DISTRIBUTION OF RAINFALL

India is a vast country having diversified geological set up. Variations exhibited by rock formations range from Archaean crystalline to Recent alluvium. Variations in relief features range from coastal and riverine plains, dissected plateau to lofty mountains. Amount of rainfall, infiltration-runoff ratio vary from place to place. All these factors are responsible for variation in hydro-geological status in different parts of the country.

Hydrogeological environment: The hydrogeological environment of the country varies widely from place to place. The occurrence of different litho units reveal that a large part (about 3/4th) of the country is underlain by consolidated rocks at a very shallow depth.

Regions of high relief in the northern and northeastern India, Aravalli Ranges of Rajasthan, Central highlands, Western Ghats, Eastern Ghats, peninsular plateau and adjacent hills experience extremely high surface run-off and limited ground water storage.

Over the plateaus geological formations allow ground water to remain in the weathered residuum and it circulates through the underlying fracture system.

The coastal and deltaic tracts, especially the east coastal plains, are covered with extensive alluvium. Though the tracts are highly productive in terms of groundwater yield, the overall ground water regime in the vicinity of coasts suffers from salinity hazard.

Porous unconsolidated formations occupy the rest of the area. The piedmont zone of the Himalayas, locally called 'Bhabar' or 'Kandi' belt acts as the main recharge zone for the artesian flow. The northern plain, often referred to as Indus-GangaBrahmaputra plains, is the most potential and important region from the perspective of ground water resources.

Based on mode of occurrence of ground water in similar geological formations and nature of aquifer system, two major categories of formations have been identified, viz., porous formations and consolidated formations. Porous formations may be sub-divided into two zones, viz., a) areas underlain by unconsolidated formations and b) areas underlain by semiconsolidated formations.

Unconsolidated formations:

Unconsolidated formations include the alluvial plains of IndusGanga-Brahmaputra river systems, the coastal alluvial tracts, inland river basins, valleys and areas covered with wind blown sands.

The Quaternary sediments comprising of Recent alluvium, older alluvium, coastal alluvium are by and large important repositories of ground water. These are composed of clay, silt, sand, gravels, pebbles, cobbles, boulders, ferruginous nodules, kankar (calcareous concretions) etc.

The hydrogeological environment and ground water regime conditions in areas drained by Indus-Ganga-Brahmaputra river system indicate the existence of enormous fresh ground water reservoirs at least down to 600m below land surface. Bestowed with high incidence of rainfall, this ground water reservoir gets replenished every year. Alluvial aquifers up to the explored depth of about 750 m in Ballia district, Uttar Pradesh, have transmissivity values from 250 to 4000 m^3/day and hydraulic conductivity from 10 to 800 m/day. The well yields are 40-100 l/sec. The Bhabar aquifers have a high transmissivity ranging from 7,500-14,000m^3/ day down to about 100m depth. The Terai aquifers have transmissivity ranging from 250 to 1,200m^3/ day. The transmissivity of coastal alluvium is more or less similar to that of Ganga alluvium.

Semi-consolidated formations:

Semi-consolidated formations include Palaeozoic, Mesozoic, Tertiaries of Rajasthan in the west as well as the central and northeastern Himalayan states, the coastal sedimentaries and the coal measures of central India. The terrestrial fresh water deposits belonging to Gondwana system of the peninsular shield are also included in this category. The sandstones in this group form highly potential aquifers especially in the peninsula. Under favourable conditions, the sedimentaries give rise to flowing conditions as in parts of the Godavari valley, Khambhat basin and parts of west coast.

Consolidated formations:

Consolidated formations include the basement complex and the Pre-Cambrian rocks of the peninsular India, much of the metamorphic formations in the Himalayas. Most of the consolidated rocks, except vesicular volcanic rocks containing porous layers between successive lava flows have negligible primary porosity. Igneous and metamorphic rocks cover large tracts in the states of Tamil Nadu, Telangana, Karnataka, Madhya Pradesh, Chhattisgarh, Odisha, Meghalaya, Jharkhand, Uttarakhand and parts of Rajasthan. These rocks are devoid of primary porosity, but have been rendered porous due to weathering and development of lineaments and fractures. The volcanic rocks include the Deccan Trap lava belt (including the Rajmahal hills) and Krol formation in Kashmir. The Deccan Traps consisting of plateau basalts do not possess any primary porosity. The secondary porosity develops due to weathering and joints.

Factors controlling groundwater replenishment:

The following factors contribute in ground water reservoir recharge: i) Precipitation infiltration to the water table.
ii) Natural recharge from streams, lakes and ponds.
iii)Ground water inflow into the area under consideration.
iv)Recharge from irrigation, reservoirs and other schemes especially designed for artificial recharge.

The following factors are responsible for ground water depletion:
i) Evaporation from capillary fringe in areas of shallow water table and transpiration by vegetation.
ii) Natural discharge by seepage and spring flow to streams, lakes and ponds.
iii) Ground water outflow.
iv) Artificial discharge by pumping or flowing wells.

Groundwater development in the country:
The average annual water availability of the country is assessed as 1,869 billion cubic metres. Of this, total utilizable water resource is assessed as 1,123 billion cubic metres (surface water 690 BCM, ground water 433 BCM).
The development or utilization of groundwater resources in different areas of the country is not uniform. Highly intensive development (utilization) of ground water in certain areas in the country has resulted in over exploitation leading to decline in the levels of groundwater and seawater intrusion in coastal areas. Out of 5723 assessment units (blocks/ mandals/ talukas) in the country, 839 units have been categorized as over exploited or highly critical, i.e., the annual ground water extraction exceeds the annual replenishable resource. In addition, 226 units are critical, i.e., the stage of ground water development is above 90 percent and within 100 per cent of annual replenishable resource. There are 550 semi-critical units, where the stage of ground water development is between 70 and 90 per cent. Artificial recharge of aquifers and rainwater harvesting is necessary in districts that are over exploited, critical and semi- critical.