CHAPTER VII
SUMMARY AND CONCLUSION

The important features of the various aspects of Sustainable Groundwater Management Studies through Geospatial Techniques in the Nagavathi Watershed, Dharmapuri District, Tamil Nadu, India are summed up here under.


The average annual rainfall varied from 760 to 910 mm, The Nagavathi watershed lies mainly over the Archaean crystalline terrain and the groundwater occurs under Phreatic condition in the weathered and fractured zones of the hard rock aquifers. The study area geologically consists of wide range of igneous and metamorphic rocks such as Champion gneiss, Charnockite, Syenite, Pink Pegmatite and Pyroxene Granulite. The Charnockites and associated pink Migmatities mostly occupy northern and southern part of the study area.

Drainage system in the watershed reveals that the Nagavathi stream is a major ephemeral in nature. It appears only rainy seasons other seasons normally dry. The main drainage patterns observed in the watershed are
dendritic and parallel to sub-parallel. Nagavathi is major stream and has been identified as a fifth order stream.

Average annual rainfall has been calculated by adding rainfall totals over a specified period (2007 to 2016). According to the rainfall data, of the total mean annual rainfall, the Northeast monsoon accounts for 30.56 % (711.22 mm), Southwest monsoon 40.71 % (854.21 mm), Summer 23.75% (474.98 mm) and the Winter 4.98 % (14.75 mm).

In spite of the average water level being lower than 4.70 m BGL, there is an increase in water level up to 5.80 m in parts of central, southern, and southeastern regions and deepening below 4.70 m in eastern, western and northern regions. The rise and fall in water levels depend upon the amount, duration and intensity of precipitation, infiltration rate, depth of weathering, specific yield and fracture condition of the formation etc. The water level is deeper in topographically elevated regions and shallower in plain surface terrain.

The morphometric analysis has been carried out through measurement of linear, areal and relief aspects of the watershed. Micro watersheds show dendritic to sub dendritic drainage pattern with moderate drainage texture. According to the Strahler’s stream ordering system twenty seven morphometric parameters of the watershed were estimated. The 513 streams were identified out of which 317 streams are first order, 159 second order, 25 third order, 9 fourth order and 3 fifth order.
Drainage density, texture ratio, circulatory ratio and elongation ratio shows that texture of the watershed is moderate and shape of basin almost elongated. High bifurcation ratios indicate a strong structural control on the drainage. The stream tributary directions and the local tectonic regime, and the stream channels of the Nagavathi watershed were grouped according to their order (1-5) and eight rose diagrams were created for each watershed.

The major and minor lineaments are found upstream and downstream sections of the watershed. The watershed consisting micro watersheds such as MWS01, MWS06 and MWS08 trends in Northeast - Southwest direction. The lineament crosses the watershed in a Southwest-Northeast direction. In all the micro watersheds the dominant direction of the streams is NE-SW.

MWS01, MWS02, MWS03, MWS04, MWS06, are very good and good to medium range in the increasing water level and development of agricultural activity. MWS05, MWS07, MWS08 are medium and poor to very poor range of sustainable groundwater management point of view. Through this study Perumpalai, Errapatti and Nagarkuda area need to improve the water level through artificial recharge structures for sustainable development and management of groundwater resources.

Forty six groundwater samples were collected and analysed in the laboratory. A set of spatial maps has been prepared to understand the regional quality behaviour of groundwater. Based on the World Health
Organization (WHO) limiting standard, water samples were classified into permissible, allowable, admissible categories. pH of the groundwater during post monsoon ranged from 6.11 to 7.59 with the average value of 6.6, while during pre-monsoon pH ranged from 6 to 7.9 with the average value of 6.84 indicating the overall basic nature.

Electrical Conductivity (EC) varied from 356 to 2153 μS/cm² in pre monsoon and 270 to 1954 μS/cm² in the post monsoon. Domestic and agricultural activities are mainly confined to the river course in the Nagavathi watershed. As per the WHO standard, most of the samples fall in permissible and the doubtful category in the both monsoons.

EC is directly related to TDS and the locations showing high contents of EC support higher TDS concentration. The groundwater samples are falling within the Potable limits (500–1500 mg/l). The pre-monsoon samples of 461 Sq.km and the post-monsoon samples of 411 Sq.Km are useful for drinking.

Analysed data have been graphically projected in Gibb’s U.S. Salinity Laboratory, Doneen’s permeability schemes for classifying the groundwater. Gibb’s diagrams show that all the samples of both seasons fall in the rock dominance field. It’s suggested that chemical weathering of the rock forming minerals, which contribute the ions to the groundwater.

The results of the U.S. Salinity Laboratory diagram reveals that 68.42%, 14.04%, 8.77%, 5.26% and 3.51% of the groundwater samples of the
pre monsoon falls in the field, C3-S1, C2-S1, C4-S2, C3-S2 and C1-S1 respectively indicating high to low category of salinity hazard and low to medium category of sodium hazard. In post monsoon period, 66.67% and 33.33% of the samples fall in C3-S1 and C2-S1 categories respectively, showing high to medium salinity hazard and low sodium hazard.

The Doneen’s permeability plots indicate that the range from 41 to 75 mg/l and 8.57 to 21.68 mg/l respectively during pre and post monsoon. On the basis of PI, the groundwater in the study area falls under class I and class II indicates that groundwater is good for irrigation in both seasons.

Through Geophysical survey master curves were prepared using IPI2Win software of the study area vize, AA (ρ1<ρ2<ρ3<ρ4: 28.26%), HA (ρ1>ρ2<ρ3<ρ4: 32.61%), AK (ρ1<ρ2<ρ3<ρ4: 19.57%), QH (ρ1>ρ2>ρ3<ρ4: 8.69%) HK (ρ1>ρ2<ρ3<ρ4: 8.70%) and KH (ρ1<ρ2>ρ3<ρ4: 2.17) and its shows that dry top soil, weathered zone, highly fracture zone and hard and compact massive layer together form a basement. The fracture zone controls the groundwater occurrences in the Nagavathi watershed.

The AHP technique is a collaboration with ARC GIS has proven to be very effective in identifying potential groundwater zones in the study area. GIS based AHP technique has involved eight thematic layers to develop a pairwise comparison matrix which has been used to commute the priority vector or priority weightage of the parameters. A detailed knowledge on slope, geomorphology, geology, lineament density, drainage density,
rainfall, and land use/land cover has been very immense in the assignment of weightage for thematic features. All thematic layers have been integrated and analysed using weighted overlay analysis.

From the AHP results, it was found that very good and good potential zones of groundwater are present at the areas of gentle slope, high lineament density, shallow buried pediplain and pediments, water bodies, and younger alluvium conditions. Areas with Very good and good groundwater potential are about 161.394 Sq.km. Very Poor and Poor potential groundwater areas covering about 184.46 Sq. km are associated with hilly regions of high slope, well-drained soil. Medium groundwater zones have been found randomly in almost all areas covering 134.240 Sq.km.

The spatial variation in the groundwater potential is due to the influence of geology, slope, geomorphologic units, rainfall, land use/land cover, drainage density and lineament density. The movement of groundwater mainly depends on geology like lithology and thickness of rock formation in the study area. Eventually the author concludes that the GIS based AHP has proved its efficiency in delineating groundwater potential zones with maximum accuracy (Fig.6.8).

The positive impact has been noticed in terms of rise in water level in the Mankanur, Adangapatti and Elagiri villages. Increase in crop area in the Pennagaram and Mankanur villages and pumping rate increases in the
wells of the Kullunur, Mankanur and Adangapatti villages located in the watershed.

The methodology adopted and the results obtained in this study could be used as a positive predictive tool for further developmental schemes of the Government or Co-operative entrepreneurs in the Nagavathi watershed.