Spillway

Definition:

Spillways are structures constructed to provide safe release of flood waters from a dam to a downstream are, normally the river on which the dam has been constructed.

Every reservoir has a certain capacity to store water. If the reservoir is full and flood waters enter the same, the reservoir level will go up and may eventually result in over-topping of the dam. To avoid this situation, the flood has to be passed to the downstream and this is done by providing a spillway which draws water from the top of the reservoir. A spillway can be a part of the dam or separate from it.

Spillways can be controlled or uncontrolled. A controlled spillway is provided with gates which can be raised or lowered. Controlled spillways have certain advantages as will be clear from the discussion that follows. When a reservoir is full, its water level will be the same as the crest level of the spillway.

This is the normal reservoir level. If a flood enters the reservoir at this time, the water level will start going up and simultaneously water will start flowing out through the spillway. The rise in water level in the reservoir will continue for some time and so will the discharge over the spillway. After reaching a maximum, the reservoir level will come down and eventually come back to the normal reservoir level.

The top of the dam will have to be higher than the maximum reservoir level corresponding to the design flood for the spillway, while the effective storage available is only up to the normal reservoir level. The storage available between the maximum reservoir level and the normal reservoir level is called the surcharge storage and is only a temporary storage in uncontrolled spillways. Thus for a given height of the dam, part of the storage – the surcharge storage is not being utilized. In a controlled spillway, water can be stored even above the spillway crest level by keeping the gates closed. The gates can be opened when a flood has to be passed.

Parameters considered in Designing Spillways

Thus controlled spillways allow more storage for the same height of the dam. Many parameters need consideration in designing a spillway. These include:

1. The inflow design flood hydro-graph
2. The type of spillway to be provided and its capacity
3. The hydraulic and structural design of various components and
4. The energy dissipation downstream of the spillway.

The topography, hydrology, hydraulics, geology and economic considerations all have a bearing on these decisions. For a given inflow flood hydro graph, the maximum rise in the reservoir level depends on the discharge characteristics of the spillway crest and its size and can be obtained by flood routing. Trial with different sizes can then help in getting the optimum combination.

Types of Spillways – Classification of Spillways

There are different types of spillways that can be provided depending on the suitability of site and other parameters. Generally a spillway consists of a control structure, a conveyance channel and a terminal structure, but the former two may be combined in the same for certain types. The more common types are briefly described below.

Ogee Spillway

The Ogee spillway is generally provided in rigid dams and forms a part of the main dam itself if sufficient length is available. The crest of the spillway is shaped to conform to the lower nappe of a water sheet flowing over an aerated sharp crested weir.

Chute (Trough) Spillway

In this type of spillway, the water, after flowing over a short crest or other kind of control structure, is carried by an open channel (called the “chute” or “trough”) to the downstream side of the river. The control structure is generally normal to the conveyance channel. The channel is constructed in excavation with stable side slopes and invariably lined. The flow through the channel is super-critical. The spillway can be provided close to the dam or at a suitable saddle away from the dam where site conditions permit.

Side Channel Spillway

Side channel spillways are located just upstream and to the side of the dam. The water after flowing over a crest enters a side channel which is nearly parallel to the crest. This is then carried by a chute to the downstream side. Sometimes a tunnel may be used instead of a chute.

Shaft (Morning Glory or Glory hole) Spillway

This type of spillway utilizes a crest circular in plan, the flow over which is carried by a vertical or sloping tunnel on to a horizontal tunnel nearly at the stream bed level and eventually to the downstream side. The diversion tunnels constructed during the dam construction can be used as the horizontal conduit in many cases.

Siphon Spillway

As the name indicates, this spillway works on the principle of a siphon. A hood provided over a conventional spillway forms a conduit. With the rise in reservoir level water starts flowing over the crest as in an “ogee” spillway. The flowing water however, entrains air and once all the air in the crest area is removed, siphon action starts. Under this condition, the discharge takes place at a much larger head. The spillway thus has a larger discharging capacity. The inlet end of the hood is generally kept below the reservoir level to prevent floating debris from entering the conduit. This may cause the reservoir to be drawn down below the normal level before the siphon action breaks and therefore arrangement for de-priming the siphon at the normal reservoir level is provided.

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