CHAPTER – VII

SUMMARY AND CONCLUSIONS

The summary of Integrated Hydrogeological Investigations of Lower Gundar Basin is given below.

The study area occupies southeastern part of Tamil Nadu, South India. This area is underlain by both crystalline rocks and sedimentary formations. The crystalline basement is exposed in north and the depth to same decreases towards the southern coast. Archaean crystalline, the oldest that are made up of hornblende biotite gneiss and are exposed in north. These crystalline basement rocks are highly weathered. Sandstones of Mio-Pliocene age (Cuddalore Sand stone) overlie the basement with an unconformity. These formations are exposed in north, northeast and central regions. Alluvium of recent and sub recent age is dominant in the area of study. The alluviums are made up of sand with clay. Kankar also occurs in few locations illustrating evaporation environment. Along the coastal tract marine and fluvio-marine sediments occur.

Coastal plain exists near the south. Pediment and buried pediment is observed with upland in north forms the recharge zone. Flood plain occurs in the central region and along the courses of the rivers. Sedimentary high land exists in central part. Sedimentary plain and coastal plain occur in south. Recharge zone exist in north while southern region forms the discharge zone.

Groundwater potential zones have been demarcated using GIS analyses, integrating various thematic maps such as Geology,
Geomorphology, Lineament and Palaeochannel and drainage. Final integration map indicates presence of high potential zones occur in south, which is an area of discharge. Moderate potential zone falls in central region and low potential zones exist in north. The low potential zone coincides with the areas of recharge at higher elevations.

Gundar river along with its tributaries are ephemeral in nature. Large numbers of rain fed tanks exist in this area, which are filled with rainwater during monsoon and utilized for domestic and agricultural purposes. The study area enjoys tropical climate with an average annual rainfall of 700 mm. Maximum rainfall is contributed by the northeast monsoon. The prevailing climate is semi arid.

Water level studies suggest that groundwater along the north and central regions groundwater occur at deeper level and in sand dunes along the coast at shallower depths. The fluctuation ranges from 0.21 m to 3.2 m with higher values falling around north and central regions. The higher fluctuation is observed in settlement areas. Meager water level change in post monsoon season, indicate that the contribution of rainfall to recharge is very less. Decline in water level is encountered during pre monsoon period. The direction of flow of groundwater is from northwest to southeast and north to south. High transmissivity zone occurs in north at higher altitude, indicates the existence of highly porous zone that has been also confirmed by GIS analysis.

From hydrogeochemistry studies of groundwater in lower Gundar basin during pre and post monsoon, are of saline to brackish in southern region. This brackish water exists in few places in northwest. Fresh water occurs along the north and central part. Saline water (TDS > 18,000 mg/l)
occurs in Kadaladi (Loc. No. 28) in both seasons. Permanent hard water is dominant in this area during both seasons. Temporary hard water exists in north and central regions. In central zone, temporary hard water in pre monsoon changes into permanent hard water in post monsoon by the influence of agricultural pollutants.

The study area is mostly exhibited by Type III groundwater. Type IV water occur in central zone. Type I water occurs in isolated places in north and center during both seasons. The dominance of Type III & IV groundwaters indicate that they have longer residence time. No much change in groundwater type is observed between two seasons, which implies very poor recharge.

Brackish water occurs around north central and most of the southern part in pre and post monsoon period. Fresh water zones exists in isolated locations in northeast and central regions. Most of the southern region and few locations in north are occupied by $C_5S_4$ water in during pre monsoon. Low to moderate quality groundwater ($C_2S_1$ to $C_3S_1$), a more suitable for agriculture occurs in north and central zones of this area. During post monsoon $C_5S_4$ water is restricted to few locations in southern and northern regions. In coastal zone, this water changes to $C_5S_3$ in post monsoon.

Rock – water interaction is dominant in this region during both seasons indicating groundwater with higher residence time. Evaporation process controls the chemistry to a considerable extent.

The saline intrusion study proves the existence of inland salinity during both seasons. The extent of saline water intrusion in these area is
minimized during post monsoon period. The over exploitation of groundwater leads to upconing in salt water / fresh water interface which reflects in the inland salinity (vide Fig. 3.10). The trend analysis of various ions and TDS implies the source of salinity may be from the sea.

From the tritium analysis it is inferred that the zone of recharge exists in northwest with higher tritium concentration and low in southeast. Another high tritium zone is observed near the coast. In general higher tritium groundwater will flow towards the areas of low concentration. It is concluded that the groundwater is recharged in Periya Kattangudi (Loc. No. 3) in northwest reaches Mudulkulathur (Loc. No. 7) in southeast with a velocity of $6.2 \times 10^{-5}$ m/s in 20.7 years. The same water reaches Sayalkudi (Loc. No. 9) in south in 32 years. The high values in these southern locations are explained by comparing this region with other coastal regions of India. The tritium content in precipitation during 1970's is nearly 44 TU and 50 TU in those regions. Since, study area also falls on coastal zone and recharged with a higher tritium water of 1970's in northwest, which have reached southern part after 32 years. From the above analysis, it is understood that groundwater of this region has a very low velocity.

From isoresistivity maps, it is inferred that poor quality of groundwater occur in southern part and existence of fresh water zones in central region. Fresh to moderate quality occurs around northern part. The depth to basement is shallow in northwestern region and increases towards south. The study area isoapparent resistivity maps of different depth zones indicate, landward extension of saline water / fresh water interface at deeper levels. The inland high salinity exists in areas of over
exploitation, which has also been confirmed by hydrogeochemical investigations (vide sub title 4.8).

Transverse resistance below 100 ohm.m² is widely spread over the north and central region. The high value occurs along the southwestern part where high groundwater potential zone exist (vide sub title 2.7.2). In turn the longitudinal conductance is high around northern region, indicating this part act as a zone of discharge with less groundwater potential.

The groundwater model of lower Gundar basin aquifer has been developed using standard finite difference techniques and has been simulated to make a fair assessment of the groundwater in storage. A computer program – FLOW that can perform the computations of the backward (Implicit) difference method with built in provision to compute nodal yields, flows permeability has been used.

The predicted water levels approximately matches with the actual water levels of this region. It implies that the model developed for Lower Gundar aquifer system matches with the actual field conditions. The model developed is suitable for all feature prediction purpose under various stress conditions.
The conclusions derived out of this study is listed below:

- Moderate potential zone of fresh water exist in central region whereas poor quality of higher potential exist in south. However, the occurrence of fresh water is restricted to sand dunes adjacent to coast.

- GIS applications and integration out put suggests that the low potential zone occur in north and high zone exits in south. Central moderate potential and fresh water occurrence have been identified. The geological studies and GIS application confirms earlier statement.

- From the geochemical investigations indicate the existence of fresh to moderate quality groundwater in central alluvial and flood plain and SW / FW interface at shallower level near the coast. Geophysical study also confirms the fresh water existence central region and landward extension of SW / FW interface at deeper level.

- Isotope studies suggest that the zone of recharge zone of the study area occurs only in north at higher altitude. The groundwater flows from northwest to southeast and north south with very low velocity. The water level studies also confirm this groundwater flow direction. The developed groundwater model matches with the actual field conditions and this model can be used for any prediction purposes.
7.1 SUGGESTIONS FOR FEATURE GROUNDWATER DEVELOPMENT

✓ As the recharge zone exist at higher altitude and much of the rainwater is lost in the form of surface run off. This rainwater can be trapped through rain fed tanks, which exist in large number.

✓ By raising the bunds (banks) of larger rainfed tanks the storage capacity of tanks can be increased. The stored rainwater can be utilized for domestic and agricultural purposes.

✓ A few tanks that are identified for recharge purpose, which needs periodical desilting. The desilting will improve the resource potential that in turn would improve the quality.