Vertical Distribution of Groundwater

The subsurface distribution of water is divided into two primary categories based on the degree of saturation: the Zone of Aeration and the Zone of Saturation, separated by the Water Table.

1. Zone of Aeration (Vadose Zone)

In this zone, soil pores are only partially saturated with water. The space between the ground surface and the water table marks the extent of this zone. Water that occurs in the zone of aeration is called vadose water (unsaturated zone water).

Vadose water is the water present in the pore spaces of soil and rock above the water table. Unlike saturated groundwater, this subsurface water exists in an environment containing both air and water, moving primarily downward through infiltration. It is crucial for plant growth, nutrient cycling, and replenishing aquifers.

The zone of aeration is divided into three sub-zones:

Soil Water Zone

Intermediate Zone

Capillary Fringe (Zone)

(i) Soil Water Zone (or Soil Moisture Zone)

This zone is located closest to the ground surface. It is the topmost layer of the unsaturated zone, residing directly below the ground surface within the plant root zone.

The soil is saturated either during irrigation or when rainfall occurs.

This saturation is of short duration because excess water drains through the soil under the force of gravity.

(ii) Capillary Fringe (Zone)

The capillary fringe is the often-saturated subsurface zone immediately above the water table, where water is held in pore spaces against gravity by capillary forces. It acts as a bridge between the saturated groundwater and the unsaturated soil.

(iii) Intermediate Zone

This zone lies between the soil water zone and the capillary fringe. It contains non-moving vadose water (pellicular water) held by molecular and surface tension forces. Temporarily, this zone may also carry some gravitational water during periods of infiltration.

2. Zone of Saturation (Phreatic Zone)

The Zone of Saturation is also known as the groundwater zone or phreatic zone. In this layer, all the pores of the soil and rock are completely filled with water.

Location: It is the subsurface layer below the water table where all pores, cracks, and spaces are entirely filled with water.

Function: It represents the sources of groundwater and is part of an aquifer.

Contrast: It stands in contrast with the unsaturated zone (vadose zone) located above it.

The Water Table

The water table forms the upper limit of the zone of saturation. It represents a free surface, meaning it is a surface subjected to atmospheric pressure.