WATER LOGGING

- When water table rises to such heights that the soil pores in the root zone become saturated, thus displacing the air, the land is said to be water logged.
- With restriction of normal circulation of air, decline in level of oxygen and increase in the level of carbon dioxide occurs.
- Over irrigation can raise the water table high enough to suffocate plant roots with water logging.
- The process of water logging starts even when water table is quite below the surface.
- Water rises on the surface due to capillary action.

Capillary action depend upon the type of soil, being small height for coarse and sandy soil and large for fine grained soil.

- The water table which is considered harmful will depend on the type of crop, type of soil and the quantity of water.
- With respect to the type of crops, depth of water table may vary over a wide range from zero for rice to about 1.5 m for other crops.

Nomenclature	Depth of water table
Water logged	< 2 m
Potential area for water logging	2-3 m
Safe	> 3 m

Remedial Measures of Water logging

There are two possible ways to get rid of the water logging:

1. Surface drainage

Surface drainage is the removal of excess water from the land surface to create more favourable conditions for plant growth.

The water may be from excess precipitation; water applied in irrigation; losses from conveyance channels and storage systems and/or water that has seeped from ground water in upper reaches.

These can be broadly described as

i.On-farm field drainage system

ii.Intermediate drains (collector or carrier drains)

iii.Main drains (or sub main drains)

iv.Seepage drains

Environmental Impacts of Water Logging

Environmental Impacts of water logging are caused by un-thoughtful planning of irrigation system and result into:

- Loss in crop yield
- Water logging and salinity causes destruction of vegetation and crops.
- Causing dampness and therefore diseases like Malaria, etc
- Destruction of roads due to reduced bearing capacity of water logged soil
- Rise of water in buildings due to capillary action
- Appearance of salts on the walls
- Coming down of plasters in the buildings.

2. Sub-surface drainage

It is removal/control of ground water and removal/control of salts using water as vehicle.

The source of water may be percolation from precipitation or irrigation, leakage from canals, drains or surface water bodies at higher elevation.

Any drain or well, designed to control/lower the ground water, is considered sub-surface drainage.

They may be broadly classified in two categories as :

(a) Horizontal Drainage, and (b) Vertical Drainage

(a) Horizontal drainage: It is accomplished by buried pipes or pipe less (mole) drains and also by deep open ditches.

(b) Vertical Drainage: It consists of direct extraction of ground water to lower the water table by a system of shallow tube wells spread in the area.

Water Logging:-

Effects of water logging:-

1. Inhabiting activity of soil bacteria:

The liberation of plant food is dependent upon the activity of soil bacteria, which requires adequate amount of oxygen in the air for proper functioning. When the soil pores within the root zone of the crops normally grown are so saturated as to effectively cutoff the normal circulation of air, the land is water logged.

2. Decrease in available capillary water:

Plant life draws its substance from the soil solution round the soil particles which is drawn into the plants by capillary action and osmosis. If the water-table high, the roots of the plants are confined to the top layers of the soil above the water table when if he water table is lower, the roots of the plants have more room for growth.

3. Fall in soil temperature:

A water logged soil warms up slowly and due to lower temperature, action of soil bacteria is sluggish and plant food available is less.

4. Defective air circulation:

When water table is high, the drainage becomes impossible and the carbon dioxide liberated by the plant roots cannot be dissolved and taken away. Consequently fresh air containing oxygen is not drawn and activity of soil bacteria and plant growth suffers.

5. Delay in cultivation operations:

In water logged areas, cultivation operation such as ploughing and mulching are either impossible or difficult and in any case they are delayed. Sowing of crops and their growth are also delayed. Crops yield is poor and it arrives late in market causing loss to cultivators.

6. Growth of wild flora:

In water logged, natural flora such as water hyacinth grows profusely. This crop reduces the crop yield. A cultivator has to waste money and time both for clearing it out.

7. Rise of salt:

The rise of water table also causes accumulation of alkali in the surface soil by the upward flow of water which is established in waterlogged lands.

The alkaline deposit changes the pH value of soil. Soil with pH value 7.0 to 8.5 gives normal yields, with pH value 8.0 to 9.0 the yield decreases; when pH value raises to 11.0 the soil become infertile.

8. Adverse effect on community health:

The climate of a water logged area becomes damp. Formation of stagnant pools may become breeding places for mosquitoes. The climate thus becomes extremely detrimental to the health of community.

Causes of water logging:

Water logging in any particular area is normally the result of several contributory factors. The main factors causing water logging are given below:

1. Inadequate surface drainage:

When the surface drainage is not adequate, the heavy precipitation in the area is not drained off quickly and rainwater remains stagnant over the area for considerable time. The gives to heavy percolation and water table rises in the area.

2. over irrigation field:

When the irrigation water applied to the field is in excess of the requirement of the crop, deep percolation takes place which is retained in the intermediate zone augmenting the groundwater storage.

3. Obstruction of natural drainage:

If a natural drainage is obstructed by irrigation channel, rail or road embankments, it will not be able to pass the rain water of catchment. There will thus be floating of land and consequent water logging.

4. Obliteration of natural drainage

Sometimes the cultivators plough up and obliterate an existing natural drainage. Thus result in stoppage of storm water flow, consequent flooding and water logging.

5. Construction of water reservoir:

The seepage from canal and reservoir augments the water table and may cause water logging.

6. Natural obstruction to the flow of groundwater:

Sometimes subsoil does not permit free flow of subsoil water due to natural obstruction. This may Accenture the process of raising the water-table.

The creation of a high false water-table or perched water-table also leads to water logging.

Remedial Measures:

In devising anti-water logging measures, the nature and magnitude of various factors, enumerated in previous article, should be correctly assessed and allowed for various remedial measures adopted for prevention of water logging.

1. Efficient surface drainage:

This system, which permits a quick flow of rainwater in short period helps to reduce the water logging. They have initial cost of construction.

2. Under-drainage by tile drains:

The drainage of agricultural land is done more satisfactorily by the drains. A suitable tile drain can hold the water table at a predetermined level which will be most beneficial to the crops. It has large initial cost.

3. Reducing percolation from canals:

Measures for substantial reduction of percolation losses from canal have to be undertaken.

(a) Lining of irrigation channels so as to make bed and sides of canal impervious.
(b) Lowering of full supply level of irrigation channels. If the full supply level of irrigation channel is reduced, there will be lesser seepage loss from embankment. The effective head between full supply level and field will also reduce and therefore chances of waste ful use of water are avoided.

4. Restriction of irrigation:

(a) The cultivators should be educated for economic use of water and induced to divided his field into "Kiaries" to avoid wastage. He should also encouraged to supplement his water requirement from open and tube wells.

(b) Area with high water table may be allowed only for Kharif irrigation and during Rabi the cultivators may irrigate from open and tube wells.

5. Lining of water courses:

The losses by percolation from cultivators water course are the order of 20% and above. Their lining therefore, further checks the inflow of canal water to subsoil through water courses.

6. Removing obstruction in natural drainage:

Drainage crossing with road, railways and canals should be remodeled to make it more efficient.

7. Prevention of seepage from water reservoir:

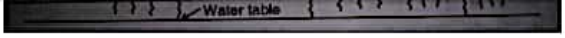
Adequate and suitably designed toe filters provided so that seepage ultimately finds its way into the natural stream.

8. Adoption of sprinkler method for irrigation:

This reduces the percolation losses from watercourses as only predetermine[illegible] of water is applied to the land.

9. Changes in crop pattern:

A change in crop pattern may minimize the damage to plant line.



Lining of Irrigation channels:

Necessity:

1. To minimize the seepage losses in canal.
2. To increase the discharge in canal in canal section by increases the velocity.
3. To prevent erosion of bed and side due to high velocities.
4. To retard the growth of weeds
5. To reduce maintained of canal.

Advantage of Lining:

1. The lining of canals prevents seepage loss and thus more area can be irrigated by the water so saved.
2. The increased velocity minimizes the losses due to evaporation.
3. The increased velocity helps to provide a narrow c/s for lined channels.

4. The lining of canal is an important anti –water logging measure as it reduces seepage to the adjoining land.
5. Higher velocity helps in providing a flatter hydraulic gradient or bed slope. Thus better command can be obtained.
6. Higher velocity prevents silting of channel.
7. Lining makes the banks more stable in light textured soil.
8. Lining reduces maintenance costs and possibility of breaching due to increased stability of section.
9. Lining of a canal increases available head for power generation as a flatter gradient can be provided.
10. Canal lining assures economical water distribution.
11. Canal lining prevents water to come contact with harmful salts during transit.

Disadvantage of canal lining:

1. Canal lining requires a heavy initial investment.
2. Lining being permanent, it is difficult to shift the outlets very often.
3. It is very difficult to repair the damage lining.
4. A lined channel section is without berm.

Suitability of canal lining material:

1. The material used for lining should provide complete water tightness.
2. The material used should have low coefficient of rugosity so as to marked the section hydraulically more efficient.
3. The material chosen for canal lining should be strong and durable.
4. The lining should not have a very high intial cost.
5. The material used should be unaffected by tramping of cattle.
6. The materials should withstand high velocity.
7. The material should permit construction of required slope easily.

Types of lining:

1. Hard surface type lining
   a. Cement concrete lining
   b. Shotcrete lining.
   c. Precast concrete lining.
   d. Cement motor lining.
   e. Brick lining.
   f. Asphaltic lining
   g. Stone blocks or undressed stone lining.
2. Earth type lining
   a. Soils cement lining.

   b. Clay puddle lining.
   c. Sodium carbonate lining.
3. Buried and protected membrane type lining
   a. Prefabricated light membrane lining.
   b. Bentonite soil and clay membrane lining.
   c. Road oil lining.