Weirs

Weir is defined as a barrier over which the water flows in an open channel. The edge or surface over which the water flows is called the crest. The overflowing sheet of water is the nappe.

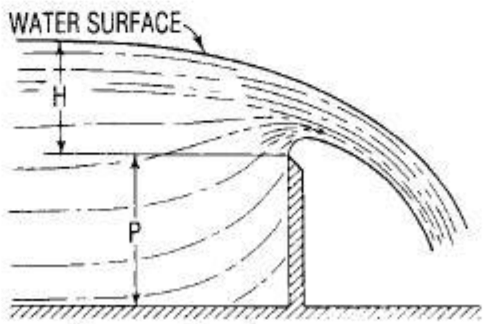
If the nappe discharges into the air, the weir has free discharge. If the discharge is partly under water, the weir is submerged or drowned.

Types of Weirs.

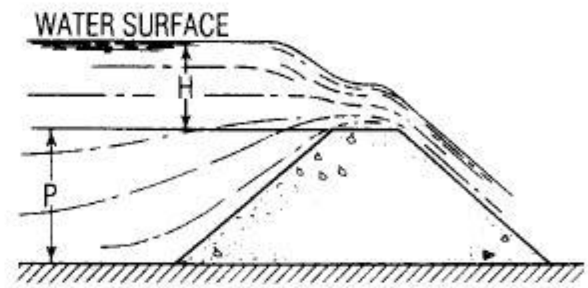
A weir with a sharp upstream corner or edge such that the water springs clear of the crest is a sharp-crested weir.

All other weirs are classed as weirs not sharp crested. Sharp-crested weirs are classified according to the shape of the weir opening, such as rectangular weirs, triangular or V-notch weirs, trapezoidal weirs, and parabolic weirs. Weirs not sharp crested are classified according to the shape of their cross section, such as broad-crested weirs, triangular weirs, and trapezoidal weirs.

The channel leading up to a weir is the channel of approach. The mean velocity in this channel is the velocity of approach. The depth of water producing the discharge is the head. Sharp-crested weirs are useful only as a means of meas- uring flowing water. In contrast, weirs not sharp crested are commonly incorporated into hydraulic structures as control or regulation devices, with measurement of flow as their secondary function.



Sharp-crested weir.



Weir not sharp crested.

FLOW OVER WEIRS.

1) Rectangular Weir

The Francis formula for the discharge of a sharp-crested rectangular weir having a length b greater than 3h is

$Q=3.33*(b-nh)/10*[(h+h_0)^{(3/2)}-h_0^{(3/2)}]$

where

Q= discharge over weir, ft^3/s (m^3/s)

b= length of weir, ft (m)

h= vertical distance from level of crest of weir to water surface at point unaffected by weir drawdown (head on weir), ft (m)

n= number of end contractions (0, 1, or 2)

h_0= head of velocity of approach

If the sides of the weir are coincident with the sides of the approach channel, the weir is considered to be suppressed, and n=0. If both sides of the weir are far enough removed from the sides of the approach channel to permit free lateral approach of water, the weir is considered to be contracted, and n= 2. If one side is suppressed and one is contracted, n=1.

2) Triangular Weir

The discharge of triangular weirs with notch angles of 30°, 60°, and 90° is given by the formulas as

Discharge of Triangular Weirs

Notch (vertex) angle	Discharge formula	
90°	Q	$0.685h^{2.45}$
60°	Q	$1.45h^{2.47}$
30°	Q	$2.49h^{2.48}$

h is as defined above in the Francis formula.

3) Trapezoidal (Cipolletti) Weir

The Cipolletti weir, extensively used for irrigation work, is trapezoidal in shape. The sides slope outward from the crest at an inclination of 1:4, (horizontal/vertical). The discharge is

$$Q=3.367bh^{3/2}$$

where b, h, and Q are as defined earlier. The advantage of this type of weir is that no correction needs to be made for contractions.

4) Broad-Crested Weir

The discharge of a broad-crested weir is

Q=Cbh3/2

Variations in Head Ratio and Coefficient of Discharge for Broad-Crested Weirs

Ratio of actual head to design head	Coefficient of discharge
0.20	3.30
0.40	3.50
0.60	3.70

0.80	3.85
1.00	3.98
1.20	4.10
1.40	4.22

Q, b, and h are as defined for rectangular weirs.
Values of C for broad-crested weirs with rounded upstream corners generally range from 2.6 to 2.9. For sharp upstream corners, C generally ranges from 2.4 to 2.6.

Source: http://www.engineeringcivil.com/weirs.html