DETAILS FOR STUDY MATERIAL

SEMESTER II

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Subject name:Environmental Science

Hons. Core Course 03 (Water and water resources)
Unit 3 (Surface and Subsurface water)

Subsurface Water

SUB-SURFACE OR UNDERGROUND SOURCES

The water which gets stored in the ground water reservoir through infiltration, etc., is known as underground water. This water is generally pure, because it undergoes natural filtration during the percolation through the soil pores. Moreover, these waters are less likely to be contaminated by bacteria. However, they are generally rich in dissolved salts, minerals. gases, etc. The extent of the salts and minerals present in the ground water depends upon the type and extent of zeological formations through which the water is passing before joining the watertable.

Sometimes, the ground water is brought to the surface by some natural processes like springs, and sometimes these waters are tapped by artificial means by constructing wells, tube wells, infiltration galleries, etc.

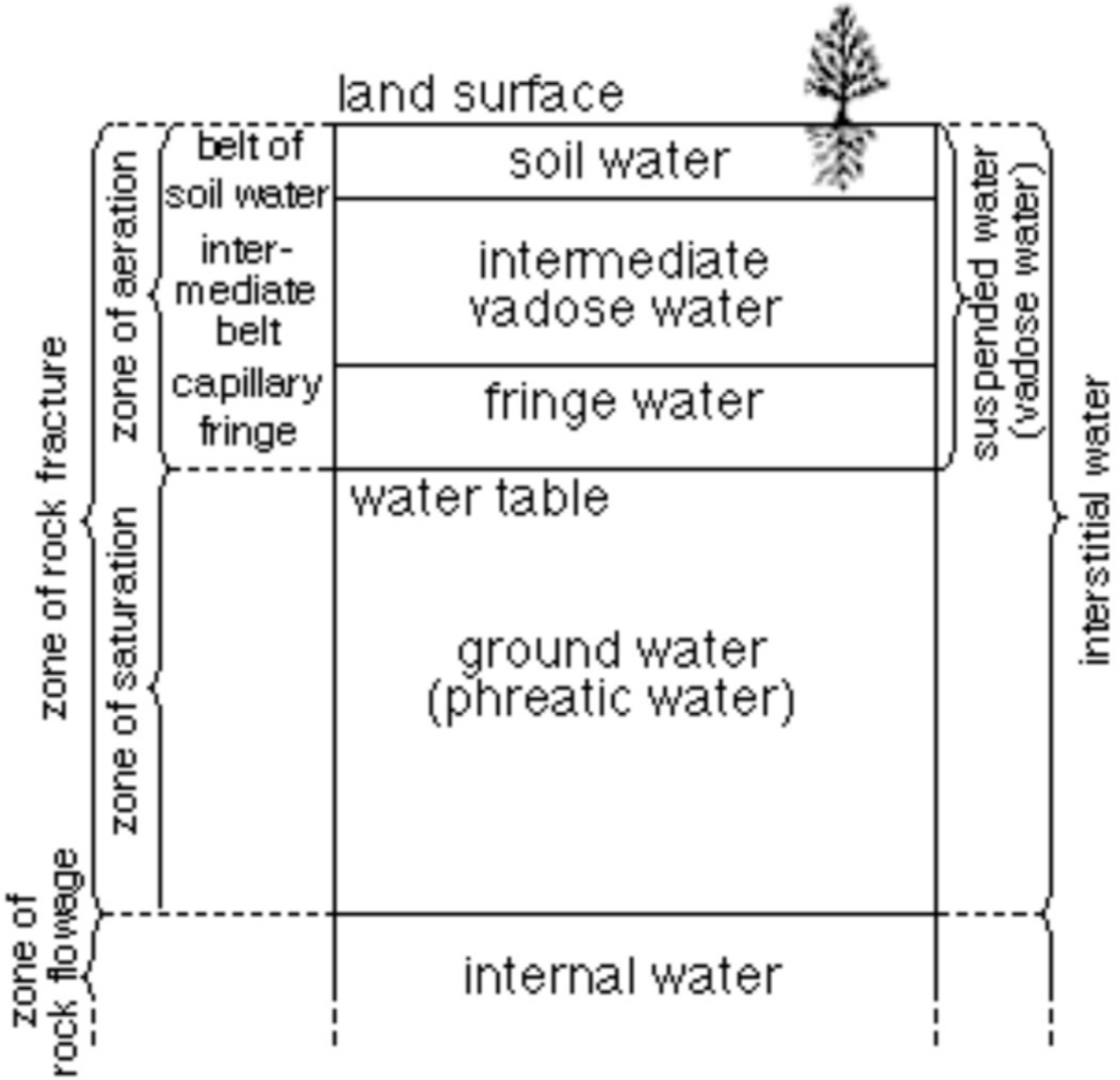
The replenishment (*i.e.*, filling up) and drainage (*i.e.*, tapping out) of the ground water reservoir is a full topic in itself, involving the hydrological concepts of ground water flow, the possible yields, the construction details of wells, tubewells, galleries, etc. *Since the ground water is largely tapped in our country for water supplies and there is a scope for its development in future also, the next full chapter has, therefore, been devoted to the same.* The surface and sub-surface supplies have also been compared there itself.

Surface water

Rivers are the most important sources of water for public water supply schemes. It is a well known fact that most of the cities are settled near the rivers, and it is generally easy to find a river for supplying water to the city. Rivers may be perennial or non-perennial. Perennial rivers are those in which the water is available throughout the year. Such rivers are generally fed by rains during rainy season and by snow during summer season. Perennial rivers can be used as sources of public supplies directly, whereas the non-perennial rivers can be used as sources of public supplies by providing storage on the upstream of the intake works. The construction of a dam is generally adopted on a highly non-perennial river and may be adopted even on a perennial river when water is used for multiple uses such as irrigation, hydropower, etc. The head works, such as a barrage or a weir, may also be constructed on those perennial rivers, where supplies are considerably reduced during dry weather periods.

The *quality* of water obtained from rivers is generally not reliable, as it contains large amounts of silt, sand and a lot of suspended matter. The disposal of the untreated or treated sewage into the rivers is further liable to contaminate their waters. The river waters must, therefore, be properly analysed and well treated before supplying to the public.

Vertical distribution of ground water



Techniques for ground water recharge

(1) **Spreading method.** This method consists in *spreading* the water over the surfaces of permeable open land and pits, from where it directly infiltrates to rather shallow aquifers. In this method, the water is temporarily stored in shallow ditches, or is spread over an open area by constructing low earth dykes (called *percolation bunds*). The stored water, slowly and steadily, percolates downward, so as to join the nearby aquifers. The recharging rate depends upon the permeability of the spread area and on the depth of water stored, and is generally less, say of the order of 1.5 m/day, though rates as high as 22.5 m/day have been possible. Certain chemicals, when added to the soil, may help in increasing the recharging rate and are under research.

(2) **Recharge-well method.** This method consists in injecting the water into bore holes, called recharge wells. In this method of recharge, the water is therefore, fed into recharge wells by gravity or may be pumped under pressure to increase the recharge rate, if surface conditions permit. The recharge wells used for this purpose, are just like ordinary production wells. Infact the ordinary production wells are many a times directly used for recharge during the off season, when the water is not required for use. *Recharge-well method* is certainly preferred when the *spreading method* cannot yield appreciable recharge, because of low perme-

able areas. High recharge rates can be obtained with this method. Moreover, this method may help in injecting water into the aquifers, and also where it is most needed. This method is widely practised in Israel.

The water to be used in the recharge well should, however, be purer than that is required in the first method. This water should be free of suspended matter, so as to avoid clogging of the well screens. Since the recharge well inject the water directly into the aquifer, the water used for recharging must also be free from bacteria. Hence, if the treated sewage is used for recharge, it should generally be bacteriologically pure.

(3) **Induced Infiltration method.** The third method which is sometimes used for recharge is that of the induced infiltration, which is accomplished by increasing the watertable gradient from a source of recharge. In this method, Renney type wells are

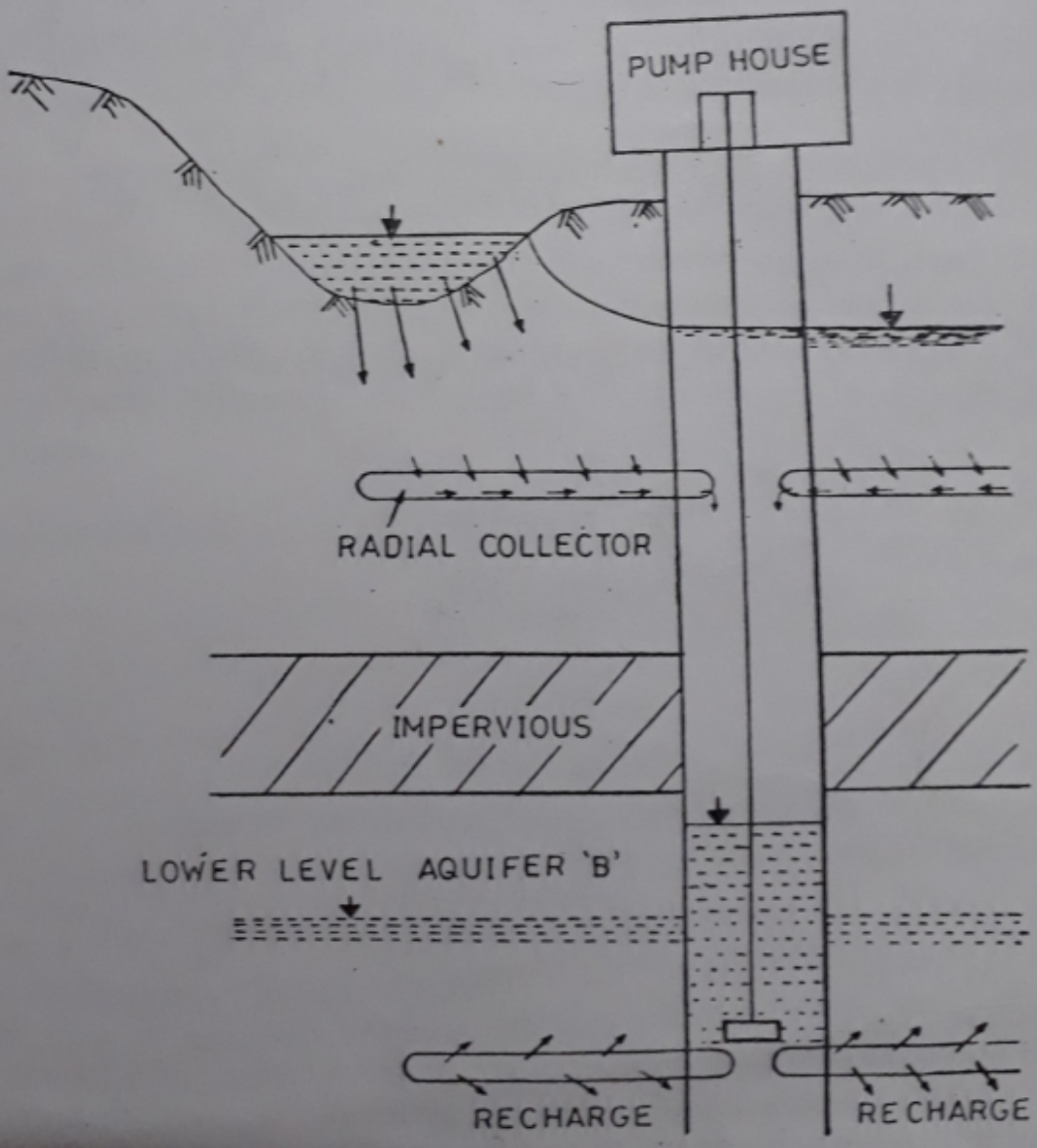


Fig. 16.28. Induced infiltration method of recharge.

Core course 04(Land and Soil Conservation and Management)
Unit 4 (Landuse changes and land degradation)

Visual indicators of land degradation

1. **Soil salinization**: It is the process of soluble salt accumulation which is of great concern on farms because it directly influence plant growth. Due to sea water intrusion followed by evaporation soil salinization occurs in coastal areas.

2. **Water logging:** Many agricultural farms suffer from water logging, poor drainage conditions due to the presence of strong and thick soil at different depths. Water logging affects the surrounding community.

3. **Loss of vegetation:** Due to land degradation vegetative cover is sparse and is dominated by a few species. Overgrazing and the harsh climate contribute to low vegetation.

4. **Water erosion:** Some land are prone to water erosion. Most of the desert environment consists of sand dunes soils that absorb rain water and no water erosion. The soil that are mere stable and cohesive have shown signs of the combined effect of wind and water erosion.

Drivers of land degradation

1. Deforestation: Forests play an important role in maintaining fertility of soil by shedding their leaves which contain many nutrients. Forests are also helpful in binding up of soil particles with the help of roots of vegetation. So,cutting of forest will affect the soil adversely.

2. **Land salinization:** Due to excess use of fertilizer and poor drainage of soil land salinization occurs. The concentration of soluble salts in the soil.