

Canal alignments

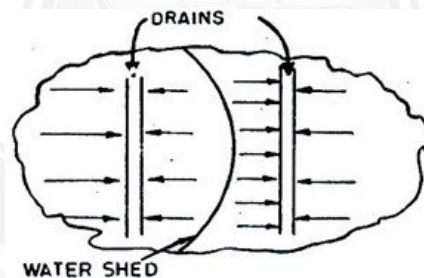
- It is now clear that irrigation water, in flow type, should reach the fields by gravity. To accomplish this requirement irrigation canal is always aligned in such a way that the water gets proper command over the whole irrigable area.
- Obviously if the canal follows a watershed or a ridge of the drainage area it will get necessary gravity flow. The watershed or the ridge is a dividing line between two drainage areas. Thus a canal which runs over the ridge gets command of area on both sides of the ridge.

Irrigation canals can be aligned in any of the three

- ways:
1. As watershed canal
 2. As contour canal; and
 3. As side slope canal

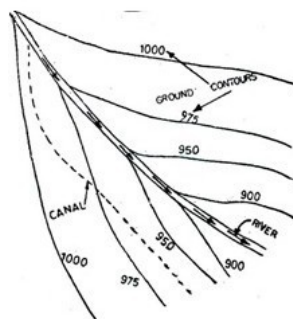
Watershed Canal

- The dividing line between the catchment area of two drains (streams) is called the watershed.
- Thus, between two major stream, there is the main watershed which divides the drainage areas of the two.
- Similarly, between any tributary and the main stream, and also between any two tributaries there, are subsidiary watersheds, dividing the drainage between the two streams on either side.



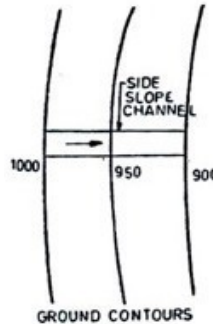
(ii) Contour Canal:

- The above arrangement of providing the canals along the watershed is not possible in hill areas.
- In the hills, the river flows in the valley, while the watershed or the ridge line may be hundred of metres above it.
- It becomes uneconomical to take the canal on top of such a ridge. The channel, in such cases, is generate sufficient flow velocities, are given to it.



iii) Side Slope Canal:

- A side slope channel is that which is aligned at right angles to the contours, i.e. along the side slopes, as shown in figure.
- Such a channel is parallel to the natural drainage flow and hence, does not intercept cross drainage, and hence no cross drainage works are required.



Precautions in Canal Alignment:

While aligning a canal following points should be considered in general:

- The canal should be aligned on the ridge or in such a way as to obtain maximum command.
- So far as possible the canal alignment should be kept in the centre of the commanded area.
- The canal should be aligned in such a way that the length is minimum possible.
- The alignment should avoid inhabited places, roads, railways, properties, places of worship etc.
- Canal should be taken through the area where subsoil formation is favourable. Water logged, alkali, saline, rocky soils create troubles.
- The alignment should be straight so far as possible. Where alignment is not straight simple circular curves of large radius should be provided.
- To ensure economy the alignment of the canal should be such that excessive cuttings and fillings are not required. The alignment should not cross hills or depressions.

Canal Linings

Canal Linings are provided in canals to resist the flow of water through its bed and sides. These can be constructed using different materials such as compacted earth, cement, concrete, plastics, boulders, bricks etc. The main advantage of canal lining is to protect the water from seepage loss.

Canal Lining is an impermeable layer provided for the bed and sides of canal to improve the life and discharge capacity of canal. 60 to 80% of water lost through seepage in an unlined canal can be saved by construction canal lining.

Types of Canal Linings

Canal linings are classified into two major types based on the nature of surface and they are:

1. Earthen Type lining

Earthen Type linings are again classified into two types and they are as follows:

- i. Compacted Earth Lining
- ii. Soil Cement Lining

Compacted Earth Lining

Compacted earth linings are preferred for the canals when the earth is available near the site of construction or In-situ. If the earth is not available near the site then it becomes costlier to construct compacted earth lining.

Compaction reduces soil pore sizes by displacing air and water. Reduction in void size increases the density, compressive strength and shear strength of the soil and reduces permeability. This is accompanied by a reduction in volume and settlement of the surface. Proper compaction is essential to increase the stability and frost resistance (where required) and to decrease erosion and seepage losses.

Soil Cement Lining

Soil-cement linings are constructed with mixtures of sandy soil, cement and water, which harden to a concrete-like material. The cement content should be minimum 2-8% of the soil by volume. However, larger cement contents are also used.

In general, for the construction of soil-cement linings following two methods are used. Dry-mix method

Plastic mix method

For erosion protection and additional strength in large channels, the layer of soil-cement is sometimes covered with coarse soil. It is recommended the soil-cement lining should be protected from the weather for seven days by spreading approximately 50 mm of soil, straw or hessian bags over it and keeping the cover moistened to allow proper curing. Water sprinkling should continue for 28 days following installation.

2. Hard Surface Canal Linings

It is sub divided into 4 types and they are

- i. Cement Concrete Lining
- ii. Brick Lining
- iii. Plastic Lining
- iv. Boulder Lining

Cement Concrete linings are widely used, with benefits justifying their relatively high cost. They are tough, durable, relatively impermeable and hydraulically efficient. Concrete linings are suitable for both small and large channels and both high and low flow velocities. They fulfill every purpose of lining.

There are several procedures of lining using cement concrete

- i. Cast in situ lining
- ii. Shotcrete lining
- iii. Precast concrete lining
- iv. Cement mortar lining

Brick Lining

In case of brick lining, bricks are laid using cement mortar on the sides and bed of the canal. After laying bricks, smooth finish is provided on the surface using cement mortar.

Plastic Lining

Plastic lining of canal is newly developed technique and holds good promise. There are three types of plastic membranes which are used for canal lining, namely:

- a) Low density poly ethylene
- b) High molecular high density polythene
- c) Polyvinyl chloride

The advantages of providing plastic lining to the canal are many as plastic is negligible in weight, easy for handling, spreading and transport, immune to chemical action and speedy construction.

The plastic film is spread on the prepared sub-grade of the canal. To anchor the membrane on the banks 'V' trenches are provided. The film is then covered with protective soil cover.

Boulder Lining

This type of lining is constructed with dressed stone blocks laid in mortar. Properly dressed stones are not available in nature. Irregular stone blocks are dressed and chipped off as per requirement.

When roughly dressed stones are used for lining, the surface is rendered rough which may put lot of resistance to flow. Technically the coefficient of rugosity will be higher. Thus the stone lining is limited to the situation where loss of head is not an important consideration and where stones are available at moderate cost.

Advantages of Canal Lining

1. Seepage Reduction
2. Prevention of Water Logging
3. Increase in Commanded Area

4. Increase in Channel Capacity
5. Less Maintenance

1. Seepage Reduction

The main purpose behind the lining of canal is to reduce the seepage losses. In some soils, the seepage loss of water in unlined canals is about 25 to 50% of total water supplied. The cost of canal lining is high but it is justifiable for its efforts in saving of most of the water from seepage losses. Canal lining is not necessary if seepage losses are very small.

2. Prevention of Water Logging

Water logging is caused due to phenomenal rise in water table due to uncontrolled seepage in an unlined canal. This seepage effects the surrounding ground water table and makes the land unsuitable for irrigation. So, this problem of water logging can be surely prevented by providing proper lining to the canal sides.

3. Increase in Commanded Area

Commanded area is the area which is suitable for irrigation purpose. The water carrying capacity of lined canal is much higher than the unlined canal and hence more area can be irrigated using lined canals.

4. Increase in Channel Capacity

Canal lining can also increase the channel capacity. The lined canal surface is generally smooth and allows water to flow with high velocity compared to unlined channel. Higher the velocity of flow greater is the capacity of channel and hence channel capacity will increase by providing lining.

On the other side with this increase in capacity, channel dimensions can also be reduce to maintain the previous capacity of unlined canal which saves the cost of the project.

5. Less Maintenance

Maintenance of lined canal is easier than unlined canals. Generally there is a problem of silting in unlined canal which removal requires huge expenditure but in case of lined canals, because of high velocity of flow, the silt is easily carried away by the water.

In case of unlined canals, there is a chance of growth of vegetation on the canal surface but not in case of lined canals. The vegetation affect the velocity of flow and water carrying capacity of channel. Lined canal also prevents damage of canal surface due to rats or insects.

6. Safety against Floods

Break down of canal damages the water table and flood which is unlined canal may overflow. So, there is a chance of canal lining for