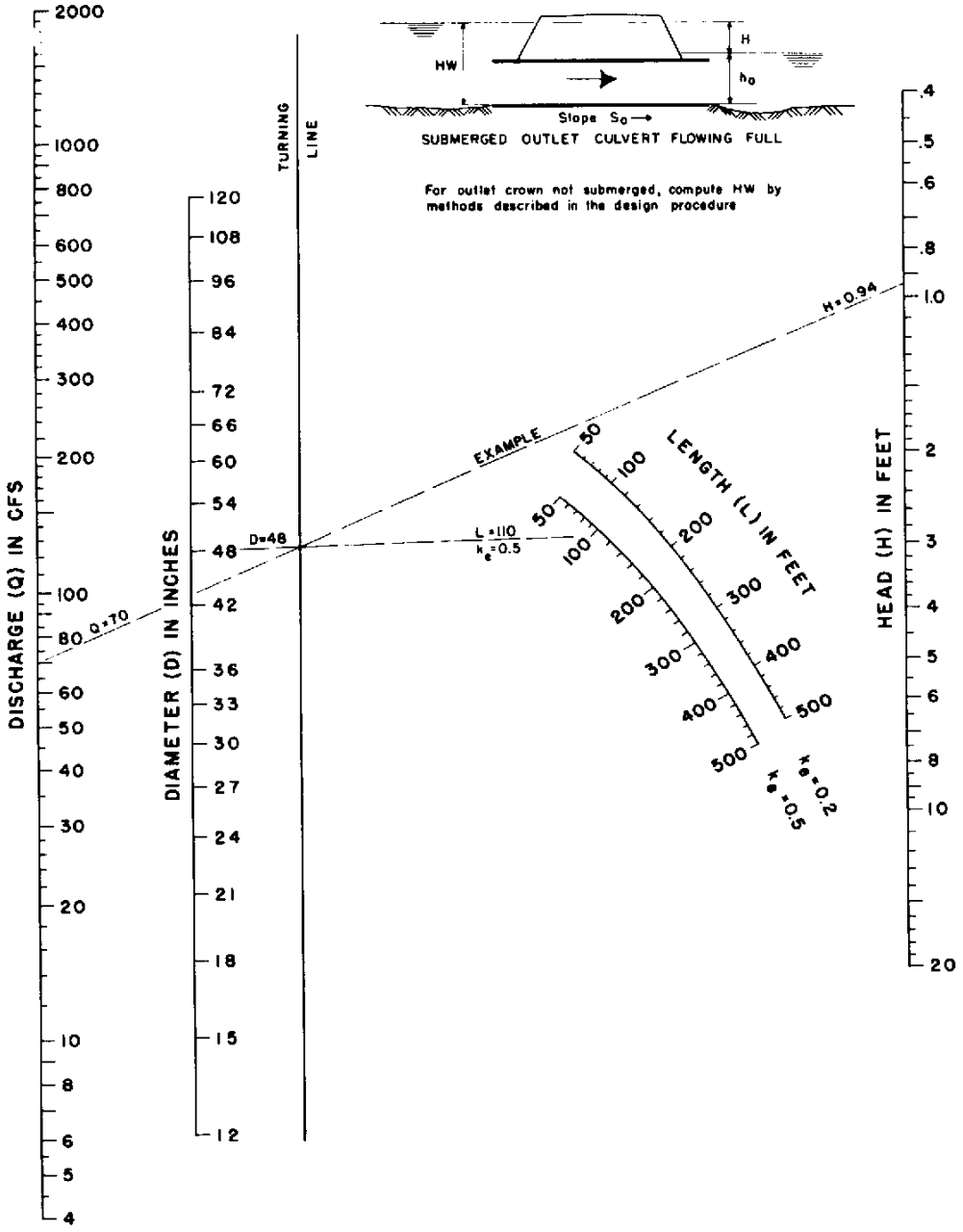


HEADWATER SCALES 2&3
REVISED MAY 1964

HEADWATER DEPTH FOR CONCRETE PIPE CULVERTS WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN. 1963

CHART 5B



HEAD FOR
CONCRETE PIPE CULVERTS
FLOWING FULL
n = 0.012

BUREAU OF PUBLIC ROADS JAN. 1963

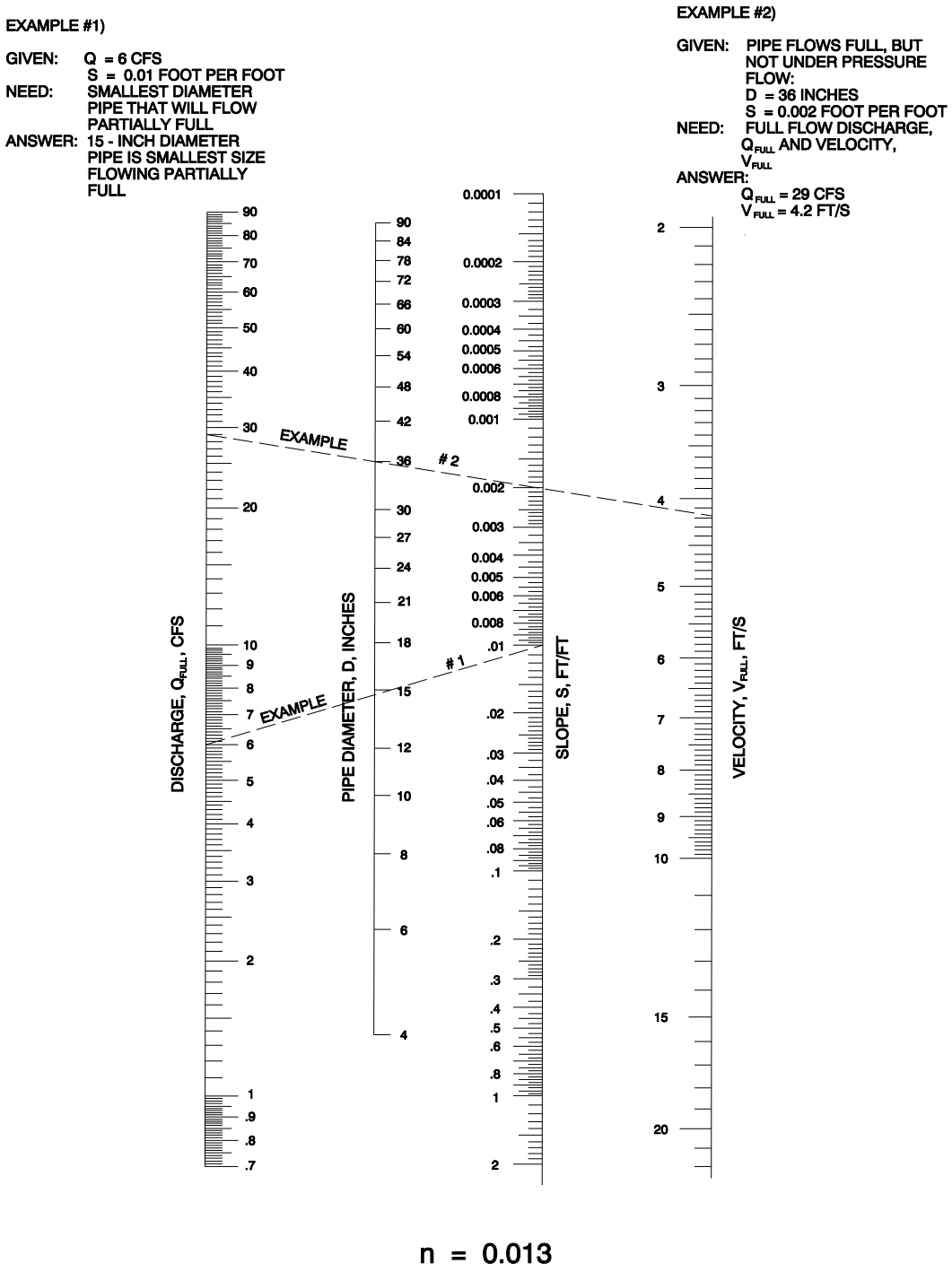


Figure 8-19 Capacity and Velocity Nomograph for Circular Concrete Pipes Flowing Full

EXAMPLE
GIVEN: Q = 15 CFS
D = 24 INCHES
NEED: ESTIMATE OF FRICTION
SLOPE IN FEET PER FOOT
ANSWER: FRICTION SLOPE = 0.015 FOOT
PER FOOT

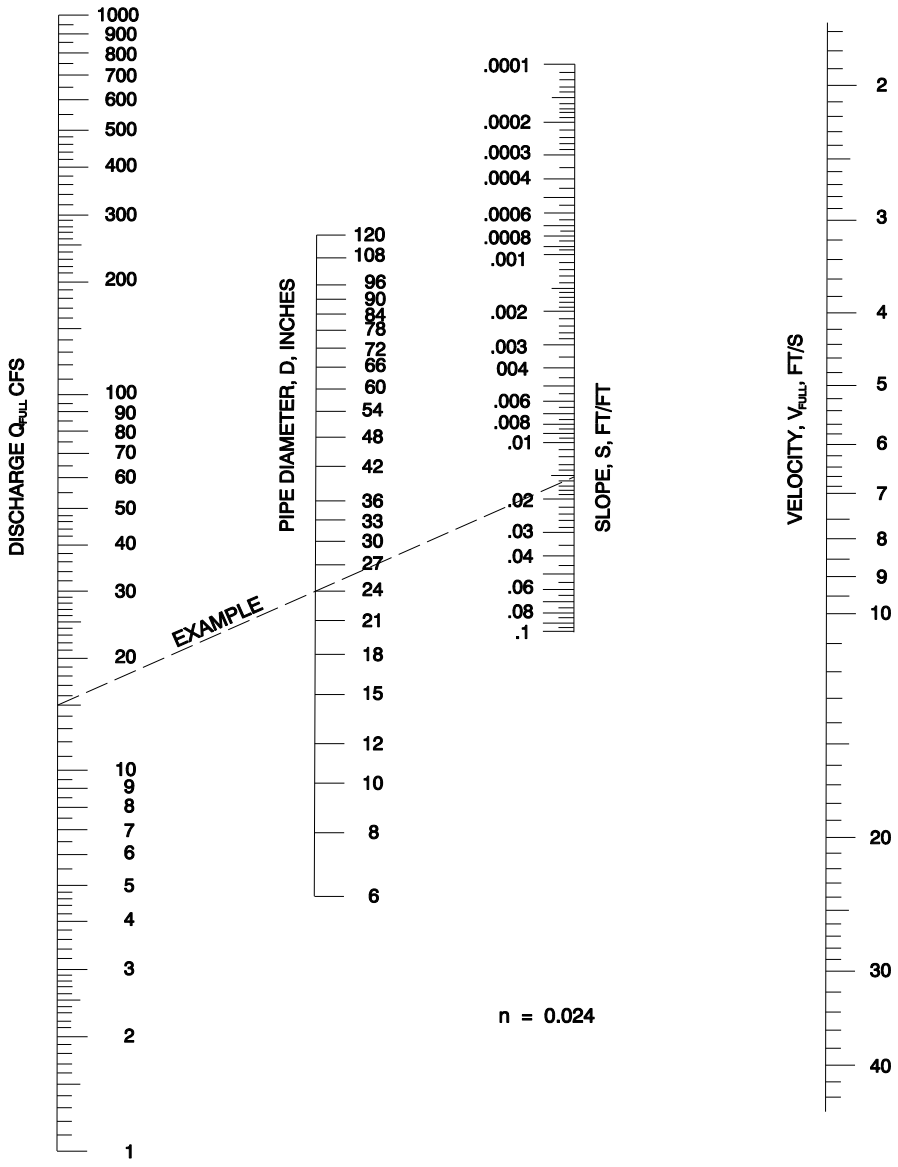


Figure 8-20 Capacity and Velocity Nomograph for Circular Corrugated Metal Pipes Flowing Full

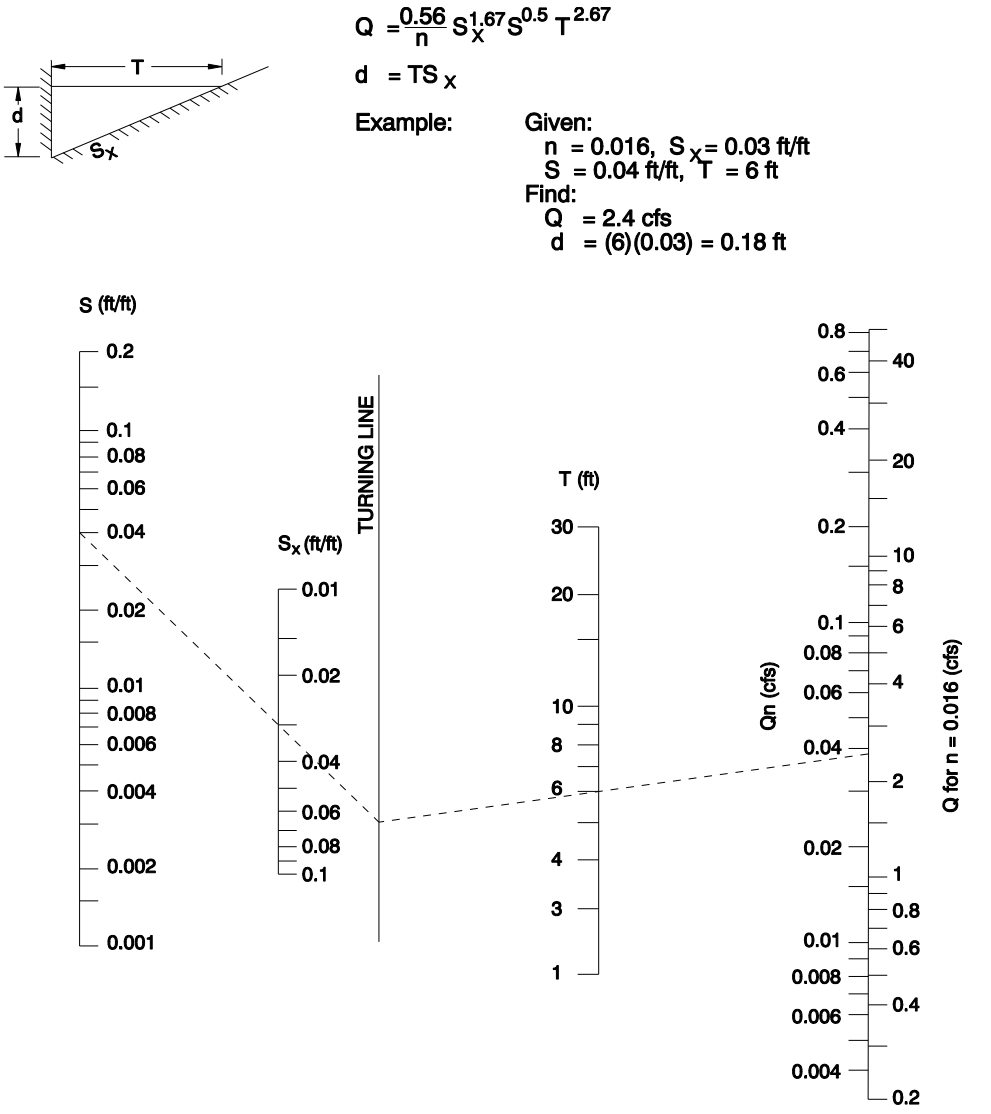
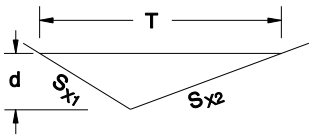


Figure 8-14 Discharge Nomograph for Gutter with Near Vertical Curb and Single Gutter Cross Slope

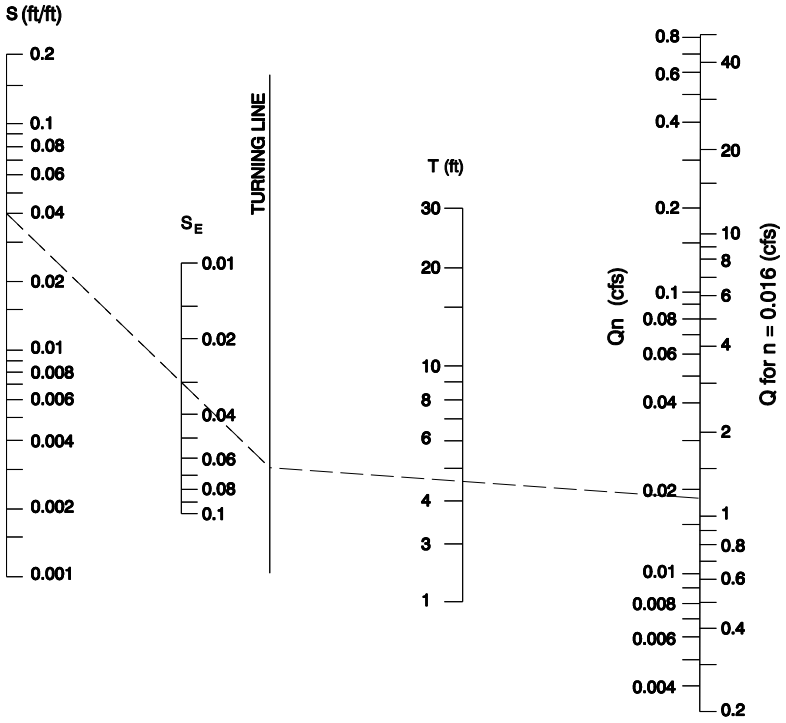


$$Q = \frac{0.56}{n} S^{1.67} S^{0.5} T^{2.67}$$

$$S_E = S_{X1} S_{X2} / (S_{X1} + S_{X2})$$

$$d = TS_E$$

Example: Given:
$n = 0.016$, $S_{X1} = 0.50$ ft/ft, $S_{X2} = 0.02$ ft/ft
$S = 0.04$ ft/ft, $T = 6$ ft
Find:
$S_E = (0.50)(0.02)/(0.50 + 0.02)$
$S_E = 0.019$
$Q = 1.2$ cfs
$d = (6)(0.019) = 0.11$ ft



S = longitudinal gutter slope (ft/ft)

S_{X1}, S_{X2} = gutter cross-slope (ft/ft)

S_E = equivalent gutter cross-slope (ft/ft)

T = flow width in gutter (ft)

Q = total gutter flow (cfs)

n = Manning's "n"

d = flow depth at curb (ft)

Example: Given:
$n = 0.012$, $S_{X1} = 0.50$ ft/ft,
$S_{X2} = 0.02$ ft/ft, $S = 0.04$ ft/ft
$T = 6$ ft
Need:
$S_E = (0.50)(0.02)/(0.50 + 0.02)$
$S_E = 0.019$ ft/ft
$Q_n = 0.019$ cfs
$Q = \frac{Q_n}{n} = \frac{0.019}{0.012} = 1.6$ cfs

Figure 8-16 Discharge Nomograph for Gutter with Two Cross Slopes

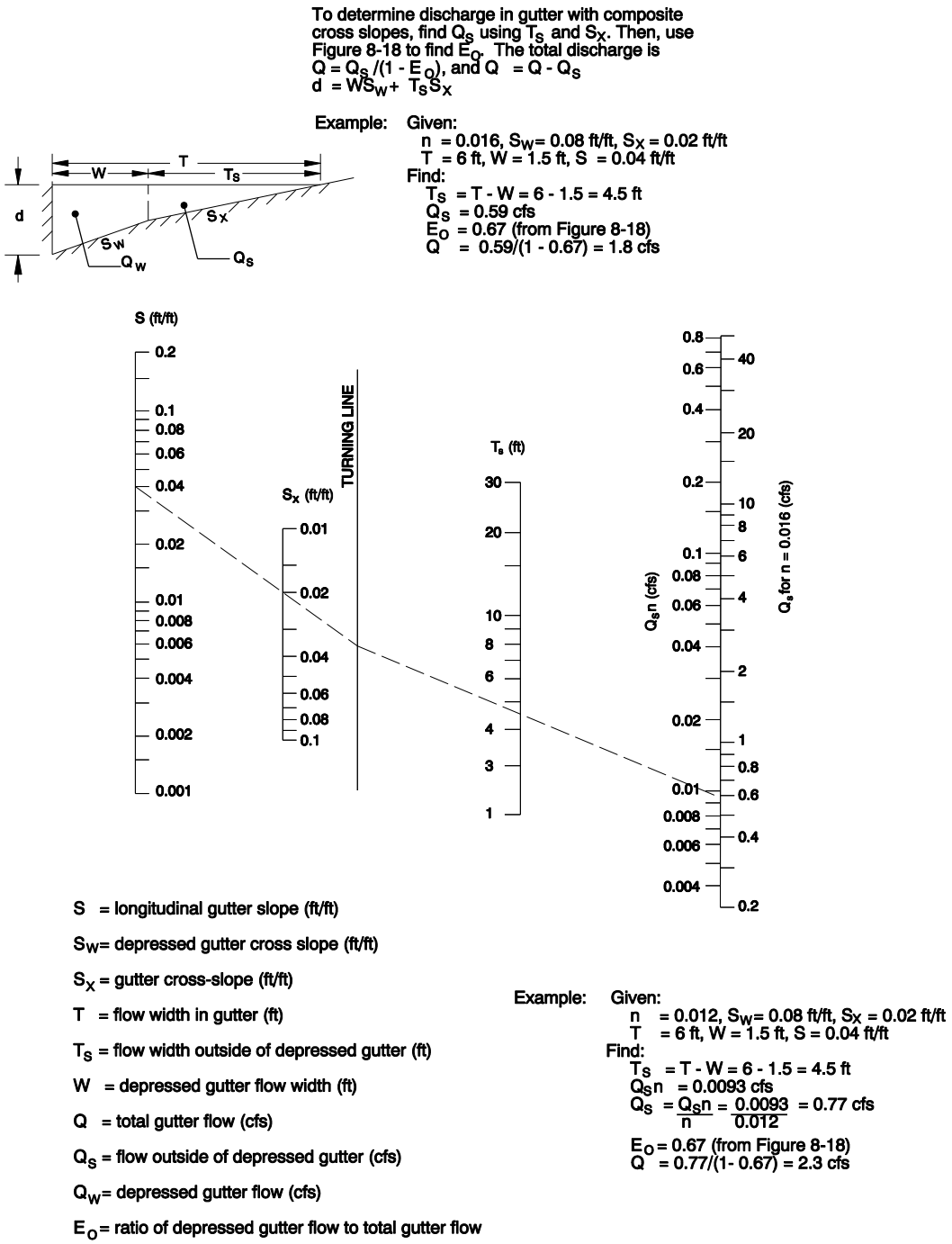


Figure 8-17 Discharge Nomograph for Gutter with Near Vertical Curb and Two Gutter Cross Slopes