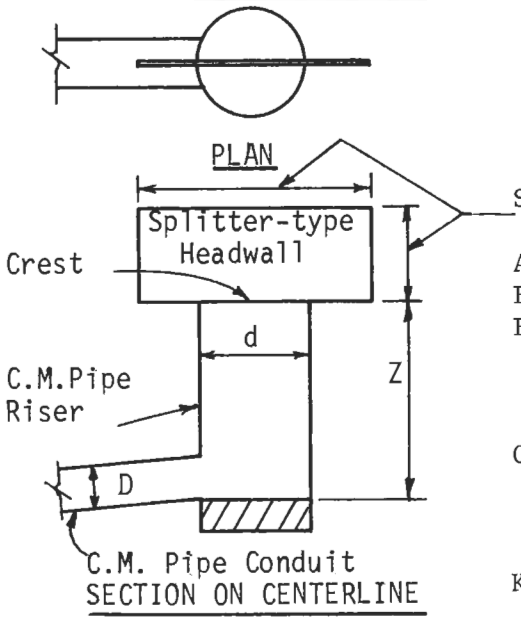
DROP INLET DESIGN CRITERIA

The attached sheets show formulas, nomenclature, criteria, coefficients, dimensions, and other information to be used in the design of drop inlet spillways.

When using the weir flow formulas, care should be exercised in determining the amount of obstruction to be deducted. If the weir flow is suppressed by fill slopes, posts, or other obstructions, suitable deductions will be made in the weir length.

CORRUGATED METAL PIPE RISER

Weir flow, $Q = 3.1 (\pi d - \text{any obstructions}) h^{3/2}$



See Table Below

Area of riser $\geq$ 1.5 x area of conduit
For conduit slope > friction slope, Z = 5D
For conduit slope $\leq$ friction slope, Z = 2D

PIPE FLOW FORMULA

$$Q = a \sqrt{\frac{2gH}{1 + K_e + K_m + \Sigma K_p L}}$$

$K_e = 1.0$

$K_m = \frac{n\ \alpha}{3}$ (for $\alpha \leq 30^0$)

(When entire length of conduit is on the same slope, $K_m = 0$)

SYMBOLS

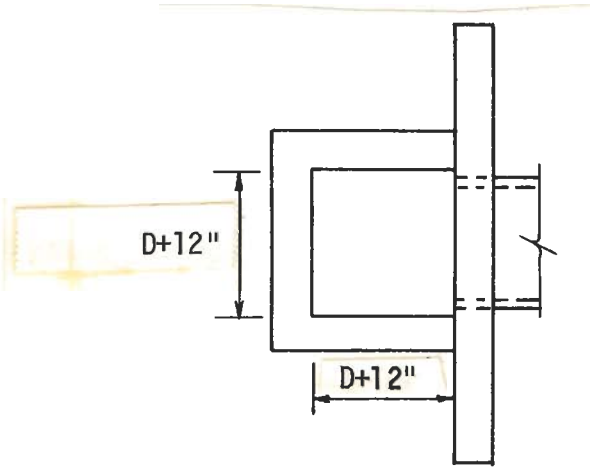
Q = Discharge in c.f.s.
h = Height of water over weir crest in feet
d = Inside diameter of riser in feet
D = Inside diameter of conduit in feet
Z = Riser height in feet
a = Area of conduit in square feet
g = Acceleration due to gravity = 32.2 ft/sec^2
H = Total available head in feet
K = Entrance loss coefficient
K = Head loss coefficient (circular pipe)
L = Length of conduit in feet

Manning's roughness coefficient
n = 0.027 for CMP (1" x 3" corrugations)
n = 0.025 for CMP (½" x 2½" corrugations)
n = 0.023 for HCMP
n = 0.010 for Welded Steel Pipe

INLET PROPORTIONS		ANTI-VORTEX DEVICE		
Pipe (D) Conduit-in.	Pipe (d) Riser-in.	Length ft.	Height ft.	Gage
8 & 10	18	5	2	16
12	18	5	2	16
15	24	6	2	16
18	30	7	2	16
21	30	7	2	16
24	36	8	2	14
30	42	9	2.5	14
36	48	10	3	12
42	54	11	3.5	12
48	60	12	4	10

SQUARE OPEN TOP RISER - PIPE DROP INLET

REINFORCED CONCRETE PIPE CONDUIT



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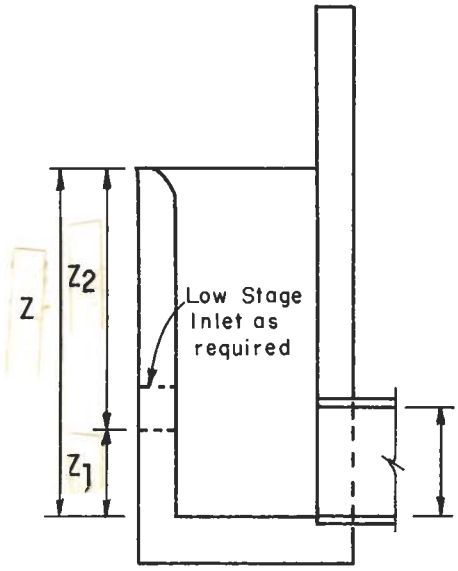


SECTION ON CENTERLINE

Weir flow, $Q = 3.1\ (L+4R - \text{Any Obstructions})h^{3/2}$

Pipe flow, $Q = a\sqrt{\dfrac{2gH}{1+K_e+K_m+\Sigma K_p L}}$

$K_e = 1.20$ (min. clear water)

$K_e = 2.00$ (max. with debris)

$K_m = \dfrac{n\ \alpha}{3}$ (for $\alpha \leq 30^0$)

(When entire length of conduit is on same slope, $K_m = 0$)

For conduit slope > friction slope,
Minimum Z = 5D

For conduit slope ≤ friction slope:

D	Q_{max}	Min. Z
24	94	5.0
30	148	5.5
36	212	6.0
42	288	6.5
48	376	7.0

Maximum allowable velocity in pipe = 30 fps.

Symbols

Q = Discharge in c.f.s.
L (Weir flow formula) = 3D+3 = Weir length in feet.
L (Pipe flow formula) = Length of conduit in feet.
R = Radius of crest rounding in feet.
h = Height of water over weir crest in feet.
D = Inside diameter of conduit in feet.
Z_1 = Low stage inlet (0 to 30 feet).
Z_2 = High stage inlet (Up to 20 feet).
$Z = Z_1+Z_2$ (Not to exceed 40 ft.).
a = Area of conduit in square feet.
g = Acceleration of gravity = 32.2 ft./sec.^{2}
H = Total available head in feet.
K_e = Entrance loss coefficient.
K_m = Bend loss coefficient.
K_p = Head loss coefficient (circular pipe).

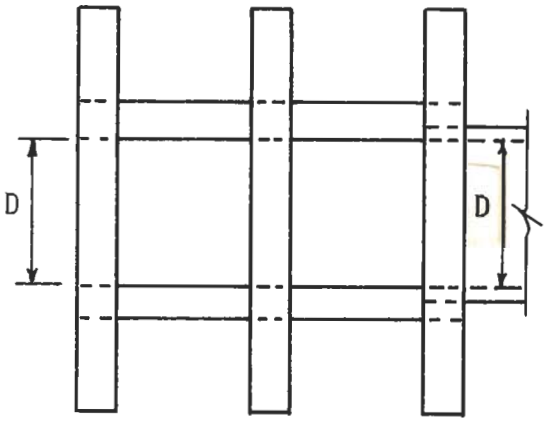
Manning's roughness coefficient "n" = 0.013

Reference:

Washington Design Note 8
Washington Design Note 18

STANDARD RECTANGULAR OPEN TOP RISER - PIPE DROP INLET

REINFORCED CONCRETE PIPE CONDUIT



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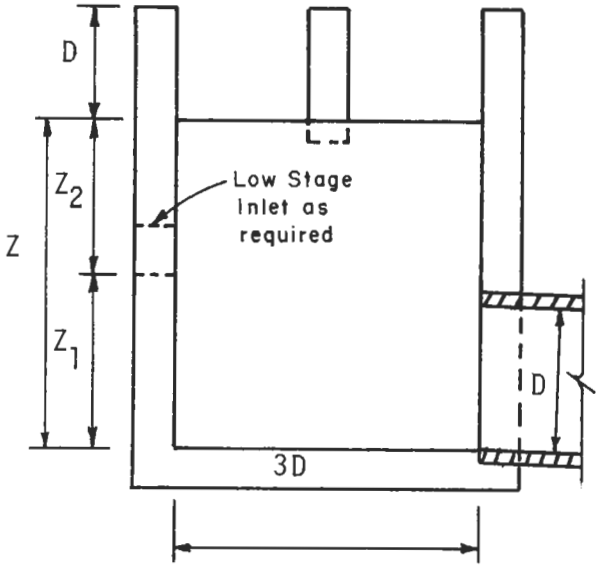

SECTION ON CENTERLINE

Weir flow, $Q = 3.1\ (L+4R - \text{Any Obstructions})h^{3/2}$

Pipe Flow, $Q = a\sqrt{\dfrac{2gH}{1+K_e+K_m+\Sigma K_p L}}$

K_e = 0.50 (for round bottom riser)(min. clear water)
0.90 (for round bottom riser)(max. with debris)
0.60 (for square bottom riser)(min. clear water)
1.10 (for square bottom riser)(max. with debris)

$K_m = \dfrac{n\ \alpha}{3}$ (for $\alpha \leq 30^0$)

(When entire length of conduit is on same slope, $K_m = 0$)

For conduit slope > friction slope,
Minimum Z = 5D

For conduit slope ≤ friction slope:

D	Qmax	Min. Z
24	94	5.0
30	148	5.5
36	212	6.0
42	288	6.5
48	376	7.0

Maximum allowable velocity in pipe = 30 fps.

Symbols

Q = Discharge in c.f.s
L (Weir flow formula) = 6D = Weir length in feet.
L (Pipe flow formula) = Length of conduit in feet.
R = Radius of crest rounding in feet.
h = Height of water over weir crest in feet.
D = Inside diameter of conduit in feet.
Z_1 = Low Stage inlet (0 to 30 feet).
Z_2 = High Stage inlet (Up to 20 feet).
$Z = Z_1+Z_2$ (Not to exceed 40 ft.)
a = Area of conduit in square feet.
g = Acceleration of gravity = 32.2 ft./sec.^{2}
H = Total available head in feet.
K_e = Entrance loss coefficient.
K_m = Bend loss coefficient.
K_p = Head loss coefficient (circular pipe).

Manning's roughness coefficient "n" = 0.013

Reference:

Washington Design Note 8
Washington Design Note 18