GEOPHYSICAL INVESTIGATION OF GROUNDWATER EXPLORATION USING SELF-POTENTIAL AND RESISTIVITY METHOD IN VEPPILAIPATTI VILLAGE, SALEM DISTRICT, TAMILNADU, INDIA

Abstract

This study in part of Veppilaipatti Village, Tamil Nadu, used 2D profiling, Vertical Electrical Sounding (VES), and self-potential methods for groundwater exploration. A predominance of A and H type curves indicated subsurface layers and water-bearing capacity. Self-potential data identified three water-saturated zones. VES at 73m depth was recommended as a high-yielding well bore point. The electrical resistivity study revealed saltwater presence in the middle portion. The 3D subsurface model illustrated the study area's characteristics. Overall, this integrated approach is valuable for informed water resource management decisions in the region.

Keywords: VES, Self - Potential, Ground water, Electrical Resistivity

Authors

Gopal V
Centre for Earth and Atmospheric Sciences
Sathyabama Institute of Science and Technology (Deemed to be University)
Jeppiaar Nagar, Rajiv Gandhi Salai, Chennai
Tamil Nadu, INDIA.

Chandravijay M
Centre for Earth and Atmospheric Sciences
Sathyabama Institute of Science and Technology (Deemed to be University)
Jeppiaar Nagar, Rajiv Gandhi Salai, Chennai
Tamil Nadu, INDIA.

Ranjith Kumar R
Centre for Earth and Atmospheric Sciences
Sathyabama Institute of Science and Technology (Deemed to be University)
Jeppiaar Nagar, Rajiv Gandhi Salai, Chennai
Tamil Nadu, INDIA.

Anshu R
Department of Geology
University of Madras
Guindy Campus, Chennai
r.anshuraju@gmail.com

Krishnamurthy R.R
Centre for Earth and Atmospheric Sciences
Sathyabama Institute of Science and Technology (Deemed to be University)
Jeppiaar Nagar, Rajiv Gandhi Salai, Chennai
Tamil Nadu, INDIA.

Prabhu Dass Batvari, B
Department of Defence and Strategic Studies
SRM Institute of Science and Technology
Chennai

I. INTRODUCTION

Geophysics is a substance of study concerned with the physiological processes and physiological properties of the Object and its surrounding set surroundings, and the use of vicenarian methods for their analysis. The period geology sometimes refers exclusive to the geological applications. Material's contour, its gravitational and magnetic comic construction and arrangement, its mechanics and their opencast look in bag geomorphology, the its internal procreation of magmas, volcanism and careen formation. Over the bygone individual decades, geophysical surveying has prettified increasingly potent and helpful for module the submersed groundwater conditions (Murthy et al; 1968 and Raman et al: 2000).

Geophysical exploration is the technological analysis of material properties of the connective encrustation for enquiry of mineralized deposits or geologic artifact. With the uncovering of oil by geophysical methods in 1926, efficient method for locating oil and pigment deposits aroused the use and betterment of many geophysical methods and equipment. Geophysical methods notice differences or anomalies of somatic properties within the earth's freshness. Spacing, attraction, elasticity, and electrical resistivity are properties most commonly rhythmic. In the covering of geophysical methods for groundwater exploration, it is often misunderstood by more than they are misused to flat notice groundwater. The important exploratory techniques normally adopted are Geological methods, Geomorphological methods, Remote sensing methods, and Geophysical methods.Geophysical methods depend on confident physical properties of earth materials. The properties are plumbed and variations in their values in lateral or straight directions are made use of for assemblage underground content. The significant properties of rock that are made use are Gravity prospecting, Magnetic prospecting, Seismic prospecting, Electrical prospecting and Radiometric prospecting.

1. **Electrical Methods:** Electrical resistivity method depends on the activity of earth to course of electric ongoing. The resistivity of an earth organization depends on its mineral composition and is influenced to a very sizable alter by the interstitial liquid accumulation tell their in. Electrical resistivity method involves the measurement of open cut possibility caused by the passageway of an exciting current. In real set measurements, a show of electrode arrangement is victimized.

2. **Electrical Resistivity Method**

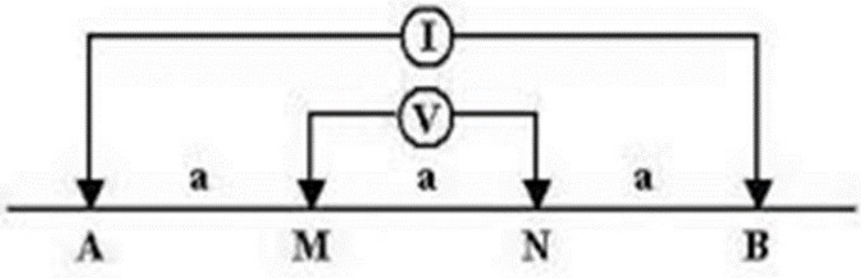


Figure 1: Shows the Wenner electrode Setup

Electrical resistivity technique based on the measurement of surface potential caused bythe flowing of an electric current on the ground from an artificial source depends on thevalidity of Ohm's law for linear conductors R-Av/1, wherethe resistance is R in Ohms, offered to current flow I and Av is the potential difference(volts), across two faces of the passing material. The resistance oflayer m is proportional to its L, length and inversely proportional to its cross-sectional area, R α L/A. The electrical resistivity or the specific resistance, P of the conducting layer, then is P= (A/L) R = (Δv / I) A/L

The above figure shows the arrangement and the current and potential lines in a homogeneous and isotropic medium. The potential difference between the two potential electrodes, M and N due to the current introduced by the two current electrodes, A and B.

3. **Electrode Setup:** The real-time measurements involve a various kinds of electrode setup are made, setups may differ in the electrode distance and geometry. Familiarly used configurations are Wenner, Schlumberger and dipole-dipole. In Wenner electrode setup, 4 electrodes, equi-distant one with respect other, are kept in a linear line, the outer two is the current electrodes.

   Schlumberger setup is also similar to Wenner configurations, but in this condition the potential electrodes are kept close to one another and away from the current electrodes, with the distance between the potential electrodes (MN) being generally kept less than 0.2 AB.

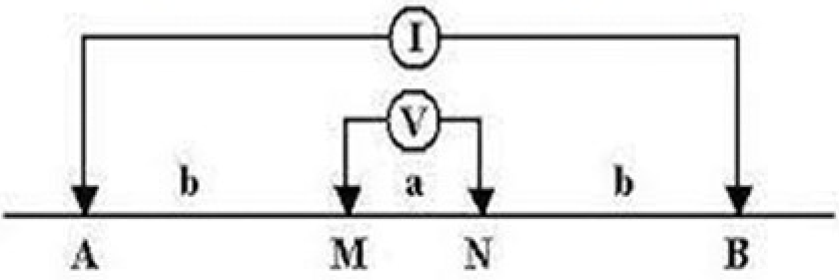


Figure 2: Shows the Schlumberger electrode configuration

4. **Horizontal Profiling and Vertical Electrical Sounding:** These methods are supported in greeting of the object to travel of galvanic prevailing. The resistivity of a shake object depends on its asphaltic schoolwork and is influenced to a really broad change by the interstitial food collection recognize there in. Electrical resistivity method involves the activity of layer possibility caused by the delivery of an electric underway. In factual earth measurements, a variety of electrode arrangements are utilized.

5. **Self-Potential:** The self-potential (SP) strategy could be a detached electrical geophysical strategy based upon measuring of spontaneous or common electrical potential created within the soil due to: electrochemical intuitive between minerals and subsurface liquids, electro dynamic forms coming about from the flow of ionic liquids or thermoelectric components from temperature angles within the subsurface.

6. **Study Area:** The study area is from Veppilaipatti village, Salem district, Tamil Nadu. This area lies between north latitude and longitude 11º35’03″ and 78º21’35″,11º35’03’’ and 78º21’39’’ and south latitude and longitude 11º34’51’’ and 78º21’33’’, 11º34’56’’ and 78º21’38’’. Salem district is bounded north Tamil Nadu. It is located between on 11.669437°N Latitude, 78.140865°E Longitude at an average elevation of 278 m (912 ft) above the mean sea level except Yercaud hills. It has an area of about 7905.38 kms with 38, 96,388 inhabitants. Salem surrounded by hills: the north is surrounded by Nagaramalai hills, Jarugumalai on the south, Kanjamalai on the west, Godumalai on the east and the Shevaroy Hills on the northeast. Entire district comprises of a hard rock terrain of Archaean age and it has the principal rock type of granite and a semi-arid weather.

7. **Geology and Geomorphology of Study Area:** Salem district is rich in mineral deposits like Magnesite, Bauxite, Granite, Limestone, Quartz and Iron ore. Geologically, the entire Salem district can be classified into hard rock formation. More than 90 percent of the district is underlain by hard rock of Archaean age. Quartz, Feldspar, and limestone those are resistant to weathering and also seen as patches in Charnockite and gneissic varieties and the above rock types found Sedimentary Formation. The granulite terrain of Salem area has witnessed two major periods of granitic activity – one during Late-Archaean to Early Palaeo-Proterozoic and the other during Neo-Proterozoic times. The granites of older event are restricted to the southern part of Salem district i.e. North of Moyar – Bhavani – Attur Lineament (MBAL), while the younger Pan-African event is spread in the terrain south of MBAL. The rocks of the Khondalite and Charnockite groups have been subjected to regional magmatisation and retrogression with influx of quartzo-feldspathic material resulting in the formation of different types of gneiss such as biotite gneiss, hornblende gneiss, Augen gneiss, garnetiferous biotite gneiss, garnetiferousquartzo-felspathic gneiss depending upon the parent rock. The entire area of Salem district is a pediplain. The Shevaroy Hills on the northeast and Jarugumalai on the south side of the district constitutes the remnants of the much-denuded Eastern Ghats and rise to heights of over 1031 m above mean sea level. There are numerous small residual hills like Nagaramalai, Kanjamalai and Kodhumalai hills. The elevation of the area is ranging between 120 m and 200m above Mean Sea Level (MSL). The prominent geomorphic units identified in the district through interpretation of Satellite imagery are Structural hill, Pediments, Shallow Pediments, Buried Pediments and Alluvial plain.

   The soils can be broadly classified into 6 major soils types including Red insitu, Red Colluvial Soil, Black Soil, Brown Soil, Alluvial and Mixed Soil. Majority of the district is covered by Red insitu and Red Colluvial soils. Block soils are mostly seen in Salem, Attur, Omalur and sankari taluks. Brown Soil is majorly found in Yercaud and Omalur and the Alluvial Soil is found in the river courses of Omalur and Sankari. Mixed soil is found only in Attur taluk.

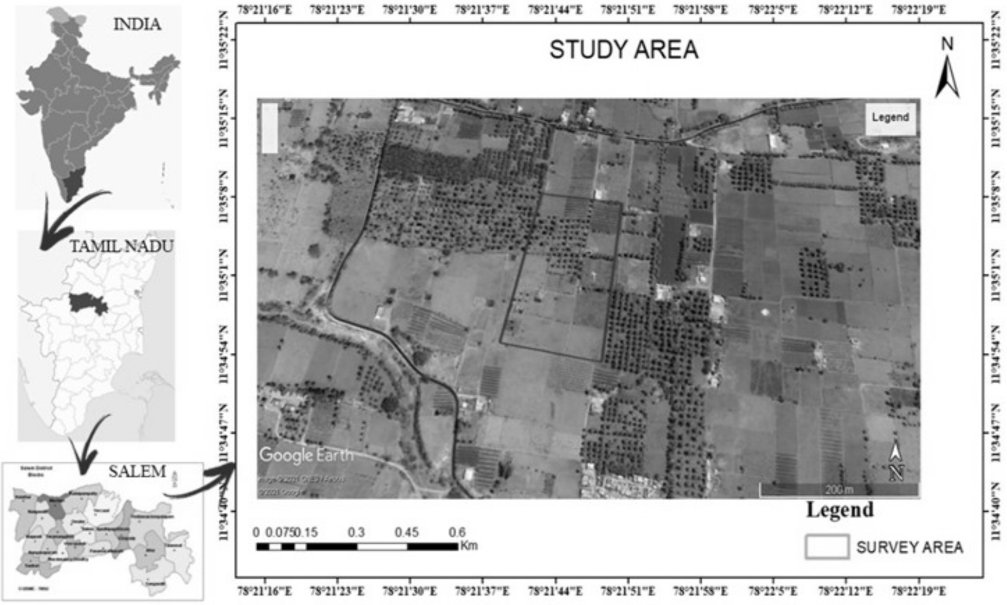


Figure 3: shows the Study area map

8. **Rainfall and Climate:** Salem district gets rain beneath the impact of both southwest and northeast rainstorm. The northeast rainstorm primarily contributes the precipitation within the area. Precipitation information from six stations over the period 1901-2003 were utilized and an examination of the analysis appears that the ordinary yearly precipitation over the area shifts from approximately 800 mm to 1600 mm. It is the least around Sankari (800 mm) within the southwestern portion of the district. It continuously increments towards north, northeast and east and attains a greatest around Yercaud (1594.3 mm) within the northern portion.

   The Salem district enjoys a tropical climate. The climate is charming amid the period from November to January. Mornings in common are muggier than the evenings, with the stickiness surpassing 75% on a normal. Within the period June to November the evening mugginess surpasses 60% on a normal. Within the rest of the year the evenings are drier, the summer evenings being the driest. The hot climate starts early in March, the most elevated temperature being come to in April and May. Climate cools down continuously from almost the center of June and by December, the cruel day by day most extreme temperature drops to 30.2°C, whereas the cruel day by day least drops to 19.2°C and 19.6°C in January in Salem and Mettur Dam.

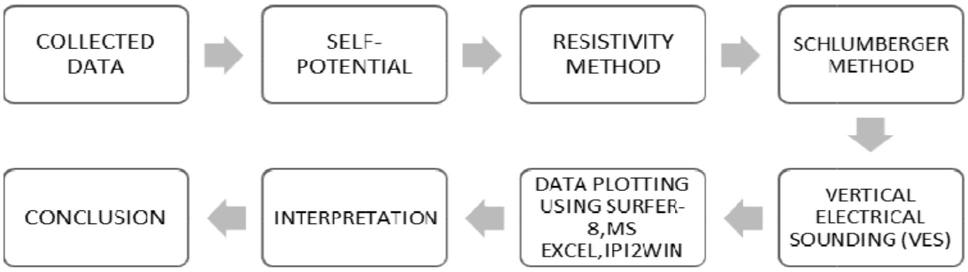
9. **Hydrogeology of the Study Area:** Salem district is underlain completely by Archaean Crystalline arrangements with later alluvial deposits happening along the waterway and streams courses like Cauvery, Thirumanimutharu, Sarapangandhi are the vital waterways within the locale. But Cauvery, other streams stream as it were amid blustery seasons. Weathered, fissured and broken crystalline rocks and the later alluvial stores constitute the important aquifer frameworks within the area. The permeable arrangements within the area are represented by waterway alluvium. These alluvial deposits are kept to the Major Stream and stream courses as it were. Ground water happens beneath phreatic conditions. The greatest immersed thickness of these aquifers is up to 10 m depending upon the

topographic conditions. The difficult solidified crystalline rocks of Archaean age represent weathered, fissured and broken arrangements of gneisses, stones, Charnockite and other related rocks.

10. **Objectives of the Study:** The major objective of present study is to explore the ground water.
    - To portray the outcrop geology of the ponder area.
    - To investigate sub surface breaks, weathered zone and water filled pores spaces at a chosen depth (Using 2D profiling)
    - To choose appropriate area to vertical electrical sounding utilizing profile information 3D plot created from surfer.
    - To investigate ground water potential of the chosen point and to choose a point to penetrate for high yielding bore well. (Using Vertical electrical sounding, Schlumberger electrode configuration).

II. MATERIALS AND METHODOLOGY

There are a few variations in electrical method. In reality, biggest assortment of strategies is conceivable in electrical method of prospecting and it'll be no shock in case unused strategies are created in upcoming years. In electrical strategies, the characteristic electrical field in a region was examined or the ground is charged by an artificial electrical field and dispersion of the electric field at the surface of the soil was explored.



III. METHODOLOGY FLOW CHART

1. **Electrical Resistivity Method:** Electrical method procedures depend on the reaction of the earth in passing the stream of electricity. Among the geophysical methods, electrical resistivity strategies appreciate the most noteworthy popularity and are broadly utilized for both territorial and point by point groundwater overviews since of its way better settling control, less costs as well as run of appropriateness. Electrical resistivity strategies have utilized in this case to Portray potential zones of subsurface water and to discover thickness of immersed layers, profundity to the subsurface topography.

2. **Apparent Resistivity:** The capacity to carry current is a critical property of rock shaping minerals, this property utilizes of in electrical method of prospecting. Electrical resistivity looking over depends on measuring of the resistivity 'p' of subsurface by passing a known electric current into the ground and measuring the potential difference between two

points. This technique depends on usage of Ohm's law in linear conduction, represented as,

$$R = \frac{\Delta V}{I}$$

3. **Electrode Configuration:** In real estimation, an assortment of electrodes course of arrangements is utilized, contrast within the inter-electrode distance and geometry. The foremost commonly utilized arrangement is the Wenner and Schlumberger arrangements.

4. **Schlumberger Arrangements:** The Schlumberger terminal setups are additionally a cluster like Wenner, but contrasts in putting the two current terminals with a much bigger gap than that between the potential (inward) electrodes. As it were one set of cathodes either potential or current are moved to extended interims at a time whereas conducting profundity soundings not at all like in Wenner cluster where there are four electrodes are moved at the same time. The current anodes are signified by A and B, whereas the potential anodes are signified by M and N. The gap between M and N is signified by 'b' whereas the gap AB is signified by a'. The apparent resistivity is given by,

$$\rho a = KR,$$
$$K = \pi \frac{AM.AN}{MN},$$

5. **Interpretation of Resistivity Data:** Elucidation of resistivity information in words of the subsurface geology and hydrology shapes 2 imperative stages within investigation of subsurface water. Point of translation of resistivity, to decide the thickness of layer and resistivity of diverse horizons present. Interpretation of V.E.S information is both quantitative and subjective. The sort of V.E.S bend gotten demonstrates the nature of subsurface that will be anticipated in a zone. For case, a H sort bend with difficult shake territory be deciphered as comprising of (1) a dry top soil layer taken after by (2) moist weathered rock/regolith, underlain by (3) the bed rock. There are numerous ways to decipher the resistivity information beginning from observational strategy using Modern strategies utilizing quick systems.

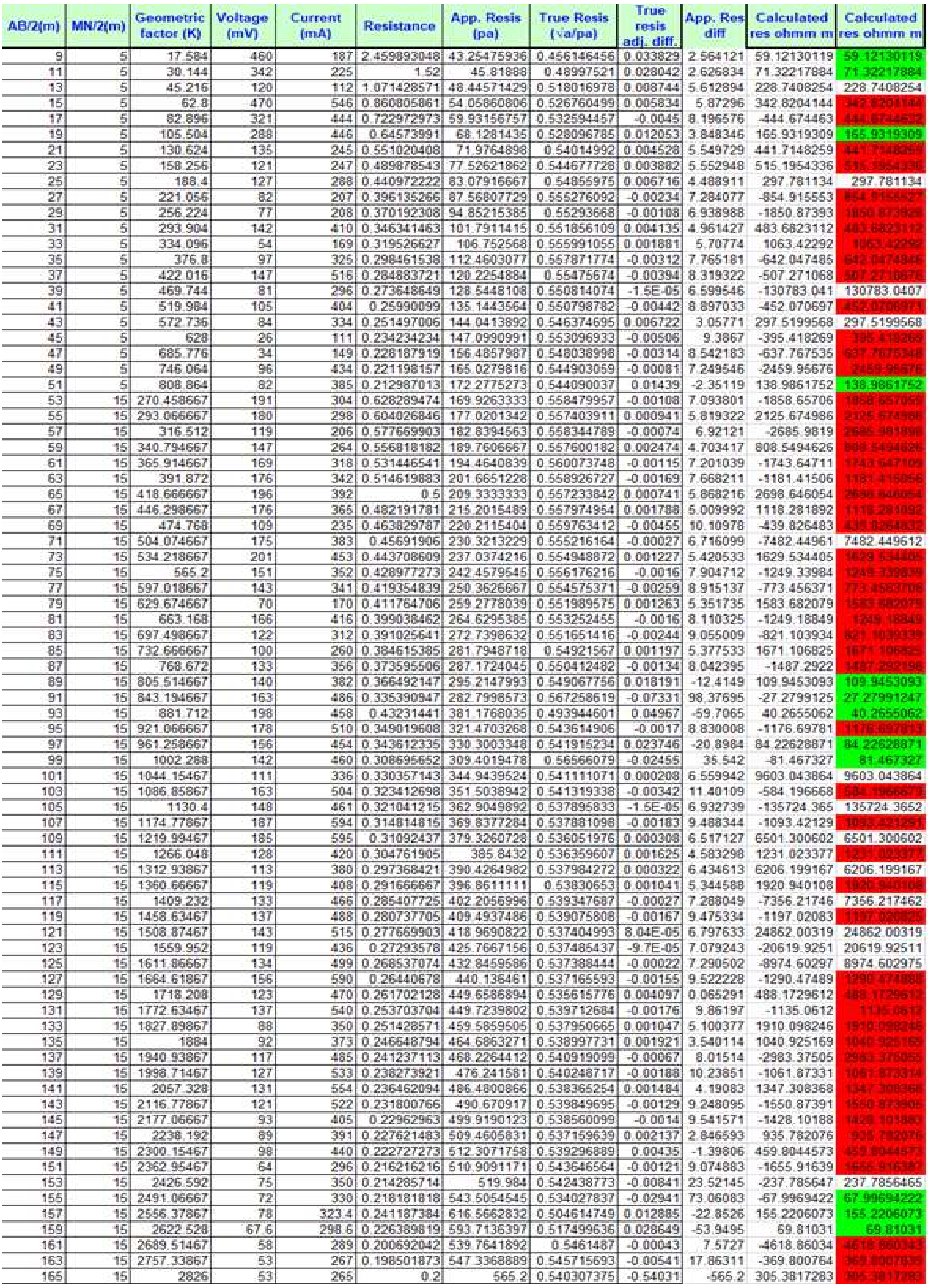
6. **Self-Potential:** The self-potential (SP) strategy may be an inactive electrical geophysical strategy based upon the estimation of spontaneous or natural electrical potential created within the soil due to: electrochemical interactions between minerals and subsurface liquids, electro kinetic forms coming about from the flow of ionic liquids or thermoelectric mechanisms from temperature angles within the subsurface. A few physical forms caused sources of SP are still hazy. Groundwater is thought to be common calculate capable for SP. Potentials are produced by the stream of water, by water responding as an electrolyte and as a dissolvable of distinctive minerals. Electrical conductivity to create possibilities of permeable rocks depends on porosity and on versatility of water to pass through the pore spaces depend on ionic mobilities, solution concentrations, viscosity, temperature & pressure.

IV. RESULTS AND DISCUSSION

VES are done infield utilizing Shlumberger arrangement additionally self-potential itself. In all 3 soundings were done and analysed. The least and most extreme value of AB/2 (currentelectrode division) chosen for the studies is 2m to 60m, the clear resistivity information of Vertical Electrical Sounding areas has plotted on graph (log-log) and coordinated with master curve for getting the layers. The depth sounding curves are classified based on layer resistivity combinations.

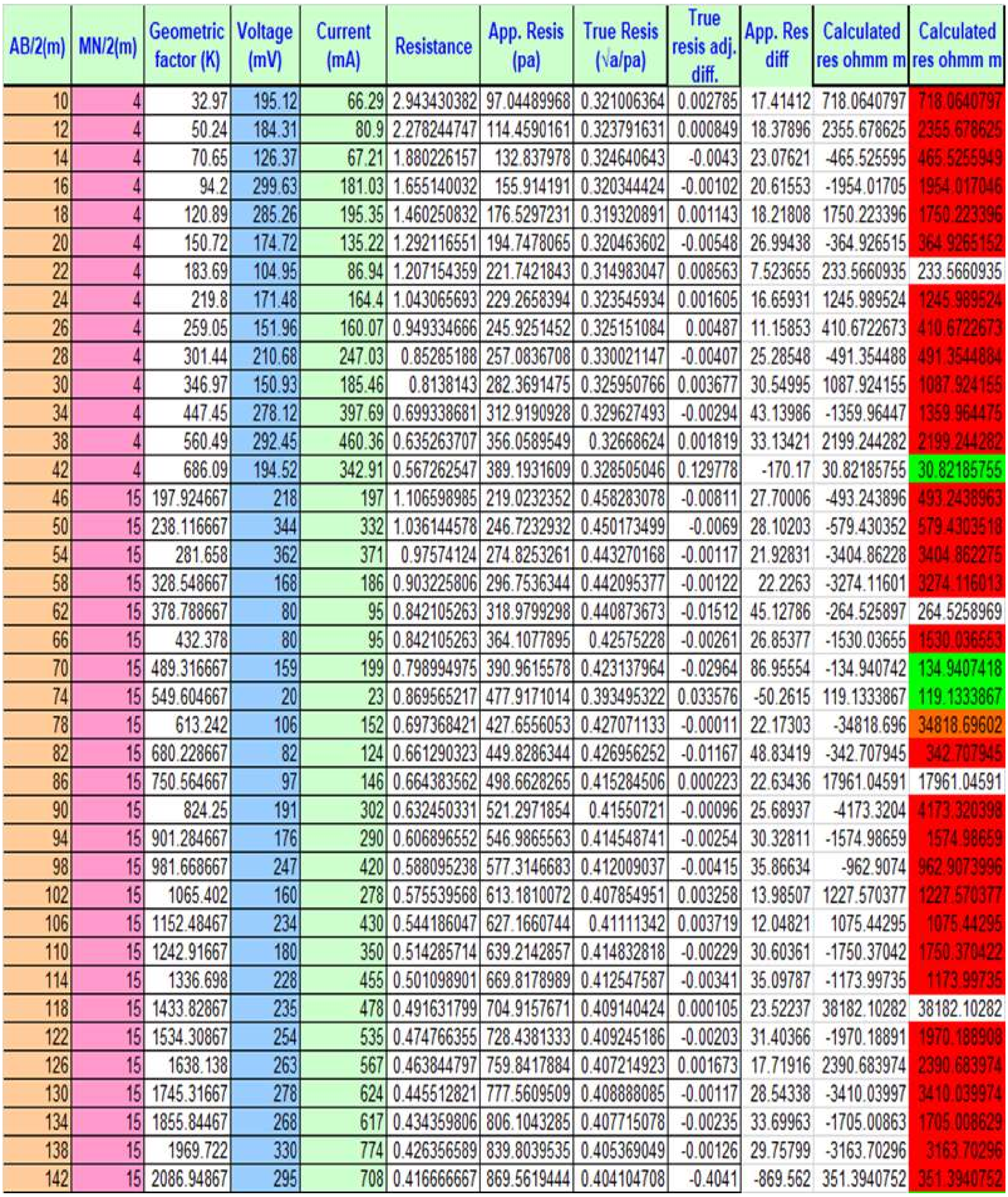
1. **Geo-Survey Equipment:** The geo-physical instrument was utilized for field work is DDR-2, which is the innate IGIS make from Hyderabad. The 3 Vertical Electrical Depth Soundings (VES) were taken for basic examination of the subjective and quantitative elucidations. The readings are arranged underneath. The 3 numbers of sounding were at first coordinated manually with the master curves arranged for vertical electrical sounding by the Ernesto Orellana and Harold. Mooney, Intercien Costanilla De Los Angeles, Madrid 1966. At that point the deciphered information has been confirmed utilizing the computer program and subtle elements are as takes after:

Table 1: The values of VES reading 1



AB/2(m)	MN/2(m)	Geometric factor (K)	Voltage (mV)	Current (mA)	Resistance	App. Resis (pa)	True Resis (√a/pa)	True resis adj. diff.	App. Res diff	Calculated res ohmm m	Calculated res ohmm m
9	5	17.584	460	187	2.459893048	43.25475936	0.456146456	0.033829	2.564121	59.12130119	🟩 59.12130119
11	5	30.144	342	225	1.52	45.81888	0.48997521	0.028042	2.626834	71.32217884	🟩 71.32217884
13	5	45.216	120	112	1.071428571	48.44571429	0.518016978	0.008744	5.612894	228.7408254	228.7408254
15	5	62.8	470	546	0.860805861	54.05860806	0.526760499	0.005834	5.87296	342.8204144	🟥 342.8204144
17	5	82.896	321	444	0.722972973	59.93156757	0.532594457	-0.0045	8.196576	-444.674463	🟥 444.6744632
19	5	105.504	288	446	0.64573991	68.1281435	0.528096785	0.012053	3.848346	165.9319309	🟩 165.9319309
21	5	130.624	135	245	0.551020408	71.9764898	0.54014992	0.004528	5.549729	441.7148259	🟥 441.7148259
23	5	158.256	121	247	0.489878543	77.52621862	0.544677728	0.003882	5.552948	515.1954336	🟥 515.1954336
25	5	188.4	127	288	0.440972222	83.07916667	0.54855975	0.006716	4.488911	297.781134	297.781134
27	5	221.056	82	207	0.396135266	87.56807729	0.555276092	-0.00234	7.284077	-854.915553	🟥 854.9155527
29	5	256.224	77	208	0.370192308	94.85215385	0.55293668	-0.00108	6.938988	-1850.87393	🟥 1850.873928
31	5	293.904	142	410	0.346341463	101.7911415	0.551856109	0.004135	4.961427	483.6823112	🟥 483.6823112
33	5	334.096	54	169	0.319526627	106.752568	0.555991055	0.001881	5.70774	1063.42292	🟥 1063.42292
35	5	376.8	97	325	0.298461538	112.4603077	0.557871774	-0.00312	7.765181	-642.047485	🟥 642.0474846
37	5	422.016	147	516	0.284883721	120.2254884	0.55475674	-0.00394	8.319322	-507.271068	🟥 507.2710676
39	5	469.744	81	296	0.273648649	128.5448108	0.550814074	-1.5E-05	6.599546	-130783.041	130783.0407
41	5	519.984	105	404	0.25990099	135.1443564	0.550798782	-0.00442	8.897033	-452.070697	🟥 452.0706971
43	5	572.736	84	334	0.251497006	144.0413892	0.546374695	0.006722	3.05771	297.5199568	297.5199568
45	5	628	26	111	0.234234234	147.0990991	0.553096933	-0.00506	9.3867	-395.418269	🟥 395.418269
47	5	685.776	34	149	0.228187919	156.4857987	0.548038998	-0.00314	8.542183	-637.767535	🟥 637.7675348
49	5	746.064	96	434	0.221198157	165.0279816	0.544903059	-0.00081	7.249546	-2459.95676	🟥 2459.95676
51	5	808.864	82	385	0.212987013	172.2775273	0.544090037	0.01439	-2.35119	138.9861752	🟩 138.9861752
53	15	270.458667	191	304	0.628289474	169.9263333	0.558479957	-0.00108	7.093801	-1858.65706	🟥 1858.657059
55	15	293.066667	180	298	0.604026846	177.0201342	0.557403911	0.000941	5.819322	2125.674986	🟥 2125.674986
57	15	316.512	119	206	0.577669903	182.8394563	0.558344789	-0.00074	6.92121	-2685.9819	🟥 2685.981896
59	15	340.794667	147	264	0.556818182	189.7606667	0.557600182	0.002474	4.703417	808.5494626	🟥 808.5494626
61	15	365.914667	169	318	0.531446541	194.4640839	0.560073748	-0.00115	7.201039	-1743.64711	🟥 1743.647109
63	15	391.872	176	342	0.514619883	201.6651228	0.558926727	-0.00169	7.668211	-1181.41506	🟥 1181.415056
65	15	418.666667	196	392	0.5	209.3333333	0.557233842	0.000741	5.868216	2698.646054	🟥 2698.646054
67	15	446.298667	176	365	0.482191781	215.2015489	0.557974954	0.001788	5.009992	1118.281892	🟥 1118.281892
69	15	474.768	109	235	0.463829787	220.2115404	0.559763412	-0.00455	10.10978	-439.826483	🟥 439.8264832
71	15	504.074667	175	383	0.45691906	230.3213229	0.555216164	-0.00027	6.716099	-7482.44961	7482.449612
73	15	534.218667	201	453	0.443708609	237.0374216	0.554948872	0.001227	5.420533	1629.534405	🟥 1629.534405
75	15	565.2	151	352	0.428977273	242.4579545	0.556176216	-0.0016	7.904712	-1249.33984	🟥 1249.339839
77	15	597.018667	143	341	0.419354839	250.3626667	0.554575371	-0.00259	8.915137	-773.456371	🟥 773.4563708
79	15	629.674667	70	170	0.411764706	259.2778039	0.551989575	0.001263	5.351735	1583.682079	🟥 1583.682079
81	15	663.168	166	416	0.399038462	264.6295385	0.553252455	-0.0016	8.110325	-1249.18849	🟥 1249.18849
83	15	697.498667	122	312	0.391025641	272.7398632	0.551651416	-0.00244	9.055009	-821.103934	🟥 821.1039339
85	15	732.666667	100	260	0.384615385	281.7948718	0.54921567	0.001197	5.377533	1671.106825	🟥 1671.106825
87	15	768.672	133	356	0.373595506	287.1724045	0.550412482	-0.00134	8.042395	-1487.2922	🟥 1487.292198
89	15	805.514667	140	382	0.366492147	295.2147993	0.549067756	0.018191	-12.4149	109.9453093	🟩 109.9453093
91	15	843.194667	163	486	0.335390947	282.7998573	0.567258619	-0.07331	98.37695	-27.2799125	🟩 27.27991247
93	15	881.712	198	458	0.43231441	381.1768035	0.493944601	0.04967	-59.7065	40.2655062	🟩 40.2655062
95	15	921.066667	178	510	0.349019608	321.4703268	0.543614906	-0.0017	8.830008	-1176.69781	🟥 1176.697813
97	15	961.258667	156	454	0.343612335	330.3003348	0.541915234	0.023746	-20.8984	84.22628871	🟩 84.22628871
99	15	1002.288	142	460	0.308695652	309.4019478	0.56566079	-0.02455	35.542	-81.467327	🟩 81.467327
101	15	1044.15467	111	336	0.330357143	344.9439524	0.541111071	0.000208	6.559942	9603.043864	9603.043864
103	15	1086.85867	163	504	0.323412698	351.5038942	0.541319338	-0.00342	11.40109	-584.196668	🟥 584.1966679
105	15	1130.4	148	461	0.321041215	362.9049892	0.537895833	-1.5E-05	6.932739	-135724.365	135724.3652
107	15	1174.77867	187	594	0.314814815	369.8377284	0.537881098	-0.00183	9.488344	-1093.42129	🟥 1093.421291
109	15	1219.99467	185	595	0.31092437	379.3260728	0.536051976	0.000308	6.517127	6501.300602	6501.300602
111	15	1266.048	128	420	0.304761905	385.8432	0.536359607	0.001625	4.583298	1231.023377	🟥 1231.023377
113	15	1312.93867	113	380	0.297368421	390.4264982	0.537984272	0.000322	6.434613	6206.199167	6206.199167
115	15	1360.66667	119	408	0.291666667	396.8611111	0.53830653	0.001041	5.344588	1920.940108	🟥 1920.940108
117	15	1409.232	133	466	0.285407725	402.2056996	0.539347687	-0.00027	7.288049	-7356.21746	7356.217462
119	15	1458.63467	137	488	0.280737705	409.4937486	0.539075808	-0.00167	9.475334	-1197.02083	🟥 1197.020825
121	15	1508.87467	143	515	0.277669903	418.9690822	0.537404993	8.04E-05	6.797633	24862.00319	24862.00319
123	15	1559.952	119	436	0.27293578	425.7667156	0.537485437	-9.7E-05	7.079243	-20619.9251	20619.92511
125	15	1611.86667	134	499	0.268537074	432.8459586	0.537388444	-0.00022	7.290502	-8974.60297	8974.602975
127	15	1664.61867	156	590	0.26440678	440.136461	0.537165593	-0.00155	9.522228	-1290.47489	🟥 1290.474888
129	15	1718.208	123	470	0.261702128	449.6586894	0.535615776	0.004097	0.065291	488.1729612	🟥 488.1729612
131	15	1772.63467	137	540	0.253703704	449.7239802	0.539712684	-0.00176	9.86197	-1135.0612	🟥 1135.0612
133	15	1827.89867	88	350	0.251428571	459.5859505	0.537950665	0.001047	5.100377	1910.098246	🟥 1910.098246
135	15	1884	92	373	0.246648794	464.6863271	0.538997731	0.001921	3.540114	1040.925169	🟥 1040.925169
137	15	1940.93867	117	485	0.241237113	468.2264412	0.540919099	-0.00067	8.01514	-2983.37505	🟥 2983.375055
139	15	1998.71467	127	533	0.238273921	476.241581	0.540248717	-0.00188	10.23851	-1061.87331	🟥 1061.873314
141	15	2057.328	131	554	0.236462094	486.4800866	0.538365254	0.001484	4.19083	1347.308368	🟥 1347.308368
143	15	2116.77867	121	522	0.231800766	490.670917	0.539849695	-0.00129	9.248095	-1550.87391	🟥 1550.873906
145	15	2177.06667	93	405	0.22962963	499.9190123	0.538560099	-0.0014	9.541571	-1428.10188	🟥 1428.101880
147	15	2238.192	89	391	0.227621483	509.4605831	0.537159639	0.002137	2.846593	935.782076	🟥 935.782076
149	15	2300.15467	98	440	0.222727273	512.3071758	0.539296889	0.00435	-1.39806	459.8044573	🟥 459.8044573
151	15	2362.95467	64	296	0.216216216	510.9091171	0.543646564	-0.00121	9.074883	-1655.91639	🟥 1655.916387
153	15	2426.592	75	350	0.214285714	519.984	0.542438773	-0.00841	23.52145	-237.785647	237.7856465
155	15	2491.06667	72	330	0.218181818	543.5054545	0.534027837	-0.02941	73.06083	-67.9969422	🟩 67.99694222
157	15	2556.37867	78	323.4	0.241187384	616.5662832	0.504614749	0.012885	-22.8526	155.2206073	🟩 155.2206073
159	15	2622.528	67.6	298.6	0.226389819	593.7136397	0.517499636	0.028649	-53.9495	69.81031	🟩 69.81031
161	15	2689.51467	58	289	0.200692042	539.7641892	0.5461487	-0.00043	7.5727	-4618.86034	🟥 4618.860343
163	15	2757.33867	53	267	0.198501873	547.3368889	0.545715693	-0.00541	17.86311	-369.800764	🟥 369.8007639
165	15	2826	53	265	0.2	565.2	0.540307375	-0.54031	-565.2	305.3817283	🟥 305.3817283

Table 2: The values of VES reading 2

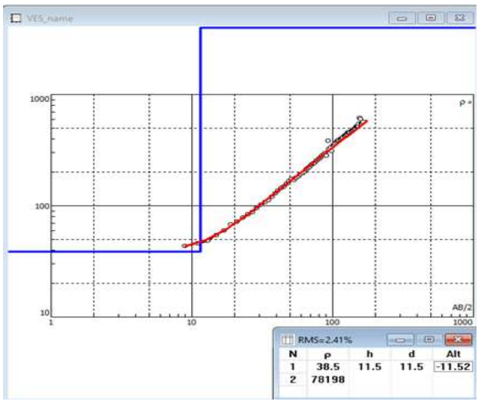


AB/2(m)	MN/2(m)	Geometric factor (K)	Voltage (mV)	Current (mA)	Resistance	App. Resis (pa)	True Resis (√a/pa)	True resis adj. diff.	App. Res diff	Calculated res ohmm m	Calculated res ohmm m
10	4	32.97	195.12	66.29	2.943430382	97.04489968	0.321006364	0.002785	17.41412	718.0640797	718.0640797
12	4	50.24	184.31	80.9	2.278244747	114.4590161	0.323791631	0.000849	18.37896	2355.678625	2355.678625
14	4	70.65	126.37	67.21	1.880226157	132.837978	0.324640643	-0.0043	23.07621	-465.525595	465.5255949
16	4	94.2	299.63	181.03	1.655140032	155.914191	0.320344424	-0.00102	20.61553	-1954.01705	1954.017046
18	4	120.89	285.26	195.35	1.460250832	176.5297231	0.319320891	0.001143	18.21808	1750.223396	1750.223396
20	4	150.72	174.72	135.22	1.292116551	194.7478065	0.320463602	-0.00548	26.99438	-364.926515	364.9265152
22	4	183.69	104.95	86.94	1.207154359	221.7421843	0.314983047	0.008563	7.523655	233.5660935	233.5660935
24	4	219.8	171.48	164.4	1.043065693	229.2658394	0.323545934	0.001605	16.65931	1245.989524	1245.989524
26	4	259.05	151.96	160.07	0.949334666	245.9251452	0.325151084	0.00487	11.15853	410.6722673	410.6722673
28	4	301.44	210.68	247.03	0.85285188	257.0836708	0.330021147	-0.00407	25.28548	-491.354488	491.3544884
30	4	346.97	150.93	185.46	0.8138143	282.3691475	0.325950766	0.003677	30.54995	1087.924155	1087.924155
34	4	447.45	278.12	397.69	0.699338681	312.9190928	0.329627493	-0.00294	43.13986	-1359.96447	1359.964475
38	4	560.49	292.45	460.36	0.635263707	356.0589549	0.32668624	0.001819	33.13421	2199.244282	2199.244282
42	4	686.09	194.52	342.91	0.567262547	389.1931609	0.328505046	0.129778	-170.17	30.82185755	30.82185755
46	15	197.924667	218	197	1.106598985	219.0232352	0.458283078	-0.00811	27.70006	-493.243896	493.2438963
50	15	238.116667	344	332	1.036144578	246.7232932	0.450173499	-0.0069	28.10203	-579.430352	579.4303518
54	15	281.658	362	371	0.97574124	274.8253261	0.443270168	-0.00117	21.92831	-3404.86228	3404.862275
58	15	328.548667	168	186	0.903225806	296.7536344	0.442095377	-0.00122	22.2263	-3274.11601	3274.116013
62	15	378.788667	80	95	0.842105263	318.9799298	0.440873673	-0.01512	45.12786	-264.525897	264.5258969
66	15	432.378	80	95	0.842105263	364.1077895	0.42575228	-0.00261	26.85377	-1530.03655	1530.036553
70	15	489.316667	159	199	0.798994975	390.9615578	0.423137964	-0.02964	86.95554	-134.940742	134.9407418
74	15	549.604667	20	23	0.869565217	477.9171014	0.393495322	0.033576	-50.2615	119.1333867	119.1333867
78	15	613.242	106	152	0.697368421	427.6556053	0.427071133	-0.00011	22.17303	-34818.696	34818.69602
82	15	680.228667	82	124	0.661290323	449.8286344	0.426956252	-0.01167	48.83419	-342.707945	342.707945
86	15	750.564667	97	146	0.664383562	498.6628265	0.415284506	0.000223	22.63436	17961.04591	17961.04591
90	15	824.25	191	302	0.632450331	521.2971854	0.41550721	-0.00096	25.68937	-4173.3204	4173.320398
94	15	901.284667	176	290	0.606896552	546.9865563	0.414548741	-0.00254	30.32811	-1574.98659	1574.98659
98	15	981.668667	247	420	0.588095238	577.3146683	0.412009037	-0.00415	35.86634	-962.9074	962.9073996
102	15	1065.402	160	278	0.575539568	613.1810072	0.407854951	0.003258	13.98507	1227.570377	1227.570377
106	15	1152.48467	234	430	0.544186047	627.1660744	0.41111342	0.003719	12.04821	1075.44295	1075.44295
110	15	1242.91667	180	350	0.514285714	639.2142857	0.414832818	-0.00229	30.60361	-1750.37042	1750.370422
114	15	1336.698	228	455	0.501098901	669.8178989	0.412547587	-0.00341	35.09787	-1173.99735	1173.99735
118	15	1433.82867	235	478	0.491631799	704.9157671	0.409140424	0.000105	23.52237	38182.10282	38182.10282
122	15	1534.30867	254	535	0.474766355	728.4381333	0.409245186	-0.00203	31.40366	-1970.18891	1970.188908
126	15	1638.138	263	567	0.463844797	759.8417884	0.407214923	0.001673	17.71916	2390.683974	2390.683974
130	15	1745.31667	278	624	0.445512821	777.5609509	0.408888085	-0.00117	28.54338	-3410.03997	3410.039974
134	15	1855.84467	268	617	0.434359806	806.1043285	0.407715078	-0.00235	33.69963	-1705.00863	1705.008629
138	15	1969.722	330	774	0.426356589	839.8039535	0.405369049	-0.00126	29.75799	-3163.70296	3163.70296
142	15	2086.94867	295	708	0.416666667	869.5619444	0.404104708	-0.4041	-869.562	351.3940752	351.3940752

Table 3: The values of VES reading 3

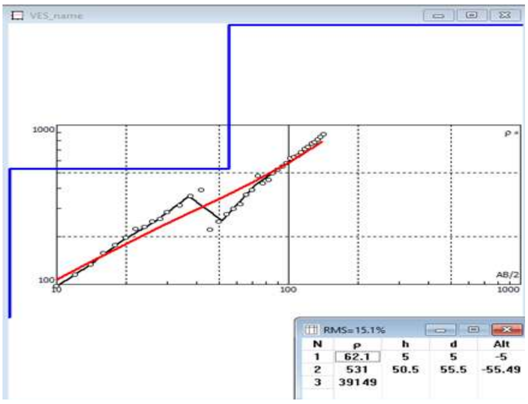
AB/2(m)	MN/2(m)	Geometric factor (K)	Voltage (mV)	Current (mA)	Resistance	App. Resis (pa)	True Resis (√a/pa)	True resis adj. diff.	App. Res diff	Calculated res ohmm m	Calculated res ohmm m
4	1	23.55	68	45	1.511111111	35.58666667	0.335263551	0.012067	30.72727	331.4914725	331.4914725
8	1	98.91	73.3	109.33	0.67044727	66.31393945	0.347330226	0.020145	22.54994	198.5610608	198.5610608
12	1	224.51	19.85	50.15	0.395812562	88.86387836	0.367475163	0.030175	12.32126	132.5582024	132.5582024
16	5	72.534	146.28	104.86	1.395002861	101.1851375	0.397650587	0.013078	17.36995	305.8577813	305.8577813
20	5	117.75	142.84	141.87	1.006837245	118.5550856	0.410728561	0.007781	18.46989	514.0492876	514.0492876
24	5	173.014	98.65	124.56	0.791987797	137.0249767	0.418509916	0.012191	13.91607	328.1232568	328.1232568
28	5	238.326	80.51	127.12	0.633338578	150.9410499	0.430700457	0.011487	12.7169	348.2193496	348.2193496
32	5	313.686	115.63	221.63	0.521725398	163.6579533	0.442187469	0.01805	6.298826	221.6062449	221.6062449
36	5	399.094	64.76	152.07	0.425856513	169.9567794	0.460237502	0.016724	5.873601	239.181771	239.181771
40	5	494.55	81.24	228.5	0.355536105	175.8303807	0.476961185	0.010717	9.175621	373.2348207	373.2348207
44	5	600.054	59.36	192.53	0.308315587	185.0060014	0.487678298	-0.02271	37.01535	-176.133088	176.1330879
48	5	715.606	60.5	195	0.31025641	222.0213487	0.464968199	0.054713	-29.4774	73.10925212	73.10925212
52	5	841.206	40.39	176.46	0.2288904	192.5439779	0.519680836	0.006544	9.686274	611.2909726	611.2909726
56	10	476.652	189.2	445.94	0.424272324	202.2302516	0.526224365	0.008093	7.930956	494.2498128	494.2498128
60	10	549.5	184.59	482.64	0.382458976	210.1612071	0.534317438	0.007132	8.143735	560.8235214	560.8235214
64	10	627.372	159.63	458.75	0.347967302	218.3049425	0.541449806	0.00604	8.554263	662.2218403	662.2218403
68	10	710.268	150.83	472.23	0.319399445	226.8592051	0.547490078	0.006746	7.533132	592.9719975	592.9719975
72	10	798.188	142.05	483.73	0.293655552	234.3923375	0.55423576	0.005286	8.369319	756.7584117	756.7584117
76	10	891.132	150.43	552.2	0.272419413	242.7616566	0.559521462	-0.01748	29.52309	-228.84646	228.8464598
80	10	989.1	110.94	403	0.27528536	272.2847494	0.542042494	0.022367	-8.59694	178.831749	178.831749
84	10	1092.092	137.42	569.14	0.241452015	263.6878143	0.564409887	0.003965	8.715837	1008.829636	1008.829636
88	10	1200.108	126.25	556.21	0.226982614	272.4036515	0.568374878	0.00209	10.29904	1913.837284	1913.837284
92	10	1313.148	14.14	65.68	0.215286236	282.7026906	0.570464919	0.005977	6.205755	669.2406142	669.2406142
96	10	1431.212	77.59	384.37	0.201862788	288.9084452	0.576441843	0.003901	8.005129	1025.258559	1025.258559
100	10	1554.3	92.78	485.69	0.191027198	296.9135745	0.580343298	-0.0004	12.30003	-10061.7418	10061.74176
104	15	1108.52467	113.85	408.15	0.278941566	309.213606	0.579945752	-0.00207	14.19717	-1932.5708	1932.570803
108	15	1197.282	87.43	323.67	0.270120802	323.4107741	0.57787597	-0.00078	12.8842	-5135.06529	5135.06529
112	15	1289.38867	91.26	349.9	0.260817376	336.2949692	0.577097012	0.000636	11.2446	6293.500147	6293.500147
116	15	1384.84467	93.53	372.69	0.250959242	347.5395682	0.577732589	0.000411	11.47282	9726.370009	9726.370009
120	15	1483.65	69.69	288	0.241979167	359.0123906	0.578143842	0.000419	11.43058	9557.925074	9557.925074
124	15	1585.80467	65.27	279.41	0.23359937	370.4429712	0.578562343	-0.00094	13.19708	-4249.48637	4249.486369
128	15	1691.30867	85.76	378.08	0.2268303	383.640053	0.577621053	0.002381	8.747701	1680.237242	1680.237242
132	15	1800.162	35.97	165.02	0.217973579	392.3877538	0.580001669	-1.4E-05	11.91011	-284943.475	284943.4747
136	15	1912.36467	11.3	53.45	0.211412535	404.2978622	0.579987631	-0.00055	12.67845	-7301.55948	7301.559483
140	15	2027.91667	48.97	238.16	0.205618072	416.9763149	0.579439803	0.001799	9.263085	2223.704682	2223.704682
144	15	2146.818	65.76	331.21	0.19854473	426.2394	0.581238603	-0.00032	12.32609	-12414.1712	12414.17121
148	15	2269.06867	55.28	286.01	0.193279955	438.5654903	0.58091639	-0.001	13.40609	-4004.53954	4004.539542
152	15	2394.66867	71.21	377.29	0.188740756	451.9715756	0.579917524	-0.57992	-451.972	262.106237	262.106237

Table 4: The values of Self-Potential data



RMS=2.41%

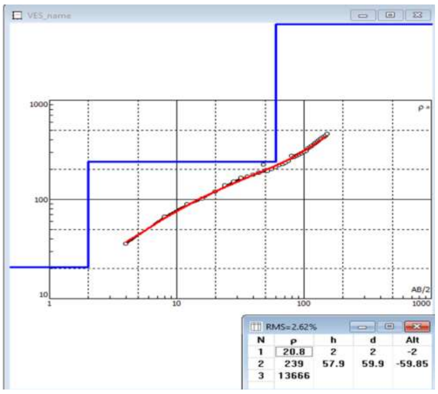
N	ρ	h	d	Alt
1	38.5	11.5	11.5	-11.52
2	78198			



RMS=15.1%

N	ρ	h	d	Alt
1	62.1	5	5	-5
2	531	50.5	55.5	-55.49
3	39149			

Figure 4: shows the VES Curve at Location 1 **Figure 5:** shows the VES Curve at Location 2



RMS=2.62%

N	ρ	h	d	Alt
1	20.8	2	2	-2
2	239	57.9	59.9	-59.85
3	13666			

Figure 6: shows the VES Curve at Location 3

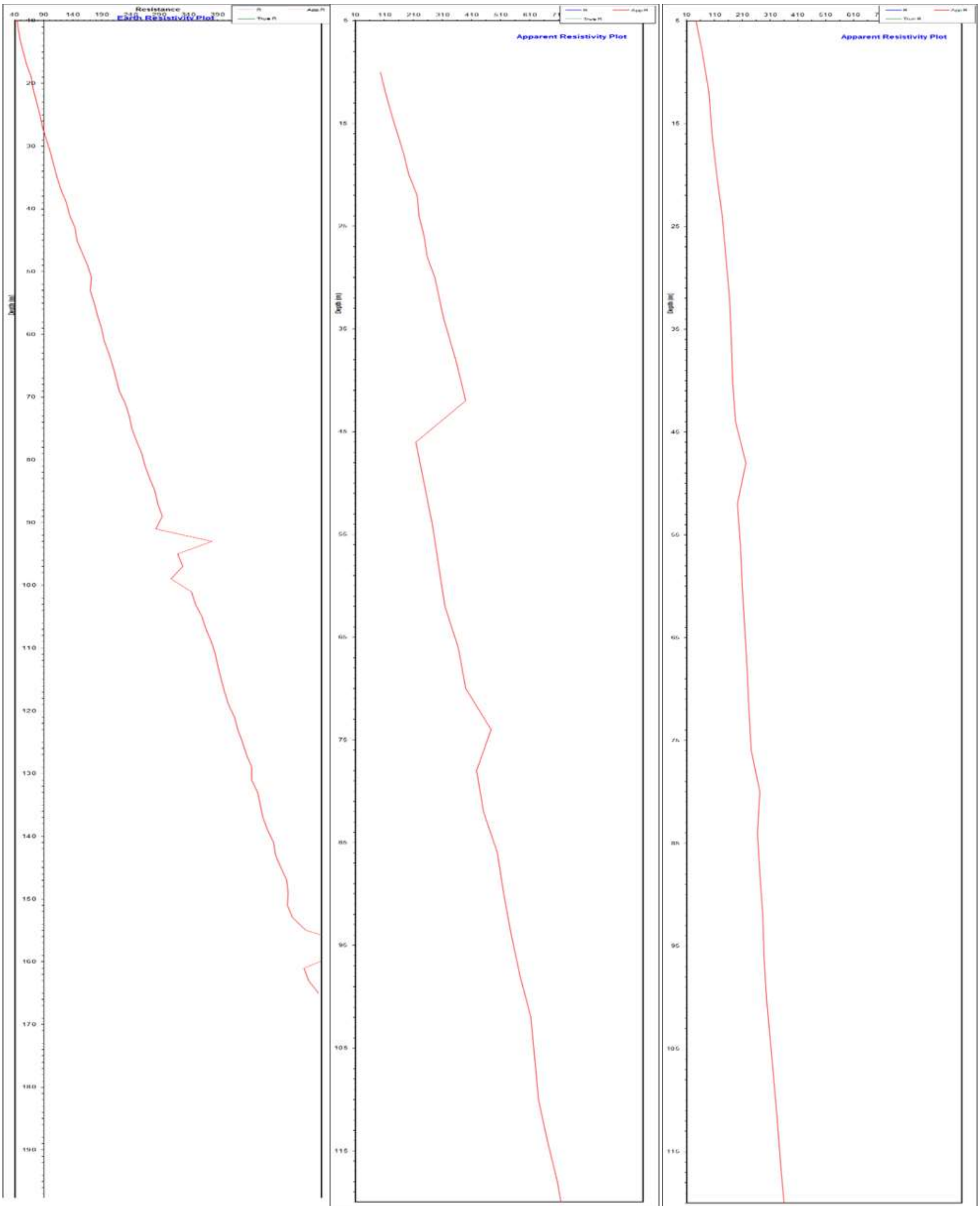
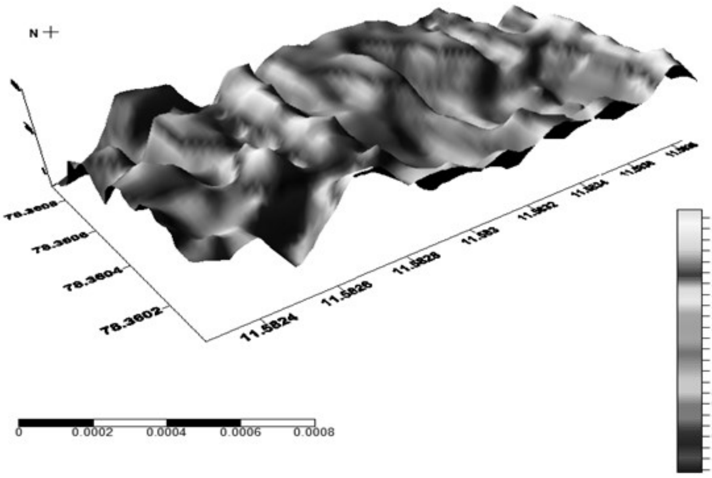


Figure 7, 8, 9: Shows the Apparent Res Plot Vs Depth



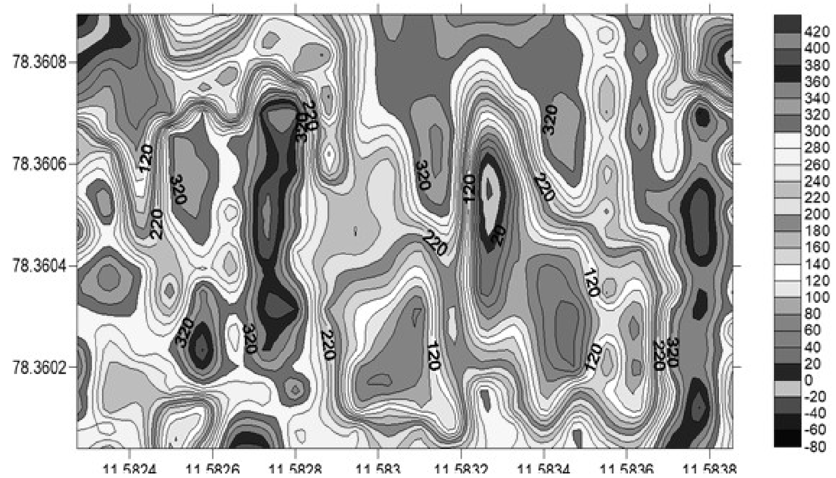


Figure 10: Shows the 3D view of the Apparent Resistivity Plot **Figure 11:** Shows the 3D view of the Apparent Resistivity Plot APPARENT RESISTIVITY CONTOUR MAP

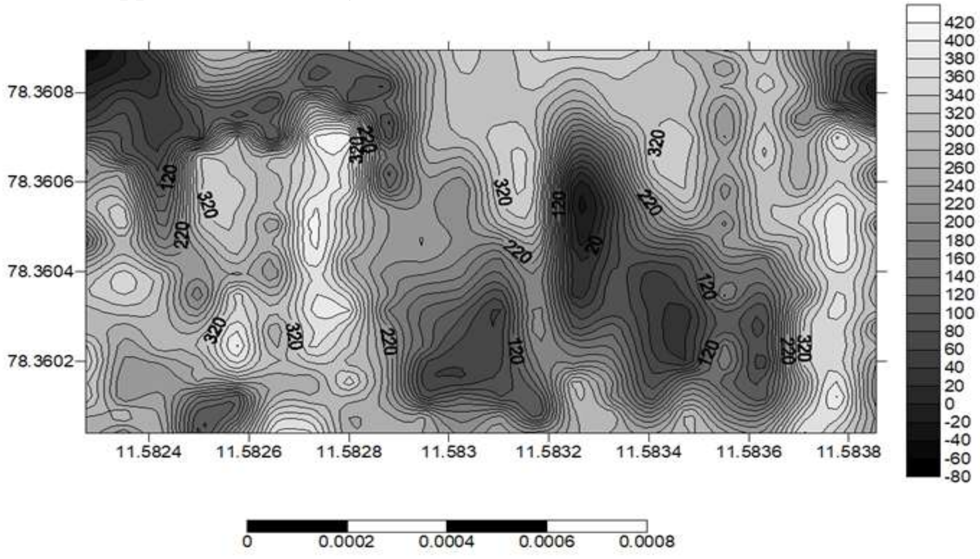


Figure 12: Shows the apparent resistivity contour map and their depth

V. CONCLUSION

Ground water exploration has been done in part of the Veppilaipatti Village, Vazhappady Taluk, Salem District in Tamil Nadu using 2D profiling and VES using Schlumberger electrode configuration and self-potential method. Vertical electrical sounding strategy of the electrical resistivity strategy and self-potential strategy has demonstrated to be effective and exceedingly successful within the recognizable proof and outline of subsurface structures that are great for groundwater amassing in a crystalline basement complex range. The foremost portion of the consider region is overwhelmed by the A and H type curve which uncovers the number of subsurface layers, their thickness and their water bearing capacity inside the study. Based on self-potential information it shows the three negative values point within the zone considered as the streaming potential point within the area (the weathered water saturated point). At the same point took the VES based on Schlumberger strategy, distinguished three water bearing zone 67m, 30m and 73m depth. The explored VES (VES POINT 2, Depth at 73m) recommended as high yielding well bore point among the studied region. In final it is that the electrical resistivity study has helped in understanding the ground hydrology and the event of salt and brackish water within middle portion of the study region and the surfer diagram uncovers that 3D subsurface of the study area.

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