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Delineation Of Recharging Zones For Groundwater In Bhima River Basin From Ancient History,pandharpur,maharashtra

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Abstract: The ground water behaviour in the Indian sub-continent is highly complicated due to the occurrence of diversified geological formations with considerable litho-logical and chronological variations, complex tectonic framework, climate-logical dissimilarities and various hydro-chemical conditions.Occurrence of groundwater in hard rock terrain is mainly controlled bystructures, landforms, litho-logy and recharge conditions. The Deccan Trap area in Maharashtra generally comes in this category. The study area considered is the Bhima Basin (Nira-Narsinghpur to Pandharpur) where ground water is a major source of usable water due to drought conditions. Electrical resistivity distribution at different depth horizons for Bhima River basin in Solapur District, Maharashtra has been delineated and represented by contour maps at different electrode spacing. These are correlated with local Geology for semi quantitative interpretation to detect potential zones of groundwater.

Keyword: Groundwater, Lithology, Deccan Trap, Pandharpur, Electrical Resistivity

INTRODUCTION

Electrical Resistivity distribution studies were made for Bhima basin between Narsinghpur to Pandharpur in Solapur District, Maharashtra located on the Toposheets 47O/1, 47O/4 & 47O/5. The area is considered along meanders of Bhima river, and is selected by keeping 3 km buffer distance on both side of flood plain. The Bhima Basin consists of unclassified basaltic lava flows representing Indrayani stratigraphic unit of Sahyadri group of Deccan Trap formation of Upper Cretaceous to Lower Eocene age. Stratigraphic succession as observed in Bhima Basin is shown in Table 1.

Weathered zeolitic/fragmentary lithounit is exposed near Babulgaon and is overlain by redbole of 1m thickness, around Umbre representing oldest flow in the basin. The thickness of the flow is 21m. IInd flow consists of lower 8m thick weathered basalt clinker and starts between Mire and Umbre Velapur. This is overlained, by fractured/massive basalt of 12m thickness around Sanghvi, Nandur,Khondapur villages. 1m thick redbole graded into zeolitic/vesicular basalt is exposed at Taratgaon. It is marker bed between IInd and IIIrd flow.

Table 1: Stratigraphic succession

Age	Super Group	Group	Stratigraphic Unit/ Formation	Litho Unit	Thickness in Meters
Quaternary			Alluvium	Poorly Sorted Sediments	4 – 7
Upper Cretaceous to Lower Eocene	DECCAN TRAP	SAHYADRI	INDRAYANI	Massive Basalt Fractured / Jointed Basal Clinker (Weathered)	5 9 8
				Red bole Zeolitic Massive Fracture Basal Clinker (Weathered)	1 22 19 4
				Red Bole / Zeolitic Massive Basalt Basal Clinker (Weathered)	1 12 8
				Red Bole Zeolitic (Weathered)	1 20

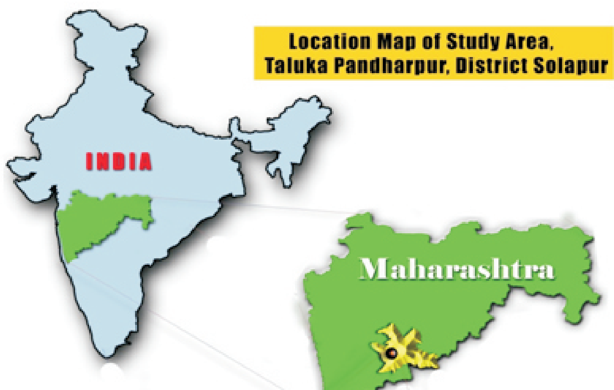

Figure 1: Location of study area

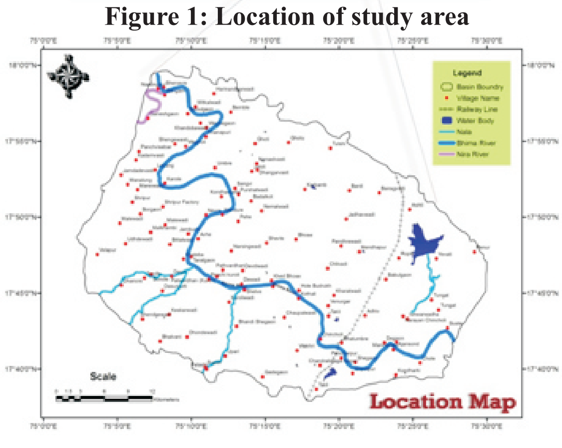

Figure 2: Map showing study area- villages

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Figure 3: Base map

2. METHODOLOGY

2.1 Electrical Resistivity studies

Extensive use of electrical resistivity method for groundwater exploration is exploration is extensively used because of direct relation between electrical conductivity and groundwater, simple field operations and improved interpretation techniques. Depth of the occurrence of groundwater and location of well sites can be determined more precisely by electrical resistivity method. However, these studies besides mapping and delineation of potential areas on small and regional scales, help geologists for the determination of hydraulic characteristics of aquifers (Senthil Kumar, Gnanasundar & Elango 2001), characterization of lineaments to locate groundwater potential zones,(Subhas Chandra et.al. 2006), flow pattern of groundwater (Narayanpethkar, Vasanthi and Mallick 2006) and estimation of natural recharge. Electrical resistivity studies have also been used to study groundwater pollution (Natkar et.al. 2008) and to carry out groundwater modeling and to estimate groundwater recharge (Narayanpethkar, Gurunadha Rao and Mallick 1993,1994)

2.2. Resistivity Contour Map

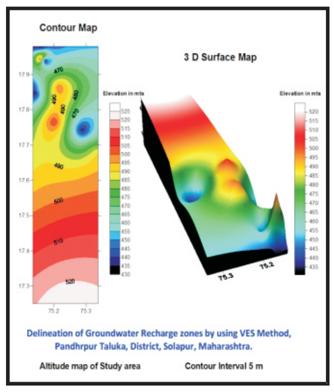
The Resistivity distribution over the entire area would qualitatively correspond to variations of the resistivity at different depths. This is achieved by increasing electrode spacing. More the electrode spacing, deeper is the current penetration. This can be used to establish litho-logical correlation.

3. ANALYSIS & OBSERVATIONS

Resistivity contouring has been done with Wenner configuration for different electrode spacing a = 5, 10, 25,50 & 75m. This provides the variation of resistivity at 5 different horizons carried out at 18 locations. Table 2 shows the apparent resistivity values at the 18 locations at different electrode spacing.

Table 2: Apparent Resistivity Values for different electrode spacing at 18 locations in the selected area

S.No	Village Name	Long	Lat	a=5	a=10	a=25	a=50	a=75
1	Malegaon	75.161	17.98	23.55	22.294	2.355	34.6185	41.5237
2	Nira Narsingpur	75.135	17.969	21.509	21.086	42.9395	51.653	50.5147
3	Babulgaon (North Side)	75.16	17.944	9.42	12.32	14.3	15.7	15.5
4	Babulgaon	75.172	17.954	11.43	14.29	16.23	16.34	20
5	Babulgaon (South Side)	75.169	17.941	1.9468	2.80402	2.7789	4.553	6.5233
6	Wagholi	75.161	17.91	34.226	24.806	26.69	37.052	25.434
7	Mire	75.137	17.869	4.6315	8.478	18.94	22.13	28.67
8	Near Mire	75.146	17.853	3.45	12.22	21.12	43	45.36
9	Near Shripur Sugar Factory	75.149	17.849	12.32	14.28	23.13	27.45	31.98
10	Near Shripur Sugar Factory dump area	75.144	17.85	11.2	14.18	13.27	20.26	31.2
11	Sangvi	75.215	17.865	31.086	33.284	65.84	60.288	54.165
12	Nandur	75.203	17.835	79.128	90.746	71.435	54.008	59.5815
13	Pirachi Kuroli (North)	75.195	17.768	72.22	46.786	40.82	28.26	32.97
14	Pirachi Kuroli (South)	75.203	17.765	55.421	55.892	35.953	27.004	32.499
15	Shelve	75.23	17.25	120.89	94.2	41.605	34.4	32.97
16	Khotali	75.287	17.742	15.072	17.427	36.3062	37.366	38.151
17	Chincholi	75.315	17.699	67.196	67.824	43.489	29.83	31.725
18	Pandharpur	75.337	17.678	79.756	91.698	53.38	34.53	23.55



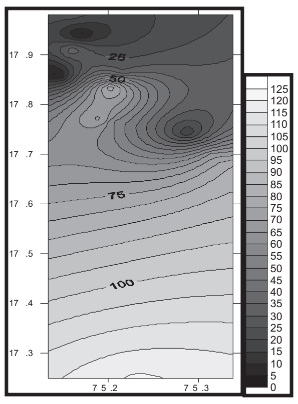
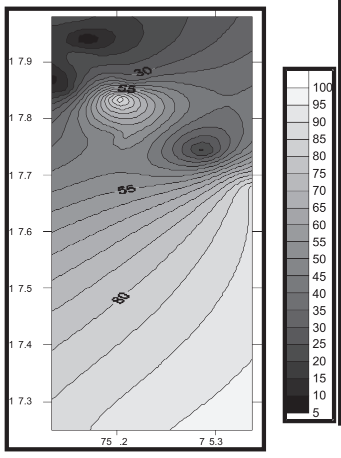


Figure 4:Surface & Contour Map in Bhima BasiFigure 5: Apparent Resistivity Contour Map in Bhima Basin,Solapur Dist, Maharashtra. Contour Interval = 5m, a= 5



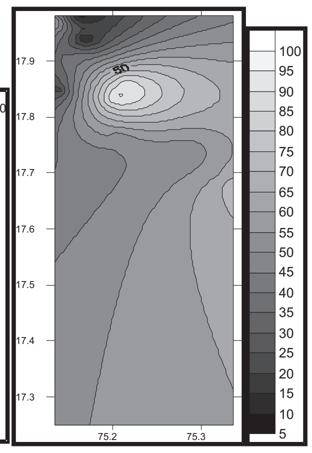


Figure 6: Apparent Resistivity Contour Map in Bhima Figure 7: Apparent Resistivity Contour Map in Bhima Basin, Solapur Dist, Maharashtra a=10m Basin, Solapur Dist, Maharashtraa=25

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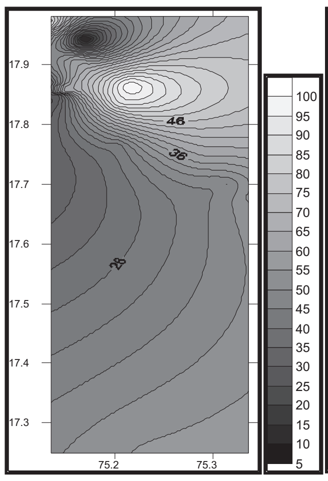

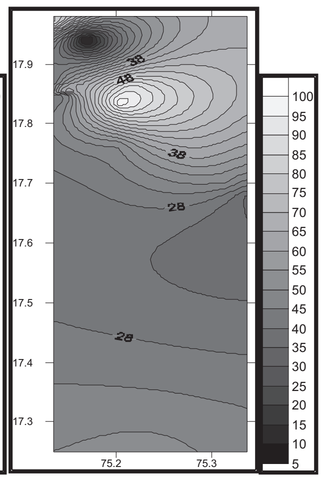

Figure 8: Apparent Resistivity Contour Map in Bhima
Figure 9: Apparent Resistivity Contour Map in Bhima Basin, Solapur Dist, Maharashtra a=50m Basin, Solapur Dist, Maharashtra a=75

Fig 5 shows variations at shallow depths by apparent resistivity contours for a = 5m. The Resistivity values go on increasing from Nira Narsinghpur in the northern part of the area to Pandharpur which lies in the southern part of the area. The resistivity values are minimum near Babulgaon in the range of 2ohm-m to 11 ohm-m. The resistivity values are highest near Shelve village in the range of 120 ohm-m to 125 ohm-m. The resistivity ranges between 70 ohm-m to 75 ohm-m near Pirachi Kuroli village where hard basalts are exposed.

Fig 6 shows variations at shallow depths by apparent resistivity contours for a = 10m. There is a similar trend in resistivity values as in fig 5.Elongated high resistivity contours are observed in the southern part of the region from Devdi village to Chincholi village. Highest resistivity values are found near Pandharpur& Nandur village. Lowest value of resistivity is again observed at Babulgaon village. Near Waphegaon village, closely spaced resistivity contours in the range of 60 ohm-m to 85 ohm-m are observed.

Resistivity contours for a=25m (fig 7) show lower ranges of resistivities from 0 ohm-m to 75 ohm-m. Resistivity values show very little variation in the southern part of the study area in the range from 40 ohm-m to 45 ohm-m. Lower resistivity values again occur near Babulgaon in the range of 2ohm-m to 10ohm-m.Fig 8 shows the reistivity contours at a=50m.Resistivity values are higher in the North East part of the study area (40ohm-m to 60 ohm-m) showing closely spaced contours and lower in the southern part (32 ohm-m to 36 ohm-m) showing elongated contours. Fig 9 shows resistivity contours at a=75m. The fig shows similar trend in the resistivity values as in fig 8.Low resistivity values occur near Babulgaon village.

4. DISCUSSIONS&CONCLUSION

The Geophysical studies conducted in the study area and the field observations have revealed the different types of rock outcrops as well as the sub-surfacial rock types.These observations have led to delineate the possible recharging zones in the area. By taking trenches along the northern banks of the channels in Chincholi, Khedbhose Chilwadi, and Khotali area, it can help for recharging the subsurfacial water bodies. The above said areas have a trend of the rocks to show strike direction of the flows in northern part which will help a lot to recharge the aquifers in northern parts only where the sub-surfacial water table has fallen down. Ashti area has a small percolation tank constructed on small streams of third order but then also the area has scarcity of groundwater. The Ashti region has compact basalt which is non-jointed in condition. But the subsurfacial flows upto a depth of more than 12 meters has columnar basalt exposed in the regions near the banks of the river which can help for recharging the aquifers. Small Kolhapur Type weirs should be constructed in the Khotali area in which there is scope for water storage during rainy season.

In Chincholi village area the streams appears to be influent streams attracted towards the course channel. The present area has an average rainfall of about 450 mm annual, hence it will be difficult to have recharging with the aquifer. This region also has a flow of compact and columnar basalt exposed near the river channel area. The erosion in the specific region has covered the columnar basalt joints due to which the seepage of the water is not occurring for recharging the aquifers. Near Chincholi open small tanks should be constructed on the columnar basalts which may help the regions of the Asti and around to have a good amour of sub-surface water in the area.

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