UNIT-4
VARIOUS IRRIGATION STRUCTURES

Irrigation structures

Those structural components that are associated with artificially supplying water to soil for raising crops are called Irrigation structures.

Various Irrigation Structures

i. Headworks
ii. Canal Head Regulator
iii. Cross Regulator
iv. Canal fall
v. Weir and Barrage
vi. Under Sluice
vii. Cross drainage Structure
viii. Settling Basin
ix. Silt excluder
x. Spillway

4.1 Headworks: Definition and Types

- The hydraulic structure which is constructed at the head of irrigation canal and supplies water to the irrigation canal continuously without disturbance is called headworks.
- Headworks are constructed for storage, raise, diversion and supply of water from natural river/stream to the canal.

Function of headworks:

- Raise water level.
- Regulate intake of water.
- Control silt entry to canal.
- Store water for certain period.
- Reduce fluctuation in level of water supply.

Types of headworks

There are two types of headworks:

i. Storage headworks
ii. Diversion headworks

i. Storage headworks

- When dam/weir/barrage is constructed across a river to form a storage reservoir, such a headwork is called storage headwork.
- It is constructed at the head of the canal.
- It stores the river/stream water in reservoir.
- It ensures regulated continuous supply of silt-free water.
- It raises the head of source (water level of river/stream).

ii. Diversion Headworks

- When a weir or barrage is constructed across a river to raise the water level and divert the water to canal, such a headwork is called diversion headwork.
- It is constructed at the head of the canal.
- It raises the water level in river.
- It regulates the flow of water.
- It diverts the river water towards the irrigation canal.
- It ensures silt-free water.

Components of diversion headworks:

The various components of diversion headworks are as follows:

a. Weir or Barrage
b. Divide wall
c. Fish ladder
d. Under sluice
e. Silt excluder
f. Canal Head Regulator
g. River training works
    i. Guide bund
    ii. Marginal bund

a. Weir or Barrage

- Weir is a structure constructed across a river to raise its water level and divert it into the irrigation canal.
- Weir is provided with shutter on the crest.
- A part of raising water is carried out by shutters.
- It is usually aligned at right angle to the direction of flow of rivers.

- Barrage is a structure constructed across a river to raise its water level and divert it into the irrigation canal.
- The crest of barrage is low.
- The raise of water level is done with the help of gates.
- It is costlier than weir.

b. Divide wall

- It is also called divide groyne.
- It is a long masonry or concrete wall which is constructed at right angle to the axis of the weir.
- It separates undersluice from rest of the weir.
- It extends from upstream to downstream of the weir.

c. Fish ladder

- Due to construction of weir or barrage, fish are not able to migrate from upstream to downstream of weir and vice versa.
- To enable fish to migrate, fish ladder is provided.
- The velocity of flow in fish ladder is maintained at less than 3 to 3.5 m/s.

d. Under sluice

- It is also called Scouring sluice.
- It is the opening provided in the weir wall with their crest at lower level.
- These openings are controlled by gates.
- They are located at same side as off-taking canal.

e. Silt excluder

- They are silt control devices.
- They exclude silt in water from entering into the canal.
- They are provided on river bed in front of head regulator.
- It consists of numbers of rectangular channels.
- It rests on the floor of undersluice pocket.

f. Canal head regulator

- It is a structure constructed at the head of canal.
- It is present at upstream of weir or barrage.
- It consists of number of spans separated by piers.
- Piers support the gate provided for regulation of water to the canal.
- The spans are 6 to 8 metres.
- The steel gates are used which are operated manually.

g. River training works

- River training works are various measures adopted on a river or stream to stabilize the river channel along a certain cross section and alignment.
- They are adopted for alluvial soil because rivers frequently change their courses.
- The following river training works are used in diversion headworks:
  i. Guide bund
  ii. Marginal bund

i. Guide bund

- It is also called guide bank.
- They are earthen or rockfill embankments provided to control the flood water of alluvial river.
- It is provided to prevent river from changing its course.
- Guide bunds were first designed in India by Bell. So, it is also called Bell's bund.

ii. Marginal bund

- It is also called a levee.
- It is earthen embankment provided to control the flood water from a river within an allowable cross section in between them.

- Spreading of flood water beyond the marginal bund is prevented by its construction.

4.1.1. Canal head regulator

The structure constructed at the head of the canal which takes off water from a reservoir and consists of number of spans separated by piers is called head regulator.

- It is operated by gates.
- It is aligned at 90° to the weir.
- It is used for diversion of flow to canal.

Functions of canal head regulator:

- To supply water into the off taking canal.
- To regulate the supplies into the canal.
- To calculate discharge of flow in canal.
- To control entry into the canal.

4.1.2. Cross regulator

A regulator is a structure constructed across a canal downstream of it to regulate water level in upstream of canal and discharge passing.

Function of cross regulator:

- To supply canal water from off taking canal
- To help water escape from canal in conjunction
- To control water surface slope in conjunction
- To control discharge of water at the downstream of cross regulator

4.1.3. Canal fall

- Canal fall is a solid structure which is constructed on the canal if the natural ground slope is steeper than the designed channel bed slope.
- Canal fall is required when ground slope suddenly changes and when cross drainage work is required to be done.

Types of canal fall:

- Ogee falls
- Rapid fall
- Stepped fall

- Trapezoidal fall
- Well type fall
- Simple vertical fall
- Straight glacis fall
- Montague type fall
- English fall or baffle fall

4.14. Weir and Barrage

- Weir is a diversion head work constructed across a river to raise the water level on upstream side.
- It does not have a storage reservoir.
- Water is raised up to a required height and water flows over the weir.
- Weir are also used to measure discharge of water.

- Barrage is a diversion head work constructed across a river to divert the flow of water.
- It also doesn't have storage reservoir. Water is raised up to only a few metres.
- It has adjustable gates installed on top of its crest.
- Water level in canal is maintained by using these gates.
- Gates are also opened during flooding season.

Differences between weir and barrage:

Barrage	**Weir**
Low set crest	High set crest
Ponding is done by means of gates	Ponding is done against raised crest or partly against crest and partly against shutter
Gated over entire length	Shutters provided in some parts of length
Gates are of greater height	Shutters are of smaller height
Gates are raised up to clear off the high floods	Shutters are dropped to pass flood
Perfect control on river flow	No control of river in low floods
Gates convenient to operate	Operation of shutter is slow and involves labour and time
High floods can be passed with minimum afflux	Excessive afflux in high flood

Less silting in upstream due to low set crest	Raised crest causes silting in upstream
Longer construction period	Shorter construction period
Silt removal is done through undersluices	No means for silt disposal
Road or rail bridges can be constructed over it at low cost	Not possible to provide road or rail bridge
Costly structure	Relatively cheaper structure

Similarities between weir and barrage:

- They are both used to control floods.
- Both help in river navigation.
- Both are used to measure discharge of flow.