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Original Research Paper

Hydrogeochemical Evaluation of Kuderu Microwatershed of Kabini River Basin, Karnataka, India

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ABSTRACT

Microwatershed covering Kuderu, Dasanur and other adjoining villages was selected for a detailed accounting of the groundwater budget. Groundwater is the main source of water for agriculture and livestock. The net annual recharge available for minor irrigation is estimated at 438 ham thereby reaching grey category. Further exploration without recharging the groundwater body needs vigilance. Construction of artificial recharge structures are suggested. The quality of water is generally suited for drinking and irrigation purposes.

INTRODUCTION

The groundwater forms the major source for drinking and irrigational use of Kuderu micro-watershed in Chamarajanagar and Mysore districts of Karnataka. Quality of groundwater in this typical hard rock terrain is mostly controlled by the rock-water interaction and the residence time of water in aquifers. The residence time in turn depends on the location of groundwater systems within a larger hydrological unit like a transboundary river basin. An attempt has been made in this study to determine the role played by the location of watersheds of Kabini river basin in controlling the groundwater quality.

STUDY AREA

The area is located between the north latitudes 11°51'30" to 11°58'30" and east longitude 76°48'30" to 76°54'30" in Chamarajanagar and Mysore districts of Karnataka. The hydrogeochemical facies of groundwater in the watershed have been analysed in order to identify the controlling factors (Delvi & Rajanna 1971, Syed Abdul Wajid 1972). The agricultural activities in this region are carried out both by using surface and groundwater. Groundwater in this terrain occurs under water table conditions.

Climate and rainfall: The Microwatershed falls in a semi-arid tract. The area shows a typical three distinct seasons. First one is the rainy season (July to October), the second is the winter season (November to February) and the third one is the summer (March to June). Averages in summer is 36°C, while in winter it dips to 14°C. A raingauge station is located in Kuderu, which is at the western corner of the study area. As per data available from this station, the area receives an average rainfall of 776 mm. For the period from 1974 to 1996, an average of 709 mm spread over of 56 rainy days occurred. However, from the purpose of computation an average of 728 mm rainfall is taken. The long term normal rainfall from the Nanjangud taluk headquarters raingauge is 697 mm.

Physiography and drainage: Physiographically the area can be broadly divided into two regions, namely, the hilly terrain and the plains. The first one forming the hilly terrain is confined to the western and southern portions of the study area. Within this hilly terrain, two distinct features could be observed. The first one shows the hills trending almost north-south at the southern portions of the area. These two hilly terrains show steep slope within very short distances. Beyond these two hilly ranges, the area forms a gently rolling plain.

Soil: The study area consists of two types of soil, viz., red sandy soil and black soil. Red soil with more of quartz gravel is found mostly confined to the slopes and elevated regions. Red soil with or without gravel is also found in the saddles and adjoining plains. Smaller patches of fine grained deep red soil are also found, but they are small in extent and confined to lands.

Geology: The study area essentially consists of granitic-gneisses and schists with occasional dykes and quartz veins. The general strike is north-south with steep dip towards west.

MATERIALS AND METHODS

Water samples have been collected from 16 locations for pre and post-monsoon seasons and analysed to determine the physico-chemical parameters with major ions (APHA-AWWA-WPCF 1975). The hydrogeochemcial facies of groundwater were found to be dominated by sodium-bicar-

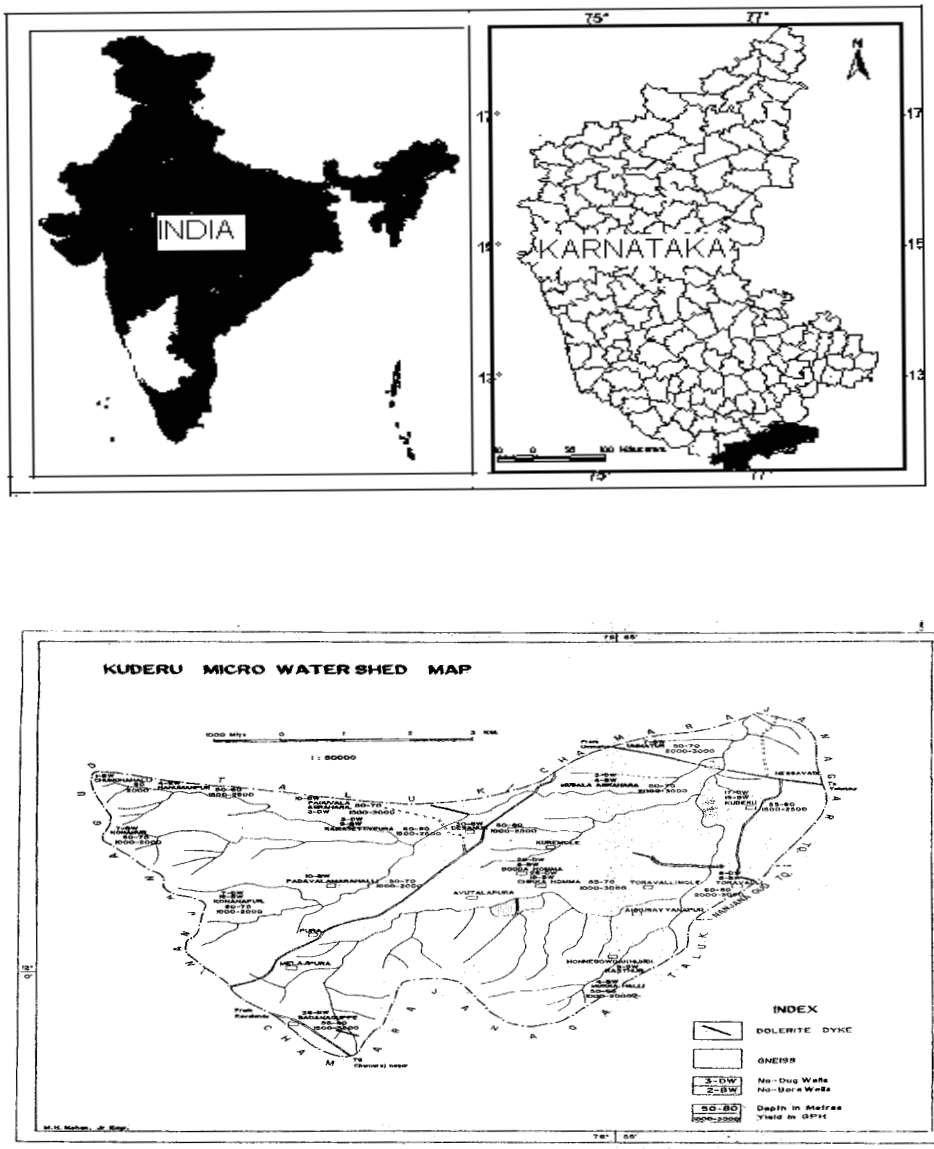

Fig. 1: Location map of the study area.

bonate type indicating the characteristics of recent recharge waters. The study also compares the variation in the quality of groundwater between the pre and post-monsoons. The study clearly indicates the freshwater availability and also the increase of total dissolved solids along the length of flow path and also time of residence.

QUALITY OF GROUNDWATER

Groundwater quality is of utmost importance when considered in the light of its usage for drinking, irrigation and industrial purposes. In order to know the chemical quality of groundwater, 16 samples have been collected and analysed in the Regional Laboratory at Mysore. All the samples are collected from bore wells. Fifteen parameters were analysed. The details are furnished in Table 1.

Total hardness: This is one of the important critical parameter for determining the quality of groundwater. As per IS specifications, water containing up to 300 ppm is considered as potable; when it is between 300 ppm and 600ppm, it is considered as potable in the absence of alternate source, while when it exceeds 600 ppm, it is considered as non-potable. The analysis results from the study area indicate that 5 samples fall in the potable category, 8 samples in the alternate source category, and 3 samples in the non-potable cat-

Table 1: Analysis results of water samples of Kuderu microwatershed.

SL NO.	Name of the Village	Ca	Mg	Na	K	Fe	$HC0_3$	CO_3	CL	F	NO_3	SO_4	TDS	Ec	TH	pH
1.	Kuderu	45	34	108	10	Nil	294	53	84	Nil	31	10	550	1000	272	8.21
2.	Paduvalamarahall	47	18	84	14	Nil	284	67	39	0.20	18	Nil	460	860	240	8.22
3.	Konapur	116	82	45	10	Nil	284	58	252	Nil	62	40	860	2000	688	8.25
4.	Dasanur	38	54	54	08	Nil	265	43	53	Nil	44	18	470	900	320	8.21
5.	Chikkahomma	38	56	150	06	Nil	299	77	76	0.40	44	24	635	1000	328	8.43
6.	Doddahomma	34	57	150	06	0.10	319	67	73	0.40	53	24	650	1050	320	8.34
7.	Avathalapura	47	42	110	15	--	392	72	39	0.20	31	26	640	900	312	8.56
8.	Hanumanapura	117	61	100	10	Nil	289	38	258	Nil	40	32	900	1750	640	8.58
9.	Konanur	39	62	120	10	Nil	382	53	95	0.40	35	12	660	1000	340	8.59
10.	Toravally	69	34	174	20	Nil	417	48	185	Nil	35	32	865	1500	372	8.44
11.	Pura	109	41	60	09	Nil	412	43	59	Nil	53	16	640	1000	444	8.54
12.	Badanaguppe	120	30	78	12	0.04	201	53	260	Nil	55	38	770	1750	600	8.52
13.	Toravally	118	43	60	10	Nil	206	53	358	Nil	55	26	750	1750	428	8.55
14.	Ummathur	67	74	54	15	Nil	265	43	109	Nil	106	14	650	1150	464	8.60
15.	Dasanur	50	32	40	29	Nil	157	48	81	Nil	42	22	430	820	288	8.59
16.	Melajipura	106	42	60	99	Nil	441	34	56	Nil	57	12	640	1000	440	8.55

egory. Regarding the spatial distribution of these three categories, it is rather difficult to pinpoint the same.

Total dissolved solids (TDS): The IS specifications stipulate 500 ppm of TDS to classify it as potable, between 500 and 2000 ppm as alternate source and anything exceeding 2000 ppm as non-potable. The results indicate that out of 16 samples, only 5 samples fall under potable category. Regarding the spatial distribution of these categories, it is rather difficult to indicate a broad zoning as both the categories are evenly distributed.

Nitrate (NO_3): The Indian standard specifications stipulate 50 ppm to classify it under potable category and above 50 ppm as non-potable. Of the 16 samples, 10 fall under potable category, while 6 samples under non-potable category. The spatial distribution points out to some peculiar features. It is rather surprising to note that the incidence of non-potable category of water occurrence at the initial catchment itself in the western parts, south-western parts, particularly around Konapura and Badanaguppe. In the central portions of the study area particularly around P. Maranahalli, Avuthalapura, Chikkahomma, Doddahomma, Desanur and the north-eastern corner around Kuderu, the NO_3 tend to fall within the potable category. The maximum of 101 ppm and 106 ppm were reported from Ummathur and Toravalli forming the initial catchment.

Iron (Fe): Iron is one of the critical parameters in determining potability of water. According to the Indian standards up to 0.3 ppm constitute potable category; between 0.3 to 1.00 ppm represents alternate source category; while the content exceeding 1.00 ppm represents non-potable category. The analysis results indicate that all the samples fall under potable category only.

Fluoride (F): Fluoride is assuming greater importance in view of its effects on living beings. Water containing up to 1.00 ppm is categorised as potable, between 1.00 to 1.5 ppm as alternate source; and that exceeding 1.5 ppm as non-potable. The maximum of 0.80 ppm was reported from Desanur.

CONCLUSION

The investigations on the microwatershed have indicated that the net recharge and draft components are 434 ham and 279 ham respectively. The study area reaches 'grey' category by December 2009. The quality of groundwater is generally suited for drinking and irrigation purposes. In view of the groundwater usage reaching 74%, it is suggested at this stage itself to go slow on further withdrawals. The need of the hour is to think seriously of recharging the groundwater levels so that same rise to the original levels. This could be made in the form of strengthening of existing contour bunds, construction of new contour bunds, de-silting of the existing tanks, construction of a large number of artificial recharge structures, such as nala-bunds, check dams, percolation

ponds, diversion of rain water into dry dug wells, growing of more trees wherever possible to arrest soil erosion, and retention of soil moisture. Apart from these, quality of water also needs periodical determination.

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