GROUND WATER PROVINCES OF INDIA

The ground water provinces occurring in India have been classified into 8 as follows
1. The Precambrian Crystalline province
2. Precambrian Sedimentary province
3. Gondwana Sedimentary province
4. Deccan Trap province
5. Cenozoic Sedimentary province
6. Cenozoic Fault Basin province
7. Indo-Gangetic Alluvial province
8. Himalayan High Land province

Precambrian Crystalline Province
The province underlain by igneous and metamorphic rocks of Precambrian age extends from Kanyakumari in the south to Delhi in the north, these rocks are weathered up to 30 m and ground water occurs under water table conditions. Ground water occurs under semi-confined to confined condition depending upon the depth and nature of the fracture.
Ground water development is largely by open dug wells and large diameter wells. Well yielding 20 cum to 200 cum / day are common. Ground water movement is mainly along joints. Quartzites and marble devoid of primary porosity, opening is not numerous. Generally these are considered to be poor aquifers. In case of lime stone characterized by solution cavities can be expected to give higher yield.

Precambrian Sedimentary Basin
This province comprise of Limestone, Shale, Sandstone, Quartzites and local conglomerate belonging to Precambrian to early Paleozoic age. These province is found in I) Cuddapah basin ii) Raipur basin iii) Vindhyan basin iv) Western Rajasthan basin.
Because of compaction and cementation process, the rocks mostly devoid of primary porosity, but the introduction of structural features, the secondary porosity developed and karstification of calcareous rocks have yielded copious supply of ground water. Weathering varies from up to 200 m. Ground water occurrence is largely limited to 150 m, Yield characters ranges from 5 to 200 cum / day for small drawdown.

Gondwana Sedimentary Province
This province occurring as disconnected patches mainly fluviatile or Locustrine sediments of sandstone, shale and with little amount of limestone. These rock formations are classified into lower and upper formations. Total thickness of the formation range from 6 to 7 km. Lower Gondwana is compact and it is devoid of water because source rock is compact shale. Upper Gondwana sediments form very good aquifers, because those are more arenaceous. Water table lies generally within 30 m. dug wells in productive sand tone yielded maximum water.

Deccan Trap Province
Deccan trap province comprising Basalt flows includes hard, massive traps, Vesicular traps, Tuffs, Breccias, Ash and Intertrappeans. Age ranging from late cretaceous to early Eocene. The flows are flat but dip of 5 o to 15 o is also seen in some places. The traps have been divided into three groups viz., upper, middle and lower Gondwana, which are 450, 1200, and 1500 m thick.
The occurrence of "red boles", which is reddish brown clayey material, water bearing causes problems during drilling. Ground water occurs under water table conditions in weathered and jointed traps. Bore well drilled in traps have given higher yield mostly trapping 2 or more flows. At places the contact between the traps and the basement rock have yielded considerable quantity of water.

Cenozoic Sedimentary Province
This province comprise of narrow coastal plains along the Kerala and Tamil Nadu coast, coastal fringes of Saurashtra and Kutch peninsula. In the east coast, the seaward dipping strata contain several artesian aquifers. This province characterized by sand stone and shale. Shale is more compact, impervious and yield little water. Where as sand stone and conglomerates are highly permeable and yield about 150 cum, example Cuddalore sand stone. In Cambay basin, the sediments of deltaic estuarine and lagoonal alternate with Marine sediments, which are generally saline. Springs are also developed in hilly tracts.
Cenozoic Fault Basin
These discrete fault basin are included viz, the Narmada, Purna and Tapti valleys. They contain quaternary valley fill deposits consisting of sand and gravel intermixed with silt and clay, affected by faults. Thickness ranging from 50m to 150m. These lenses are of sand and gravel, which form moderately, yielding aquifers.

The Ganga – Brahmaputra Alluvial Province
It is the next most extensive province covering almost northern Indian planes, after Precambrian Crystalline province, deposited in fore deep or crustal buckle; the thickness increases from south to north. The basement is hard rock under the alluvial sloping at an average of 1 o to 3o. In alluvium, ground water occurs in three-distinct physigographic and hydrological belts such as Bhabhar consist of talus material from the hill slope, which is highly permeable unsorted boulder, grave sand with little clay. The belt merges with Terai consisting of permeable water bearing gravel, sand, and pebble intermingle with silt and clay. The axial belt, which comprises of stratified fine gravel, silt and clay deposited by the river system.
Water table in this area is less then 10 mbgl. Wells have recorded free flow of 100 – 300 cum/hr. Ground water have been developed by dug, dug cum bore wells, casing wells and tube wells yielding up to 300 cum/hr for 6 to 109 m of drawdown.

Himalayan High Land Province
This province includes a group of highly folded and faulted sedimentary rock ranging in age from Paleozoic to Cenozoic. These sedimentary rocks are mainly comprising of limestone, sandstone and shale, and their metamorphic equivalents traversed by deep gorges and intermundane valley filled with alluvium this acts as conduits and transmits large quantities of water which recharges Ganga Bhramputra province. Whenever the alluvium is thick dug well for domestic purpose yield 100 – 200 cum/hr. with ion dissolved solid content.