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ORIGINAL ARTICLE

EVALUATION OF GROUNDWATER POTENTIAL ZONE USING ELECTRICAL RESISTIVITY TECHNIQUE IN PART OF UPPODAI SUB BASIN, TAMBARAPARANI RIVER BASIN, TAMILNADU

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ABSTRACT

The present study on Ground water potential zones mapping is carried out for Uppodai sub basin of Chittar – Uppodai basin, Tirunelvei District. The ground water is the main source for both domestic and irrigational purposes in the Uppodai sub basin and being exploited continuously. Hence, the identification of feasible groundwater potential zones in the basin is necessary for further continuous activities. The basin consists of the major lithounits such as gneisses, charnockites, granites and basic and acidic intrusives. Ten (10) Vertical Electrical Soundings (VES) were conducted at different locations of the basin and the resistivity data have interpreted with IPI2Win software. The results of interpretation shows that the area has 3 layers and certain locations 4 layers with curve types of A, K, HK,KH and HA..Among the 10 locations the VES-3 and VES-9 were considered for feasible ground water potential zones as the VES locations were observed with the maximum layer thickness and favourable resistivity value range.

Keywords: Electrical resistivity survey, SSR-MP-AT-ME, Groundwater, VES

1.INTRODUCTION

The ground water reserve can be developed in less time and at less cost, and more importantly, without causing too much hazard to environment by keeping the exploitation within permissible limits. For such development, geophysical techniques, electrical resistivity in particular, play leading role in groundwater exploration. Besides, the technique is one of the important methods used to investigate the nature of subsurface formations by studying the variations in their electrical properties. Generally, these methods have been used for the identification of geological contacts, tectonic and structural studies. However, it is widely employed for ground water exploration and evaluation (Karanth, 1987, Janardhana Raju et.al, 1996). Nevertheless, the geophysical electrical resistivity method is successfully employed for groundwater exploration in different terrains by various authors (Mukhopaddhay, 1985, Balasunramanian, 1989, Venkatesawara Rao, CH et.al 2004, Narasinimha Prasad et al 2007, Jeyavel Raja Kumar et al, 2012).

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2.MATERIALS AND METHODS

STUDY AREA

The study area Uppodai is a dry sub- basin which is one of the tributaries to Chittar river and Chittar River is a tributary of Tambaraparani river. The sub basin has an area of about 600km^2 and lies between 77º 35' E to 77 º 55' E and 8 º 50' N to 9 º 10' N of Survey of India topo sheets 58-G/12,16 and 58-H/9,13. The study area map shown in Figure 1. As this is a dry basin, the surface water is not sufficient to fulfill the water requirement for both domestic and irrigational purposes. The ground water is the only main source for fulfilling all needs. Hence, the present study is under taken to delineate the feasible groundwater potential zones for the study area. Geologically the area consist of crystalline rocks of Achaean age namely gneisses, charnockites, granites and intrusive. The gneiss is covered most of the study area whereas charnockite occurs as small patches. The geological map of the area is shown in the Figure 2.

To understand the subsurface Lithology and layer thickness, Ten Vertical Electrical Soundings (VES) were conducted different locations shown in Figure 3 using the Schlumberger configuration. A maximum of AB/2 spacing 100 m using SSR-MP-AT-ME model resistivity meter. The obtained data was interpreted with IPI2Win software shown in the Table 1.

The software interpreted resistivity and respective layer thicknesses are converted into one, two and three layers for anlayses**.** The resistivities of the rock types at different depth levels are used to understand the geoelectrical properties, because the behavior of conductivity mainly depends on the resistivity of lithology and age (Keller and Frischknecht, 1966).

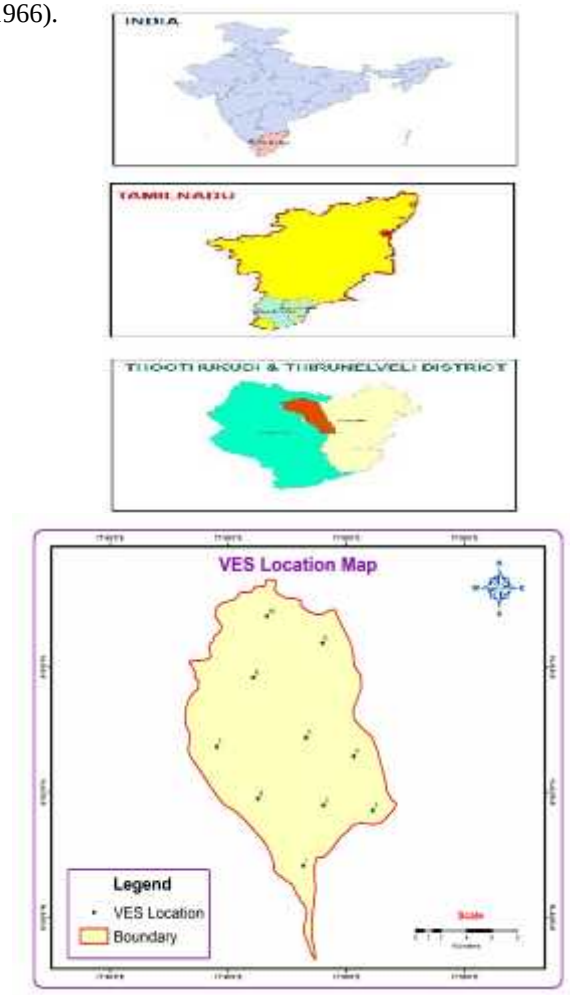

Figure 1 – Stud Area

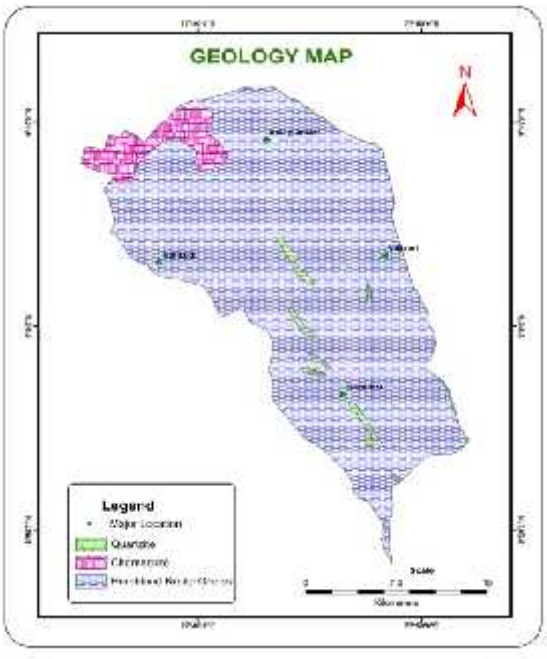

Figure 2 – Geology Map

3.RESULTS AND DISCUSSION:

The interpreted resistivity curve shows the A, K, HK, KH and HA types and they are presented in Figure 4 (1-10)**.** Besides, the type curves are very important indicators of the nature of geological formations. As this paper mainly discusses about the geoelectrical properties, the reistivity values are considered for discussion. Generally the magnitude of rock resistivities has wide range from a fraction of ohm-meter to several thousands of ohm-meters. The resistivity of a formation also changes depending on the degree of weathering and number of fractures.

The resistivity and thickness for the first layer are varied from 4.8 Ωm to 1203 Ωm and 1m to 12m. The second layer resistivity value ranged from 38.6 Ωm to 7320 Ωm. The aquifer thickness varied from 1m to 26 m. Similarly, the third layer resistivity and layer thickness varied from 1 Ωm to 35332 Ωm and 4 m to 18m respectively. The four layer curves obtained in VES-3, VES-6 and VES-10 which has given the reisitivity value range from 98 Ωm to 2448 Ωm.

Table 1- Interpreted resistivity data of the study

S. No	Location	ρ1	ρ2	ρ3	ρ4	h1	h2	h3	Error %	Curve Type
1	Chittar Sathiram	25.4	387	-	-	3.02	-	-	9.31	A
2	Perancheery	15.5	7320	258	-	1	1.43	-	12.8	K
3	Rajapudhukudi	136	76.9	5103	98.8	1.38	5.41	14.6	2.6	HK
4	Elavellangal Therku	36.5	143	35232	-	2.54	21.9	-	3.5	A
5	Elanthaikulam	57	249	-	-	12.6	-	-	9.1	A
6	Seliyanallur	4.83	62.7	7.95	2448	1.58	2.69	4.37	5.3	KH
7	Mela Elandhai	56.8	437	-	-	8.37	-	-	8.2	A
8	Thirumangala kuruchi	44.3	247	1.10	-	3.84	26.7	-	4.8	A
9	Sivaganapuram	55	87.8	312	-	1	5.63	-	6.4	A
10	Velankottai	203	38.6	87.8	2183	2.53	2.8	18.4	2.4	HA

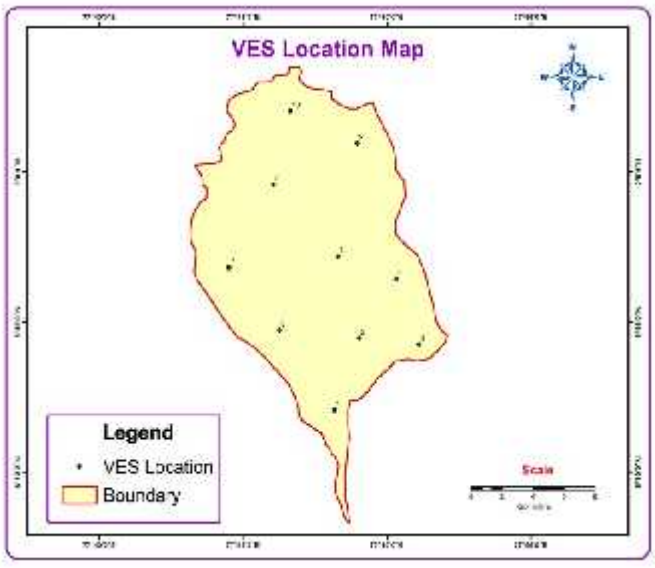

Figure 3 – VES Location Map

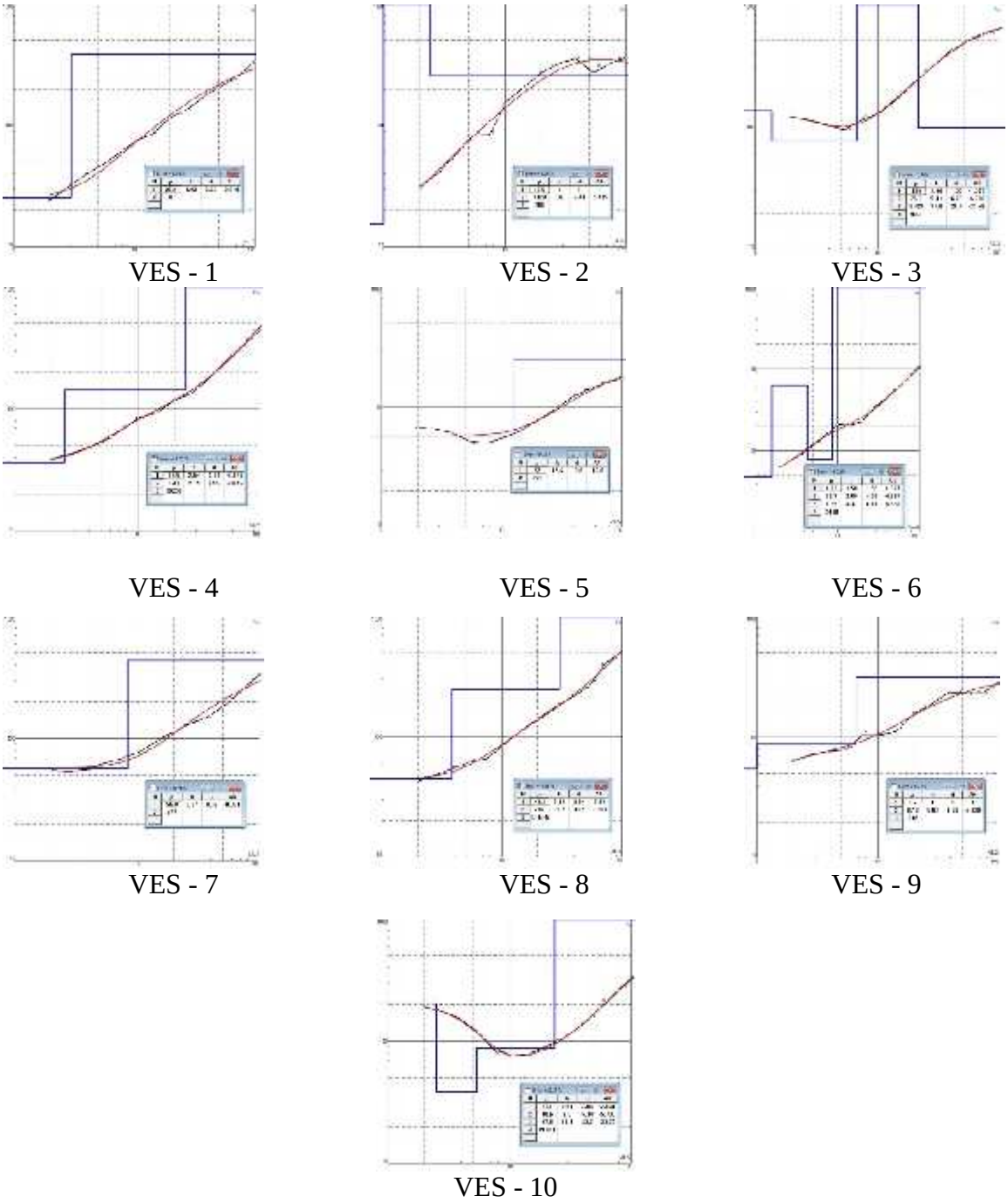

Figure 4. Interpreted resistivity curve of the study area.

4.CONCLUSION

The geophysical resistivity method is widely used for the ground water exploration. In the present study, the demarcation of suitable ground water potential zones have been carried out using the geophysical resistivity values and layer thickness parameters. The favorable zone has been delineated with respect to the recommendable resistivity of 50 Ωm to 150 Ωm. Apart from the resistivity value, the layer thicknesses are also considered for long term development. Hence the zone which has more depth to basement (thickness>5m) been considered for ground water development. With this interpretation, the zone around VES-3 and VES-9 were identified as favorable zones for ground water development.

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