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GROUND WATER STATUS AND FLOW IN YEARS 2010, 2011&2012 IN AREA AROUND RAISAR, DISTRICT BIKANER, RAJASTHAN

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ABSTRACT

Groundwater is an essential and vital component of any life support system. It is essential for agriculture, industry and human existence. This paper focuses on the analysis of ground water movement, highest and lowest level of water table present in the study area. For this purpose ground water data is collected from 24 Key Wells of villages situated around Raisar, Bikaner District, Rajasthan in year 2010, 2011 & 2012. The study indicates that in western and southern part, water table is high in compare to central and northern part of the study area. The average water table in year 2010, 2011 & 2012 is 155.95m, 155.76m & 155.04m respectively which indicate that the ground water levels continuously decrease from year 2010 to 2012. The analysis of result also shows the position and number of ground water domes & basins present in the area.

Keywords: *Component, Water Table, Groundwater Domes, Basins*

INTRODUCTION

Natural water resources are the important wealth of our country, water is one of them. Water is wonder of the nature and no life without water is a common saying, depending upon the fact that water is one of the naturally occurring essential requirements of all life supporting activities (Simpi *et al.*, 2011). It is required for growing food, for house hold uses, for industry, for tourism etc. The availability of safe and reliable source of water is an essential prerequisite for sustained development (Asonye *et al.*, 2007).

The ground water differs from surface water because of its contrasting physical and chemical environment. The availability and purity of ground water is affected by location, construction and operation of wells (Egbulem, 2003). The ground water is important for the existence of people lives in rural areas. In this region of Bikaner district around Raisar, ground water is only source for domestic and agricultural purpose as there is no seasonal and perennial river in this area. Ground water monitoring is necessary to protect the living organism. That's why analysis of Ground water quality and quantity of a particular geographical region has a great deal of interest. Here ground water is very deep and its quality is variable. In this paper ground water status and flow direction is determined by the help of Water Table Contour Maps of the area.

Study Area

The area of research work occupies the eastern part of Bikaner district and falls between the Bikaner Tehsil and Dungargarh Tehsil. The villages are situated on both side of NH-11 around village Raisar. The study area lies between North Latitudes 27°50' to 28°05' and East Latitudes 73°15' to 73°45' and has an area of approximately 500 sq.km. The area falls in survey of India Topo sheet No.45H/8, 12 and 45E/5, 9. The Broad Gauge railway line also passes through some village (Survey of India cat.). The general appearance of the study area is a typical dry desert. It has sand sheet and sand dunes everywhere. The study area has typical desert climate conditions characterized by very low and erratic rainfall, high evapo-transpiration, high diurnal variation, prolonged hot summers, lack in vegetation etc. It is dreadfully hot in summers and awfully cool in winters. High velocity wind blow in summers from west or south west which sweep away sand and creates new sand dunes and very cold breeze in winters from north (Shandilya, 2005).

Geology

Study area is covered under the sheet of windblown sand of Sub-Recent to Recent age which resulted in the geology of the area obscure, so, the geology of the area constructed on the basis of data bore hole

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drilled for exploration of hydrocarbons and groundwater in the area. It comprises of rock formations ranging from Proterozoic/Eocambrian (Paleozoic) to Quaternary Period (Shandilya, 2007). The geological formations include rocks of Precambrian Aravalli Supergroup and Malani Igneous Suite forming (the basement), Neoproterozoic - Eocambrian rocks of the Marwar Supergroup, rocks of the Tertiary Period and Recent dunal sand along with alluvium (Paliwal1993). The hydrological units of the area are the sandstones of the Nagaur Group and the Tertiary formations (Shandilya, 2008). The quality of groundwater is good wherever the aquifer rock is present, but deteriorated wherever it is in shale/ clay rocks with or without sandstone beds.

MATERIALS AND METHODS

Hydrogeological studies of the area were carried out to evaluate the water bearing properties present in the study area. There are total 24 Key Wells, which have been taken into consideration for well inventory. The selection of Key wells depends on their good conditions, proper maintenance and easy accessibility. These wells have been plotted on Survey of India Topo sheet of 1:2,50,000 scales to prepare the base map. The ground water data of Pre-monsoon (May-June) period has been measured and recorded. While collecting ground water data some necessary help has been taken from Ground Water Department and PHED, Rajasthan.

RESULTS AND DISCUSSION

Ground water in its natural state is invariably moving. It moves due to gravity and direction of the effective component of the force directly down to the slope of the water table. The movement of ground water is very slow and depends upon the gradient and permeability of the formation (Mahajan, 1989).

The Ground Water Contour represents the points of equal elevation of water table below surface. They also indicate the direction of flow of water. This direction is at right angle to the tangent drawn on contours towards lower contour but flow does not cross an impermeable rock formation. Ground Water Contour or Water Table Contour maps has been prepared from the data obtained from field measurement of static water level in Key Wells and determining the Reduced Level (R.L.) of water table by subtracting depth to water from ground surface of Key Wells (Mean Sea Level) for Pre Monsoon 2010, 2011 & 2012 shown in Table No.1. On the basis of this data of R.L. of static water table (in equilibrium condition) of all the Key Wells of study area, the ground water contours have been prepared by using linear interpolation method (Tolman, 1937).

Pre Monsoon 2010-The Water Table Contour map of Pre Monsoon 2010 (Figure 1) is prepared on the basis of data presented in Table No.1. The highest and lowest water table values are shown in Table No. 2. The average water table value in this year is 155.95m.

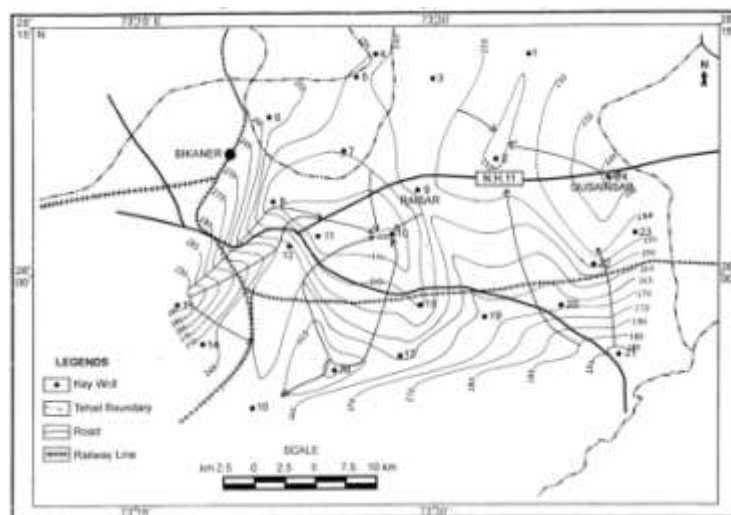


Figure 1: Water Table Contour Map (Pre Monsoon 2010)

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Table 1: Reduced Level (R.L.) of Key Well Locations & R.L. of Water Table in Key Wells in meters (Pre-Mon. of 2010, 2011 & 2012)

Key Well No.	Name of Well Location	2010			2011			2012		
		R.L. of Well Location	Depth to Water	R.L. of the Water Table	R.L. of Well Location	Depth to Water	R.L. of the Water Table	R.L. of Well Location	Depth to Water	R.L. of the Water Table
1	Ranisar	216.61	71.32	145.29	216.61	70.62	145.99	216.61	72.22	144.39
2	Naurangdesar	230.37	86.67	143.70	230.37	85.30	145.07	230.37	87.36	143.01
3	Bamblu	222.62	68.19	154.43	222.62	68.32	154.30	222.62	68.34	154.28
4	Gersar	209.36	59.94	149.42	209.36	60.40	148.96	209.36	59.97	149.39
5	Nagasar	211.08	62.10	148.98	211.08	60.86	150.22	211.08	59.50	151.58
6	Bichwal	229.78	72.37	157.41	229.78	71.72	158.06	229.78	72.65	157.13
7	Pemasar	217.42	72.40	145.02	217.42	68.84	148.58	217.42	70.83	146.59
8	Udasar	223.48	82.99	140.49	223.48	82.65	140.83	223.48	82.62	140.86
9	Raisar	225.40	73.90	151.50	225.40	74.50	150.90	225.40	74.95	150.45
10	Himtasar	206.94	72.50	134.44	206.94	73.56	133.38	206.94	72.73	134.21
11	Ridmalsar	206.92	70.63	136.29	206.92	71.53	135.39	206.92	71.96	134.96
12	Sheobari	210..18	54.68	155.50	210.18	55.36	154.82	210.18	55.98	154.20
13	Bhinasar	260.10	65.70	194.40	260.10	64.52	195.58	260.10	64.74	195.36
14	Udramsar	237.89	71.53	166.36	237.89	72.90	164.99	237.89	73.05	164.84
15	Ambasar	246.64	85.61	161.03	246.64	86.47	160.17	246.64	89.36	157.28
16	Surdhana	244.92	73.70	171.22	244.92	74.26	170.66	244.92	75.55	169.37
17	Kilchu	252.93	95.11	157.82	252.93	96.50	156.43	252.93	101.15	151.78
18	Gadwala	238.07	93.30	144.77	238.07	98.56	139.51	238.07	97.32	140.75
19	Napasar	242.45	74.96	167.49	242.45	75.20	167.25	242.45	75.30	167.15
20	Sinthal	241.98	73.20	168.78	241.98	72.40	169.58	241.98	71.98	170.00
21	Mundsar	276.60	84.76	191.84	276.60	85.90	190.70	276.60	86.45	190.15
22	Belasar	235.90	86.67	149.23	235.90	83.58	152.32	235.90	82.48	153.42
23	Tejrasar	237.71	91.10	146.61	237.71	91.21	146.50	237.71	92.78	144.93
24	Gusainsar	254.34	93.65	160.69	254.34	96.26	158.08	254.34	99.54	154.80
Average of depth of water table				155.95			155.76			155.04

Table 2: Pre Monsoon Water Table Value (Year 2010)

S. No.	Key Well No.	Name of Village	Water Table Value(m)	Average Water Table Value(m)
1.	13	Bhinasar	Hig.194.40	155.95
2.	10	Himatasar	Low.134.44	

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The study of map reveals that there are four ground water mounds or domes exist in the area and from where the ground water moves in all directions. There are two most elevated ground water domes present in the area; both the domes are surrounded with highest contour of 190 m. One such dome is present around Bhinasar (Key Well No. 13) located in the western part of the area and second one is present around Mundsar (Key Well No. 21) located in the south eastern part of the area. At Bhinasar (Key Well No. 13) the high rise of water is due to continuous recharge from the waste water body of Sujandesar existing in the vicinity of Bhinasar. The third dome represented by a contour of value 170 m around Surdhana (Key Well No. 16) located in the south western part of the area. The areas of second and third domes are comparatively at elevated places locally known as 'Magra'. The fourth dome represented by a contour of value 160 m around Gusaansar (Key Well No. 24) located in the eastern part of the area.

There are three water ground depressions or basins present in the map. The first one is around Himtasar (Key Well No.10) located in the central part and surrounded with a lowest value contour of 135m. The second basin is situated around Naurangdesar (Key Well No. 2) presented in the northern part of the area and surrounded by the low value contour of 145 m. The third basin is present around village Tejrassar (Key Well No. 23) located in eastern part of area represented by contour of 150 m. All three depressions are indicating heavy extraction of ground water for various agricultural activities, particularly irrigation.

Pre Monsoon 2011

There is no much change in the overall patterns of the contour of Water Table Contour Map of Pre Monsoon 2011(Figure 2) while comparing with the Ground Water Contour Map of Pre Monsoon 2010 (Figure .1), it is noticed that the change is observed in the western part of the area around village Bhinasar (Key Well No. 13), where the highest ground water dome with 195m contour is present. The other change is observed in the northern part of the study area particularly at the village Naurangdesar (Key Well No. 2), where the water table goes down by 5m and its value is 150m. For the period of Pre Monsoon 2011 the highest and lowest water table values are shown in Table No. 3 and the average water table value in this year is 155.76m.

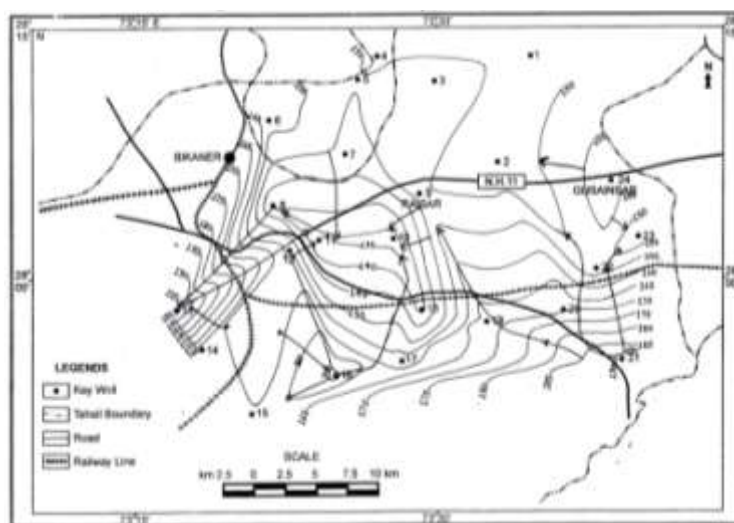


Figure 2: Water Table Contour Map (Pre Monsoon 2011)

Table 3: Pre Monsoon Water Table Value (Year 2011)

S. No.	KeyWell No.	Name of Village	Water Table Value(m)	Average Water Table Value(m)
1.	13	Bhinasar	Hig.195.58	155.76
2.	10	Himatasar	Low. 133.38	

There are four ground water mounds or domes and three ground water depressions or basins exist in the area as far as the position is concerned they are almost at the same place where they were existing in

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Ground Water Contour Map of Pre Monsoon 2010 (Figure 2) but there is a little change in the second basin which is now surrounded village Ranisar and Naurangdesar (Key Well No. 1 & 2) and located in the northern part of area. The value of contour is 150 m.

Pre Monsoon 2012

The Ground Water Contour Map of Pre Monsoon 2012 (Figure 3) is prepared on the basis of data presented in Table No.1. This map is almost similar to the two previously discussed maps of 2010 and 2011 (Figure 2 & 3). As far as locations of ground water mounds and depressions is concerned they are almost at the same places where they were existing in the map (Figure .2) of Pre Monsoon 2011, but there is a little change in geometry of the contours and heights of water table. The highest and lowest value of water table is shown in Table No.4. The average water table value in this year is 155.04m.

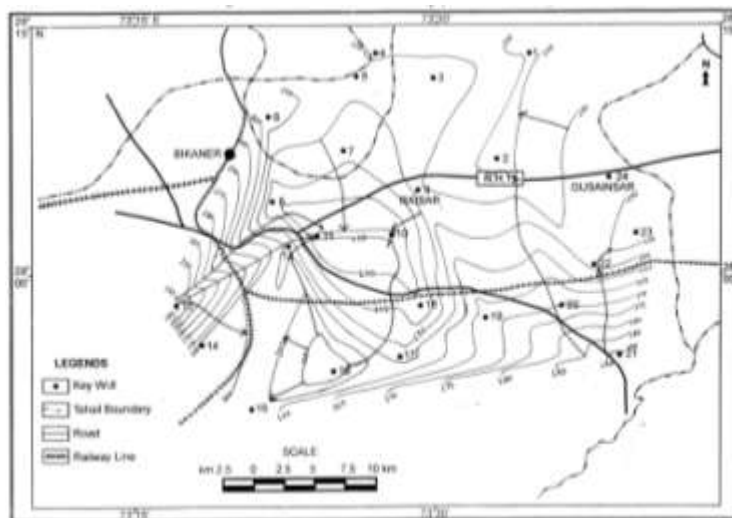


Figure 3: Water Table Contour Map (Pre Monsoon 2012)

Table 4: Pre Monsoon Water Table Value (Year 2012)

S. No.	KeyWell No.	Name of Village	Water Table Value(m)	Average Water Table Value(m)
1.	13	Bhinasar	Hig. 195.36	155.04
2.	10	Himatasar	Low. 134.21	

There is a slight change observed in southern part of the study area at the village Surdhana (Key Well No. 16) where a dome is present. In this dome the water table reaches up to 165 m, whereas it is 170m in the Ground Water Contour Map (Figure 2) of Pre Monsoon 2011. The other change is observed at the northern part of the area near village Ranisar and Naurangdesar (Key Well No. 1&2). The water table of this part goes down to 5m and a contour of 145m is present around these villages.

Conclusion

The Water Table Contour Map or Ground Water Contour is used in determining the location, extent and nature of aquifer. These maps also give the information about ground water flow direction and recharge and discharge area.

The above ground water contour maps of year 2010, 2011 and 2012 of area around Raiser, Bikaner district show that the highest water table is observed in the western part of the area around village Bhinasar and lowest water table is present in the central part of the area around village Himtasar. The average water table in year 2010, 2011 & 2012 is 155.95m, 155.76m & 155.04m respectively. The data shows that levels of water continuously decrease. In the research area four ground water domes are present in western and south eastern part of the area from where the ground water moves in all direction. There are three main ground water depressions or basins present in the central and northern part of the area. The mounds of the map are indicative of low abstraction in comparison to recharge and the depressions are the places where the abstraction of ground water is more in comparison the recharge.

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