Dams Operation

Dams are built for a difference purpose;

- **Irrigation**
- **Flood control**
- **Power Supply**
- **Water demand in downstream region.**
- **Tourist.**

To satisfy these purposes we need high accuracy to operate and control of dam, for example to supply power the storage in the reservoir must be at high level, this cause the problem for flood control purpose which needs the reservoir must be empty or at low level. Also, the operation for irrigation purpose needs we must fill the reservoir quickly to discharge water according to agriculture demand, while the power demand needs the storage at high level along the year.

The engineer must be balance among different purposes; any mistake in filled or empty the reservoir may be causes a considerable effect on dam operation.
The engineer may be make a mistake when filled or empty the malti-reservoir these cause the results are not good.
When he (engineer) didn't fill the reservoir quickly will cause the shortage of water demand for irrigation and power supply. While will case a catastrophic for agriculture and cities in downstream region when he fill the reservoir and then the flood occur.

Reservoirs:

A water-supply, irrigation, or hydroelectric project drawing water directly from a stream may be unable to satisfy the demands of its consumers during low flows. This stream, which may carry little or no water during portions of the year, often becomes a raging torrent after heavy rain and a hazard to all activities along its banks.
A storage reservoir can retain such excess water from periods of high flow for use during periods of drought. In addition to conserving water for later use, the storage of floodwater may also reduce flood damage below the reservoir.
Whatever the size of a reservoir or the ultimate use of the water, *the main function of a reservoir is to stabilize the flow of water, either by regulating a varying supply in a nature stream or by satisfying a varying demand by the ultimate consumers.*

Types of Reservoirs

If a reservoir serves only one purpose, it is called a ***single-purpose reservoir***. On the other hand, if it serves more than one purpose, it is termed a ***multipurpose reservoir***. Because in most of the cases, a single purpose reservoir is ***not economically feasible***, it is the general practice in Iraq to develop multipurpose reservoirs. The various purposes served by a multipurpose reservoir include

- irrigation
- municipal and industrial water supply,
- flood control
- hydropower,
- navigation,
- recreation,
- development of fish and wild life,
- soil conservation
- Pollution control.

Depending upon the purpose served, the reservoirs may be broadly classified into five types:
(1) Storage (or conservation) reservoirs,
(2) Flood control reservoirs,
(3) Multipurpose reservoirs,
(4) Distribution reservoirs, and
(5) Balancing reservoirs.

1. **Storage reservoirs:**

Storage reservoirs are also called ***conservation reservoirs*** because they are used to ***conserve water***. Storage reservoirs are constructed to store the water in the rainy season and to release it later when the river flow is low. Storage reservoirs in Iraq are usually constructed for:

- Irrigation,
- The municipal water supply and
- Hydropower.

Although the storage reservoirs are constructed for storing water for various purposes, incidentally they also help in ***moderating the floods and reducing the flood damage to some extent on the downstream***. However, they are ***not designed as flood control reservoir***.

1. **Flood control reservoirs:**

A flood control reservoir is constructed ***for the purpose of flood control***.

Functions:

- It protects the areas lying on its downstream side from the damages due to flood. However, absolute protection from extreme floods is not economically feasible. It is also known as the flood-mitigation reservoir. Sometimes, it is called flood protection reservoir.
- A flood control reservoir is designed to moderate the flood and not to conserve water. However, incidentally some storage is also done during the period of floods.
- Flood control reservoirs have relatively large sluice-way capacity to permit rapid drawdown before or after the occurrence of a flood.

In a flood control reservoir, the flood water is discharged downstream till the ***outflow reaches the safe capacity of the channel downstream***. When the discharge exceeds the safe capacity, the excess water is stored in the reservoir. The stored water is subsequently released when the inflow to reservoir decreases. Care is, however, taken that the discharge in the channel downstream, including local inflow, does not exceed its safe capacity:

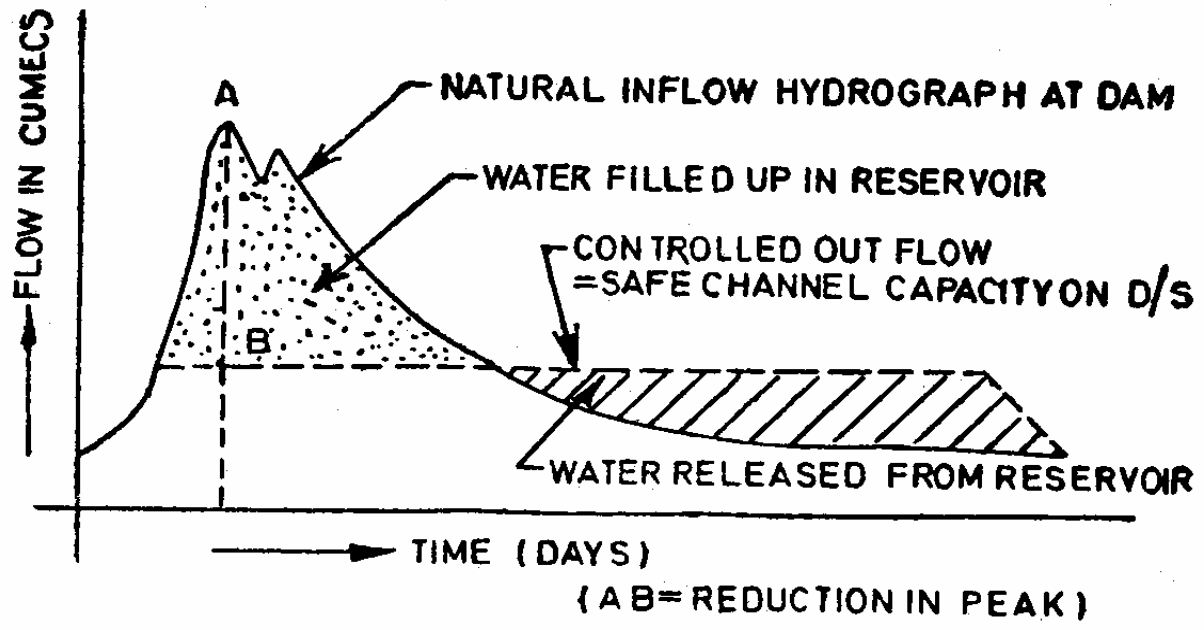
The flood control reservoirs are of two types:
(i) Detention reservoirs and
(ii) Retarding reservoirs.

i. Detention reservoirs:

Function:

- Stores excess water during floods and releases it after the flood.
- It is similar to a storage reservoir but is provided with large gated spillways and sluiceways to permit flexibility of operation.

The discharge from a detention reservoir to the downstream channel is ***regulated by gates***. In the earlier stages of a flood, the gates are left open and the water is released subjected to the safe carrying capacity B of the channel downstream. In the later stages of the flood when the discharge downstream exceeds the maximum capacity of the downstream channel, the gates are kept partially closed.



There is basically no difference between the detention reservoir and a storage reservoir except that the former has a larger spillway capacity and sluiceway capacity to permit rapid drawdown just before or after a flood. The reservoir is quickly emptied and thus the full reservoir capacity is made available again for moderating a subsequent flood after a short interval. In this manner, the available capacity is more effectively used. When the natural inflow is greater than controlled outflow rate (B), the excess water is stored in the reservoir. The volume of stored water is indicated by dotted area. When the discharge is less than B the stored water is released. The volume of released water is shown by hatched area. Because of detention reservoir, the flood peak is reduced from A to B. ***Thus the effect of reservoir on a flood is to reduce the peak discharge*** by absorbing a volume of flood water when the flood is rising, and releasing the same later gradually when the flood is receding.

Advantages

(1) The detention reservoirs provide more flexibility of operation and better control of outflow than retarding reservoirs. Large reservoirs are usually detention reservoirs.
(2) The discharge from various detention reservoirs on different tributaries of a river can be adjusted according to the carrying capacity of the d/s channel.

Disadvantages

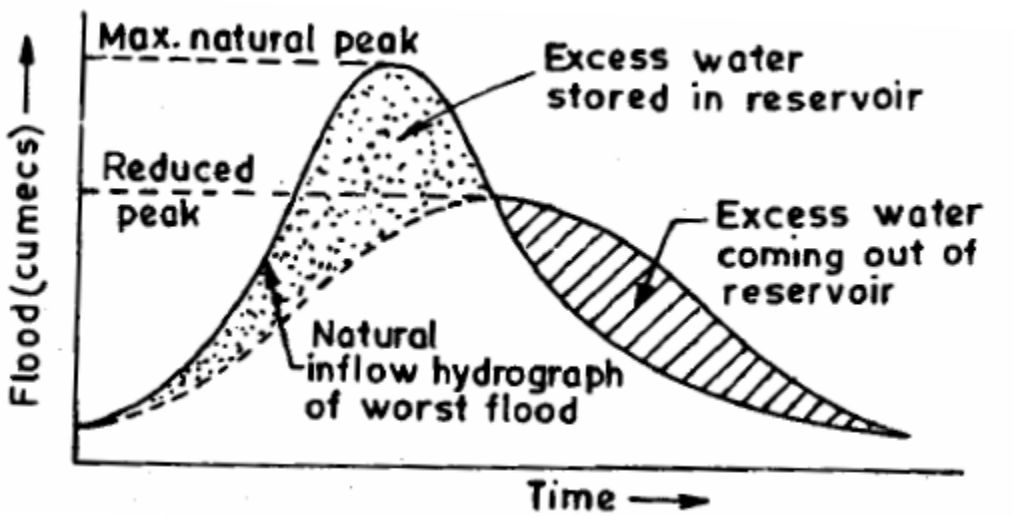
(1) The detention reservoirs are more expensive than the retarding reservoirs because of high initial cost and maintenance cost of gates and the lifting machinery.
(2) Due to the possibility of human error or negligence, a disaster can occur.

ii. Retarding Reservoirs:

Function

- A retarding reservoir is provided with spillways and sluiceways which are un-gated.
- The maximum combined discharging ***capacity of all spillways and sluiceways is limited to the safe-carrying capacity of the channel downstream***.
- The retarding reservoir stores a portion of the flood when the flood is rising and releases it later when the flood is receding. However, in this case, the discharge downstream cannot be controlled because there are no gates.
- There is an automatic release of water, depending upon the level of water in the reservoir.

As the flood occurs, the reservoir gets filled and at the same time, the discharge from the spillways and sluiceways occurs. When the elevation of water in the reservoir increases, the discharge through spillways and sluiceways also increases.



The water level in the reservoir goes on rising until the flood starts receding when the inflow is reduced and it becomes equal to or less than the outflow. After that stage has reached, the water level in the reservoir starts falling and it continues till the stored water has been completely discharged and the water level has reached the lowest sluiceway level. Fig. shows the peak reduction mechanism of a retarding reservoir. The stored water in the reservoir (dotted), which is later released, is shown hatched.

Location of Retarding Reservoirs:

- A favorable location for a retarding reservoir is just above the area or the city to be protected against floods.
- A retarding reservoir is also usually located on a tributary of a river just upstream of its confluence to protect the area downstream of it.

Advantages

(1) The retarding reservoirs are relatively less expensive than detention reservoirs.
(2) As the outflow is automatic, there is no possibility of a disaster due to human error or negligence.

Disadvantages

(1) The retarding reservoirs do not provide any flexibility of operation as the outflow is automatic.
(2) The discharge from retarding reservoirs on different tributaries of a river may coincide and cause heavy flood in the river downstream.

2. **Multipurpose Reservoirs:**

A multipurpose reservoir is designed and constructed to serve two or more purposes. In Iraq, most of the reservoirs are designed as multipurpose reservoirs to store water for irrigation and hydropower, and also to effect flood control.

3. **Distribution Reservoir:**

A distribution reservoir is a small storage reservoir to tide over the peak demand of water for municipal water supply or irrigation. The distribution reservoir is helpful in permitting the pumps to work at a uniform rate. It stores water during the period of lean demand and supplies the same during the period of high demand. As the storage is limited, it merely helps in distribution of water as per demand for a day or so and not for storing it for a long period. Water is pumped from a water source at a uniform rate throughout the day for 24 hours but the demand varies from time to time. During the period when the demand of water is less than the pumping rate, the water is stored in the distribution reservoir. On the other hand, when the demand of water is more than the pumping rate, the distribution reservoir is used for supplying water at rates greater than the pumping rate. Distribution reservoirs are rarely used for the supply of water for irrigation. These are mainly used for municipal water supply.

4. **Balancing reservoir:**

A balancing reservoir is a small reservoir constructed d/s of the main reservoir for holding water released from the main reservoir.