

SUMMARY AND CONCLUSIONS

7.1 SUMMARY:

Groundwater prospecting is a continuing process, since the natural and discharge pattern of the aquifer changes with changing groundwater scenario. Therefore, there is an urgent need for the formulation of a long-term action plan for periodical re-assessment of groundwater resources. In this study, it was found that better results could be obtained by using spatial distribution of thematic maps as the basic unit for groundwater prospecting than the conventional idea of using administrative blocks.

Several aspects related to groundwater discussed in this study area give a general scenario of groundwater condition prevailing in the study area. Unlike other natural resources groundwater is dynamic in nature and its occurrence and movement vary with time and space. The quality of groundwater also changes depending upon the geological environment and water table fluctuation pattern. The water table fluctuation is again depending upon the behavior of monsoon and groundwater development activities.

7.1.1 GEOLOGY

The geological characters of the study area shows that the Archean basement formations with, khondalite group of rocks Quartzites, Garnetiferrous hornblende biotite sillimanite gneisses, Calc gneisses, Calc Granulites and crystalline limestones. Few narrow bands of Calc granulites occur sporadically in

the area in association with garnetiferous sillimanite gneiss. Crystalline limestones occur along with calc granulites and garnetiferous granulites. The limestone bands occur near in Talaiyuthu, which is a calcite rich rock of varied colours. A number of narrow bands of quartzite are seen in different parts of the study area. These quartzites are highly recrystallised and closely fractured and jointed. Garnetifeorous biotite gneiss occupies larger part of the plains in the study area. Pinkish veins of pegmatites intrude in the gneisses. They are few centimeter to 1 m. thick. Few quartz veins trending NW, NNW-SSE and N-W directions are present. Mappable bands of pegmatite and quartz veins are not seen in the study area.

7.1.2 HYDROGEOLOGY

The monitoring of groundwater levels in the observation wells in the study area indicates that, generally water level tends to rise during monsoon, indicating good recuperation irrespective of the quantity of extraction. There is a declining trend of water levels in some parts of Manur and Alangulam unions. This may be due to lack of precipitation and heavy pumping.

The summarized results of water level of the study area as follows.

Name of Unions	Pre-monsoon W.L in m		Post-Monsoon W.L in m		Average W.L. in m		Fluctuation W.L.in m	
	Min	Max	Min	Max	Min	Max	Min	Max
Manur	2.49	11.76	0.97	8.21	1.80	9.90	1.52	4.76
Palayamkottai	3.87	10.83	1.22	6.97	2.53	8.75	2.65	3.87
Alangulam	5.58	14.79	1.65	12.33	3.63	13.85	1.84	4.69

The summarized results of the aquifer characteristics are as follows.

Name of Unions	Transmissivity		Storage Co-efficient		Specific Capacity	
	Min	Max	Min	Max	Min	Max
Manur	69	161	0.29	0.89	50	252
Palayamkottai	73	216	0.11	0.95	83	836
Alangulam	63	280	0.13	1.36	66	696

7.1.3 GROUNDWATER CHEMISTRY

Water samples collected from 36 representative wells have been analysed for their major ion concentrations. The groundwaters of the area have been classified for drinking water using WHO standard. A set of spatial variation maps depicting for pH concentration, Total Dissolved Solids, Electrical Conductivity, Sodium Adsorption Ratio, Residual Sodium Carbonate, Total Hardness, Calcium, Magnesium, Chloride and Sulphate have been prepared to project the regional drinking water quality behavior of groundwater. The summarized results of the percentage of samples fall in geochemical studies.

Spatial Variations	Percentage of Samples		
	Desirable	Permissible	Excessive
pH	100%	-	-
EC	50%	31%	19%
TDS	-	73%	27%
So ₄	93%	7%	-
Ca	24%	68%	8%
Mg	46%	50%	4%
Cl	28%	51%	21%

The spatial distribution map of SAR shows that the maximum areas are occupied by excellent water and only in the southwest side shows the good water. The spatial distribution map of RSC shows that the maximum areas are occupied by unsuitable (83%) and doubtful around (17%) the south-middle of the study area. The spatial distribution map of TH shows that the maximum areas are occupied by very hard (71%) and hard around (29%) the south-middle, western and southern part of the study area.

The main objective of Water Quality Index is to turn complex water quality data into information that is understandable and useable by the public. Water Quality Index based on some very important parameters can provide a simple indicator of water quality. The WQI range and type of water can be classified in below:

WQI Values	Type of Water	Percentage
< 50	Excellent Water	3.2
50 – 100	Good Water	72.1
100 – 200	Poor Water	24.7

The spatial distribution map of WQI shows that the maximum areas are occupied by Excellent and good (75%) and remaining part of the area is covering poor of the study area.

7.1.4 GEOPHYSICS

The Vertical Electrical Soundings (VES) was carried out in 90 locations upto a depth of 100 m in the study area by adopting Wenner Electrode

Configuration by using CRM 500 Resistivity Meter. The data were analyzed quantitatively and qualitatively (the geoelectrical parameters) are determined. This result has been translated into subsurface geological details. It could be seen that, the aquifer consists of dry topsoil of low resistivity as the first layer, moderately water saturated weathered layer of moderate resistivity as the second layer, and compact hard rock of very high resistivity as the last layer. The summarised results of the Quantitative and Qualitative are as given below.

The Summarized results of Quantitative Interpretation of the study area

Name of Unions	Top Soil Thickness in metres		Top Soil Resistivity in Ω mts		Water Bearing Formation Thickness in metres		Water Bearing Formation Resistivity in Ω mts		Depth of Basement Thickness in metres		Depth of Basement Resistivity in Ω mts	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Manur	1	3.5	8	800	2.5	46.5	29	167	4	48	272	2667
Palayamkottai	1	5	12	159	1.5	46	20	200	4	48	244	1293
Alangulam	1	4	10	403	6.5	45	26	168	4	48	342	2550

The Summarized results of Qualitative Interpretation of the study area

Name of Unions	Longitudinal Conductance in Mhos		Transverse Resistance in Ω m ²		Anisotropy		Curve Type		
	Min	Max	Min	Max	Min	Max	H	A	AK
Manur	0.16	0.74	22686	246403	1.1	2.0	9	22	0
Palayamkottai	0.25	0.75	25715	109720	1.2	2.2	10	18	1
Alangulam	0.19	0.80	27618	220964	1.1	2.6	13	15	2

7.1.5 REMOTE SENSING & GIS INTEGRATION

Based on the Geological data, HydroGeological data, Water Level data and Aquifer parameters data, Geophysical resistivity survey data, GeoChemical data and Water Quality Index data are prepared for thematic maps. Beyond that the following thematic maps such as Geomorphology map, Land use map, Lineament map, Slope map, Drainage map etc. were prepared independently in the study area. The above thematic maps are digitized using ARC/INFO GIS software into different layers. The layers are super imposed one over the other for combination of different parameters. The overlay analysis allows a linear combination of weights of each thematic map with the individual capability value with respect to groundwater potential.

The weights assigned to different classes of all the thematic layers and the cumulative map was further reclassified into five categories of groundwater prospects, viz. excellent, good, moderate, poor, and very poor. This shows the ground water potential zone into Excellent, Good, Moderate, Poor and Very Poor.

GWP Zone	Area (sq.km)	Percentage
Excellent	64	5
Good	369	30
Moderate	538	44
Poor	238	19
Very Poor	21	2

7.2 CONCLUSION

The following conclusions were made from the results of the study area:

- The geology of the study area mostly comprises of Garnetiferous biotite gneiss, Quartzite ridges are seen as narrow bands and crystalline limestone of the study area with fractured and jointed structure are serve as a good groundwater potential bearing zone
- Calc granulites and Charnockite rock types are serve as a low to moderate ground water potential zone.
- The flood plains like Tamiraparani river and Chittar river has shows the higher groundwater potential zones.
- The structural hills areas are best for groundwater occurrence.
- The pediment shows the moderate to good groundwater potential zones.
- Residual hill occupies very small portion and the water potential in this area is very poor.
- The entire study area mainly occupies the highly structurally disturbed zone like quartzites will act as a good aquifer zone. i.e. recharge as well as discharge zone.
- In some places the water quality is not upto the limit. It is because of the presence of the river and its flow from the charnockites to hornblende biotite gneiss and intrusive rock bodies of pegmatite noticed area. In this area, groundwater is not suitable for drinking purpose, but it is suitable for Irrigation.

- Quality of water affected in some areas due to presence of industry and also dense irrigation activity utilizing the urea and fertilizers.
- The Water Quality Index (WQI) studies reveals that the most of the area is favourable for drinking and irrigation purposes.
- The Suitable places or locations are to be suggested for construction of Open wells, Bore wells and Dug cum Borewells in the study area.

Name of the Union	Type of Well	Areas to be suggested
Manur	Open Well	Ukkirankottai, Pillaiyarkulam, Thalayuthu, Seethaparanallur, Seliyanallur, Abiseka pati, Near to river bank of Tamiraparani River
	Bore Well	Vettuvankulam, Pettai, Tirunelveli, Ugandhanpatti, Vallavankottai, Suthamalli Melkallur
	Dug cum Bore well	Mavadi, Nanjankulam, Tenkalampudur, Terkupatti, Ramayanpatti, Alagiyapandi puram.
Palayamkottai	Open Well	Itteri, Kilpattam, Muttur, Sengulam, Kongathanparai, Reddiarpatti, Seevala peri, Near to river bank of Tamiraparani River
	Bore Well	Sivanthipatti, Nochikulam, Kilnattam, Munneerpallam, Melapalayam, Kurichi
	Dug cum Bore well	Thidiyur, Palayamkottai, Ponnakudi, Melaseval, Pudukulam, Taruvai
Alangulam	Open Well	Alangulam, Maranthai, Kallathikulam, Viranam, Balabathiramapuram, Sivalar kulam, Muthammalpuram, Karuvantha.
	Bore Well	Vadaku Kavalakurichi, Vadiyur, Nettur, Venkateshwarapuram, Velayuthapuram
	Dug cum Bore well	Kilkalangal, Ruckumaniayammalpuram, Marandhai, Muthammalpuram, Periya samypuram, Uthumalai, Melkalangal

- The following regimes are suggested of the study area to locate the Open or Dug well and Bore Well. The area should have

Open well	Bore well
Low to moderate resistivity occurred in above basement	Low to moderate resistivity occurred in deeper portions
Depth of basement is shallow	Depth of basement deeper
Low longitudinal conductance	High longitudinal conductance,
High Tranverse resistance	Low Tranverse resistance
Less Anisotropy	Less Anisotropy

7.3 RECOMMENDATIONS

The study area is having River Tamiraparani & River Chittar and as well as adequate water bodies also available. The water bodies like existing Systematic Tanks, Recharge Tanks and Ponds are to be desilted concurrently. The inter connection of canal & irrigation tanks from Rivers.

The Domestic, Irrigation and Industry water scarcity of the study area has to be augmented on a large scale by creating addition of groundwater artificial recharge structures for harvesting rain water.

The artificial recharge of groundwater can improve the water table condition so as to avoid deterioration of ground water quality and it further helps to sustain the Groundwater potential during non-monsoon periods.

The following artificial recharge structures can to be adopted / recommended in the study area.

Name of the Union	Type of Area	Type of Recharge Structures
Manur	Plain	Percolation Pond, defunct open well recharge
	Slope	Contour bunds
	Odai / Canals	Check Dams
Palayamkottai	Plain	Percolation Pond
	Slope	Contour bunds
	Odai / Canals	Check Dam
Alangulam	Plain	Percolation Pond
	Slope	Contour bunds, Gabian structures
	Odai / Canals	Check Dam

The above said artificial recharge structures / recommendations are to be implemented in the study area in order to get development of agricultural activity, drinking as well as Industries. The basic needs of the people will fulfil the basic amenities; the socio-economic status will be automatically developed in the study area.