CHAPTER 9

CONCLUSION

The major conclusions derived from the hydrogeological, hydrogeochemical, geochemical reactions modelling, regional flow and solute transport modelling of the lower Palar River basin, southern India are as follows:

1. Rainfall is the major source for recharge of groundwater in the study area though it is a part of a river basin. Analysis of the groundwater level and rainfall indicate that groundwater in the wells located in alluvial regions show immediate response to rainfall while the wells located in hard rock regions respond only when the monthly rainfall is above 60mm. On the basis of rainfall-groundwater level analyses, geology and soil type the region was divided into five zones, each having different rainfall recharge rates. Maximum rainfall recharge of 35-40% was estimated in regions comprising of alluvial plain.

2. Electrical Conductivity (EC) of groundwater in the study area ranges from 290 to 3900 μS/cm. Generally groundwater is alkaline with high redox potential and is dominated by Ca and HCO₃ ions. The order of dominance of the cations is Ca > Mg > Na > K and of the anions is HCO₃ > Cl > CO₃ > SO₄.
Evaporation/evapotranspiration, cation exchange and silicate weathering are the major geochemical processes that control the groundwater chemistry of the study area. The dominance of Ca and HCO$_3$ is due to cations exchange, silicate weathering and rainfall recharge. Other important processes identified are the dissolution of calcite, dolomite, K-Montmorillonite and NaCl.

3. Groundwater of the study area is suitable for domestic purposes, except in a few locations where EC is high. In some of these locations high SAR, RSC and Na% restricts its suitability even for agricultural activities.

4. Simulation of groundwater flow by three-dimensional mathematical modelling indicate that this aquifer system is stable under the present pumping rate, except for a few locations along the coast where seawater has intruded upto 50-100 m inland. Villages such as Chinnakupam, Periyakuppam and Oliyakuppam located along the coast have been affected by saline water intrusion. Simulation by solute transport model indicates that the concentration of solutes such as bicarbonate, chloride, sodium and calcium in the study area is stable except for a few locations along the coast.

5. The model developed is very sensitive to recharge and to some extent to specific yield. The model is also sensitive to the changes in the bicarbonate concentration in rainfall.
6. The model forecast until the year 2010 revealed that there is no threat to this aquifer with the present rate of pumping. However, if the groundwater abstraction were increased by 2 MGD (15% increase) at the MAPS pumping site, groundwater head would lower by 0.6–0.8 m on the eastern part and 0.4–0.6 m on the western part of this pumping station. To overcome this decline in groundwater level, a subsurface barrier was constructed and its effect on flow regime was simulated. It is predicted that with the subsurface barrier the groundwater head will increase from 0.1 to 0.3 m along the upstream side of the barrier while on the downstream side the groundwater head would lower by 0.1 to 0.2 m.

7. The study indicated that in spite of the fact that the Palar River hardly flows even for a few days in a year the groundwater level has not declined to alarming level. Reasonable groundwater potential available in this region is mainly due to the substantial recharge that takes place at Madurantakam Lake. Hence, it is very essential and imperative to properly manage the Madurantakam Lake by routine desilting and preventing any encroachment. If the water level in this lake is maintained it is possible to increase the groundwater pumping from this region.

The research generated comprehensive primary data, which was used to characterize the hydrogeology and hydrochemistry that formed a basis to develop a hydrogeological model. The model developed can be used as an
effective tool to sustainably manage this aquifer system. The model can also be effectively used to study the effect of groundwater abstraction for industrial/agricultural requirements in future. The government/private agencies responsible for supply of groundwater for various purposes can use this study for effective planning and development of groundwater resources in the lower Palar River basin, southern India. Similar study can also be made for the other river basins based on this research.