

What is a Spillway? Purposes and Different Types of Spillway

What is a Spillway? Definition

Dams are generally constructed to store water of the channel so that it can be used for future work like irrigation, electricity, and mostly for flood control.

In some case, dam get overflow of water which may damage the whole design and structure if we do not discharge excess water from it.

So, a spillway provides a way to discharge water from the stored water of the dam. So, almost every dam should be provided at least one spillway according to the coverage area of the dam.



Due to variability of the season, no engineers can predict exact rainfall and volume of flood due to melting of snow and rainfall. So, it makes it difficult to design a dam for specific discharge of water through the channel.

So, to overcome these types of problems spillway is the most

important structure to be provided for the sudden rise of water upstream of the dam. Providing a spillway lets the water discharge through it and makes the dam safe from overflowing.

We cannot construct a higher dam to overcome the high flow of water since it makes the structure costly nor can we construct the dam too small since it may overflow soon and destroy the structure beside it.

Spillways are constructed with the help of a large cross-sectional tube and penstock. There is the connection of the inlet of the spillway at the upstream of the dam and the outlet of the spillway downstream of the dam.

Most of the large dam is constructed with two spillway one of them is called service spillway which is used to extract water when the dam is full and another is called emergency or auxiliary spillway which are operated when there is an excess of the flow of water in upstream of the channel.

The water stored upstream of the dam is known as a reservoir and the main function of the spillway is to control the overflow of water in the reservoir. Simply we can say it maintain the level of water in the reservoir.

By the way it is not a moving structure so that it can be open and shut down with the help of mechanical devices. It just controls the level of water by standing along vertically as shown in the figure.

When the level of water reached above the spillway then water automatically falls through the pool of the spillway and escapes out through the outlet. But how about the capacity of the spillway?

Capacity of spillway depends upon

following factors.

- The inflow flood.
- The volume of storage provided by the reservoir.
- Crest height of the spillway.
- Gated or ungated.

Purposes of spillway

- It maintains the level of water.
- It protects the bank of the dam from erosion and failure of the dam.
- It controls the overflow of water over the dam.
- It makes the way of water to transfer from the reservoir to different required sectors like irrigation, hydropower plant, etc.

Types of Spillway

1) Drop Spillway



These types of spillways are constructed whose height is very small. Its crest is very narrow so that the waterfall freely

and maintain a very less vertical position. it cannot be constructed in case if the foundation of the dam is weak.

But it can be provided for a decked overflow dam with the vertical or adverse inclined downstream face.

2) Ogee Spillway

It has a crest shaped in the form of ogee or S-shaped. Ogee spillway is the modified form of drop spillway. It is generally constructed on gravity dams or arches dam.

DESIGNING THE CREST OF THE OGEE SPILLWAY

- ❑ Several standard shapes have been developed by U. S. Army Corps of Engineers at their Waterway Experimental Station (WES)
- ❑ Such shapes are known as 'WES Standard Spillway Shapes'
- ❑ The d/s profile can be represented by:

$$x^n = K \cdot H_d^{n-1} \cdot y$$

Where, (x, y) are the co-ordinates of the points on the crest profile with the origin at highest point C on the crest, called apex.

H_d is the design head including the velocity head.

K and n are the constants depending upon the slope of the upstream face. The value of K and n are given as.

Slope of the u/s face of the spillway	K	n
Vertical	2.0	1.85
1 : 3 (1H : 3V)	1.936	1.836
1 : 1½ (1H : 1½ V)	1.939	1.810

- ❑ For a spillway having a vertical face, the d/s crest is given by:

$$x^n = 2 \cdot H_d^{0.85} \cdot y$$

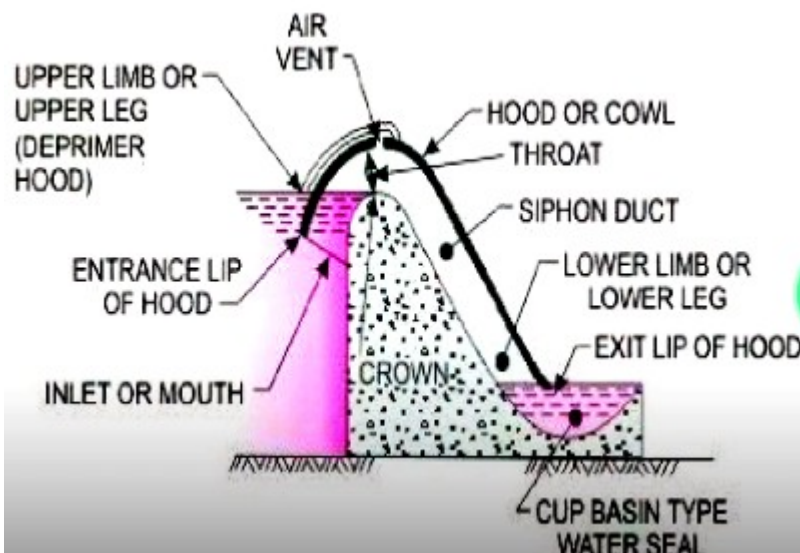
- According to studies by U. S. Army Corps, the u/s curve having a vertical u/s face is given by:

$$y = \frac{0.724 (x+0.27H_d)^{1.85}}{H_d^{0.85}} + 0.126H_d - 0.4315H_d^{0.375} \times (x + 0.27H_d)^{0.675}$$

- The u/s profile extends up to $x = -0.27H_d$
- Co-ordinates for the upper nappe for various WES shapes of ogee spillway are also available and can be utilized in the design of training walls and spillway bridges etc

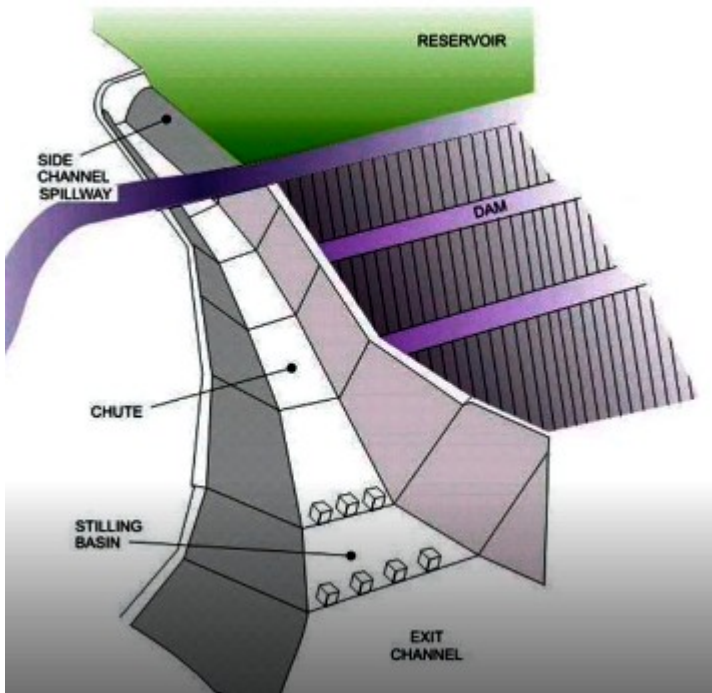
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3) Siphon Spillway



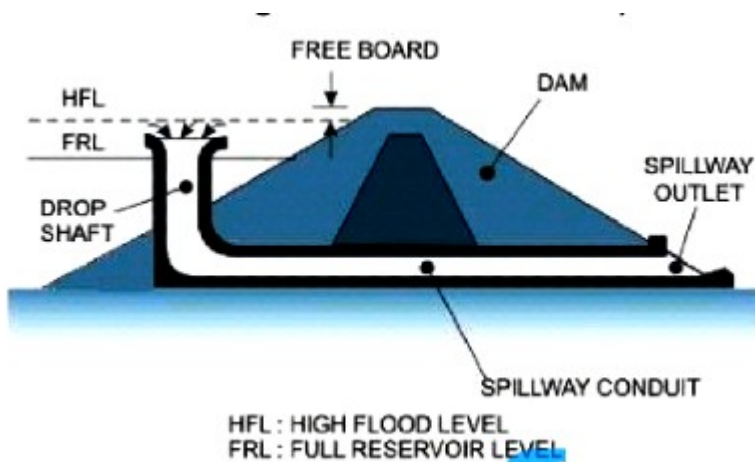
Siphon spillways are based on the siphonic principle. It consists of a closed conduit system formed in the inverted U-shaped tube. When the level of water increases in the reservoir the water begins to flow through a tube under siphonic action.

4) Chute/Trough Spillway



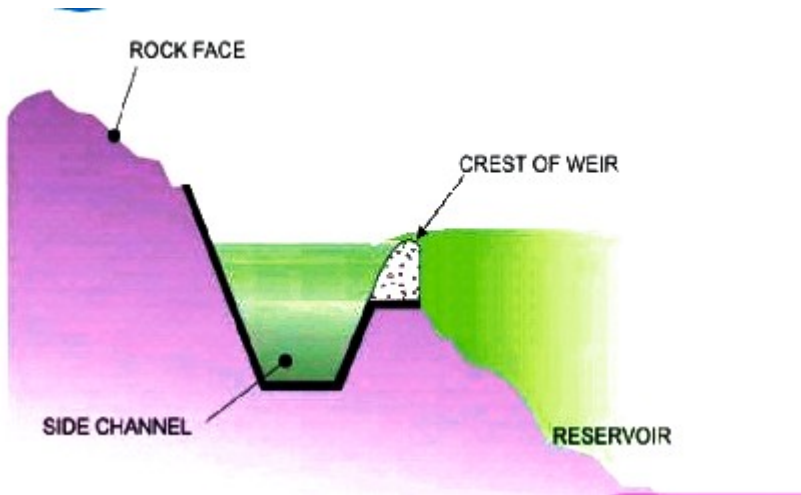
It is such a type of spillway, whose discharge is conveyed from the reservoir to the downstream river level through an open channel placed either along the dam abutment or through a saddle.

5) Shaft Spillway



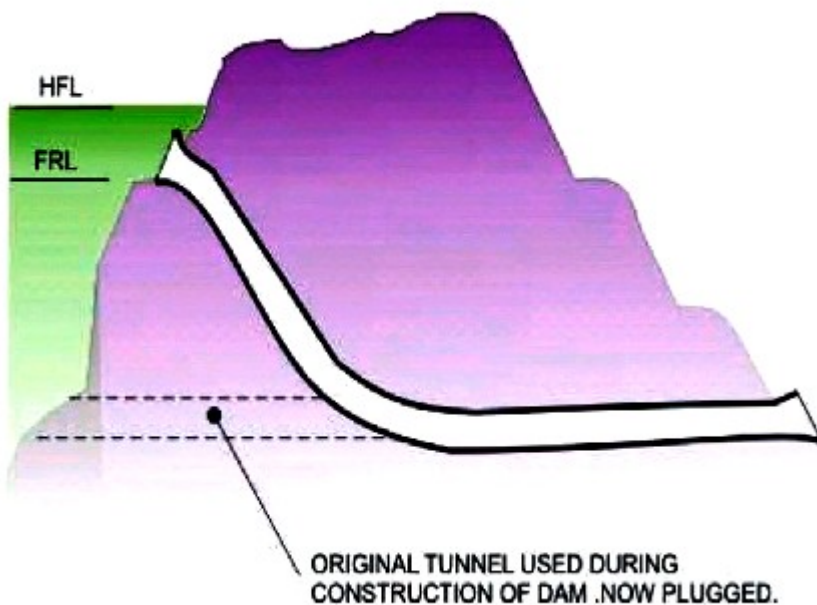
Shaft spillways are those whose shape is like a funnel which is also called a sinkhole. One end of the shaft spillway is connected with Crest and another is taken out to the downstream of the channel as an outlet of water. It surcharges a huge amount of water than another spillway.

6) Side-channel Spillway



It can be provided where free overfall is not possible. It can be constructed in a lesser space. It is constructed parallel to the dam. When there is an increase in the level of water in the reservoir water escapes out from this spillway to prevent overflow over the dam.

7) Tunnel Spillway



It is used where a closed channel is used to convey the discharge around a dam through the adjoining hillside. This tunnel is also called a tunnel or conduit spillway.

A closed channel may take the form of a vertical or inclined shaft, a horizontal tunnel through earth's or rocks, or a conduit constructed in open cut and backfilled with earth materials.

I hope this article on “What is a Spillway” remains helpful for you.

Happy Learning – Civil Concept

Contributed by,

Civil Engineer – Ranjeet Sahani

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