1. Canal Irrigation Systems

A direct irrigation scheme used a weir or a barrage as well as a storage irrigation scheme that makes use of a storage dam or a storage reservoir, require necessary network of canals. The entire system of main canals, branch canals, distributaries and minors is to be designed properly for a certain realistic value of peak discharge that must pass through them to provide sufficient irrigation to command areas. Either these canals have to align and excavate in alluvial soils or non-alluvial soils depending upon which they are called alluvial canals or non-alluvial canals.

Open channels that water flows with free surface are classified to its origin at:

1-Natural channel.

2-Artificial channel.

The following classifications are prepared based upon:

1] Function:

1- Irrigation canal: transport water to the agricultural field,

2- Carrier canal: besides irrigation task, it transports water for another canal,

3-Feeder canal: constructed with idea of feeding two or more canals,

4- Navigation canals,

5- Power canals.

2] Based on Carried Discharge and its Relative Importance in Irrigation Network:

1) Main canal (**M.C***): Carrier irrigation water directly from the source .it is not used for direct irrigation but carry water only.

*****Sometimes there are two main canals, which take from the reservoir, called left bank M.C, and right bank M.C depend on the topography of catchments.

A- Main canal (head reach): The canal head works generally situated in a valley for short distance. In such case, reach must be aligned very carefully and has to excavate in a deep cutting below natural surface level.

B-Main canal (below head reach portion): attempts are made to aligned the canal along the watershed and somewhat central to commanded area. Sometimes watershed has to be sacrificed by pass towns and villages, etc.

2) Branch canals (**B.C**): the canals branches from M.C, to feed the distributaries canal. It is also do not carry a direct irrigation.(When a main canal leaves the high ground and must therefore, divide into branches, covering the entire area required to be irrigated).

3) Distributary canals (**D.C**): Smaller channels, which take off from the branch canals and distribute their supply through outlets into watercourses, are called distributaries.

4- Water courses (**W.C**): The canals, which feeds the water to the farm units.

5- Farm channel (**F.C**): the channels that distributers water on the farm. Figure 1 shows alignment of irrigation network canals.

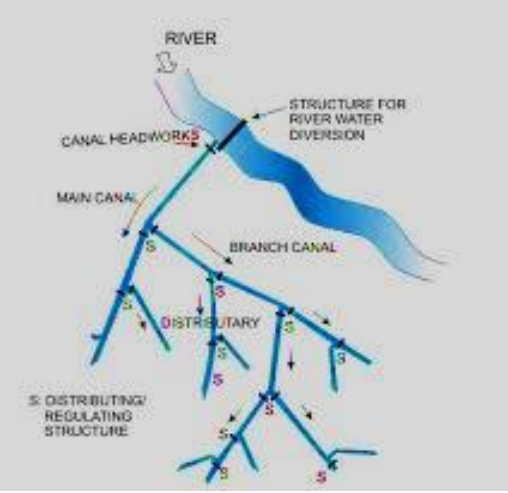

Figure 1: Layout of canal irrigation system

2. Bends in Channels

The alignment of the canals should be maintained straight as possible, but if a bend is inevitable because of the nature of the land, the aligning of unlined channel should be gentle as possible. A bend or curve causes distribution of flow and results in silting on inside (i.e. convex side or outer bank)and scouring on the outside (i.e. concave side or inner bank).See figure 2 below.

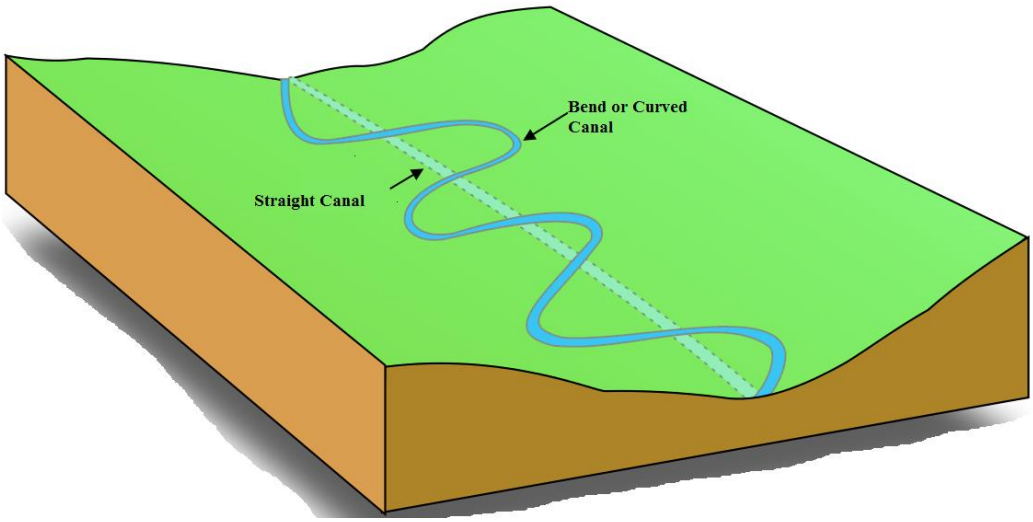

Figure 2: Diagram of canal bends

Riprap lining or concrete tiles were recommended on the concave side to avoid scouring. If the discharge is increased, the curve should more gentle and should have larger radius. The minimum values of radius for different discharge rates are given in Table-1 below.

Table-1

Discharge (m^3/sec)	Minimum radius of curvature for bend (m)
>100	1500
30-100	900
15-30	600
3-15	300
0.5-3	150
<0.5	100

1-**Gross area**:(G.A): The total area which can be economically irrigated without considering the limitation of the quantity of available water it include the cultivable as well as the non- cultivable area.

2-Intensity of irrigation (II): is defined as the percentage of culturable commanded area proposed to be irrigated during either a crop season or during a year. Alternatively, is defined as the percentage of the irrigation proposed to be irrigated annually. Usually the areas irrigated during each crop season is expressed as a percentage of the CCA* that represents the intensity of irrigation for the crop season.

***Cultivable Commanded Area (**CCA): cultivable area is the total area on which cultivation is possible, not all of the cultivable area may necessary be under cultivation at a time.

$$II = \frac{land\ cultivated(area\ to\ be\ irrigated)}{CCA}$$

3- Capacity factor: it is the ratio of the mean supply discharge to the full capacity discharge.

$$Full\ supply\ coefficient = \frac{Area\ estimated\ to\ be\ irrigated\ during\ base\ period}{Design\ discharge\ at\ its\ head\ during\ peak\ demand}$$