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Ground Water Scenario of Tonk District Rajasthan

Abstract

Ground water is one of the most valuable natural resources which supports human civilization. water is the important and voluable resource for human life and economic development, Fresh water is getting scarce day by day a man blindly using it for community, domestic services, industries, agriculture etc. But this advantage makes the water vulnerable to local pollutants. Due to these pollutants ground water quality adversely effected (Pondhe et al. 1992 and yadav et al. 2009). The increasing dependence on ground water as a reliable source of water has resulted in indiscriminate extraction in various parts of the country without due regard to the recharging capacities of aquifers and other environmental faetors. On the other hand, there are various areas in the country, where ground water development is sub-optimal in spite of the availability of sufficient resources and canal command areas suffering from water logging and soil salinity due to the gradual rise in ground water levels. The Bislpur dam is used to provide irrigation facilities and increase ground water level. at the Tonk district. The present paper focuses on the ground water scenario laying special emphasis on the problems relating to ground water of the Tonk district.

Keywords: Hyodrogeological Conditions Geogenic and Anthropogenic Activities Ground Water Potential

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Introduction

Ground water is an essential vital component of our life. The groundwater resource are being utilized for many purposes. However due to repid growth of population, urbemlization industrialization and agriculture activities, ground water resources are under stress. There is growing concern an the deterioration of ground water quality due to geogenic and anthropogenic activities.

Ground water contains a wide variety of dissolved inorganic chemical constituents in various concentrations. Inorganic contaminants including salinity chloride, fluoride, nitrate, iron and arsenic are importent in determining the suitability of ground water for drinking purposes.

Position of ground water at Tonk District

1.	Hydrogeology : Water Bearing formation	:	Geneises, Schists/Phylites and alluvium 2:75-33.43 mbgl
	Premonsoon Depth to water level (May 2011) Post monsoon Dept to water level Nov. 2011	:	1.7-26.25 mbgl
	Pre monsoon water level trend (2002-2011)	:	Rising trend 0.0032 to 0.045 m/year Falling trend 0.0088 to 0.078 m/year
2.	Ground water exploration (As on 31.3.2012) wells drilled Depth range Discharge	: : :	19EW, 40W, 8PZ, 65H 18.5 - 203 M. 3:30 IPM
3.	Ground water quality range of various consituents	:	EC 447 to 12100 hs/cm at 25^0 C F-0.175 to 20.3 mg/l Fe -0.001 to 3.625 mg/l No3 - 2.58 to 254 mg/l
4.	Dynamic ground water resources (As on 31 March 2009) Annually Replenshable Ground water resource Net Annual ground water avialabilty Annual ground water draft (irrigation + domestic) Stage of ground water development	: : : : : :	 467.5235 MCM 424.8792 MCM 418.1517 MCM 98.42%

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Hydro geological surveys were carried out between 1964 and 1966 by the geological survey of India during 1973-76, Semi detailed survey of all the blocks were carried out by the Rajasthan Ground water department based on the guide lines of A.R.D.C reappraisal hydro geological survey of the entire district was carried out by CGWB in 2003-2004. Water level from the national hydrograph network stations existing in the district were recorded by the geological survey of India between to period 1969 to 1972 and the central ground water board since 1973. Central ground water board has taken up the exploratory drilling for ground water in 1993-94 and further for construction of production wells in 2001-2002 under accelerated exploratory drilling program in Tonk district.

Study Area

Tonk, one of the erstwhile princely states of Rajasthan is located in its north eastern part between East longitudes 75^0 7'00" to 76^0 19'00" North latitudes 25^0 41'00" to 26^0 34'00" North latitudes and is covered in the survey of India degree sheets 45N, 45-0, 54B and 54C, the total geographical area of the Tonk district is 7194 sq kms. area figures according to 2011 census, which accounts for 2.1% of the total area of the state. The area lies state with normal annual rainfall of 668.3 MM (2010-11) the district tonk is situated on national highway no. 12 and distance of about 82 km. from jaipur, The capital of Rajasthan, It is bounded on the North by jaipur district and the west by the Ajmer district in the south Bhilwara and Bundi district. The district comprises of 7 sub division a tonk, niwai, deoli, uniara, malpura, todaraysing and pipllu. It has at tehsil viz. tonk, niwai, deoli, uniara, malpura, todaraysing pipllu and dooni there are six panchayat samities viz tonk, niwai, deoli, uniara, malpura and todaraysing total number of village in the district 1214 (2011 census). Rural and under population of the district is 1103653 and 717723 respectivly and 1421326 census 2011 areas is decennial growth of population in the district is 17.3% since 2001 or 24.27% since 1991.

Map of Tonk District

Physiography

Physiographical the area is characterized by general flat to undulating topography with small isolated ridges running in north-east to south-west direction between Gar and Banoli in the western part and the Aravalli hills towards. Sawai Madhopur in the south east. The general elevation of the plain ranges from 231 to 337 m above mean sea level and trends from south-west to north-east. The hills on the south-eastern side rise to a height of 518.46m amsi. (above means sea level). The Rajmahal elevation of 605.30 and 574.20m amsi. In the central part there is a hill which runs for about 14kms between chauth ka Barwara and Bhageant garh and rises to hight of 150 to 180m above the plains. Ridges of gneisses, schist and quartzite rising to height of 190m above the plains are seen at Gaonri and Tonk. At Gaunri these occurs as isolated hills while at tonk they are found as clusters trending in NE-SW and are extending up to Purtha. smau isolated hillbocks are also seen at Um and kabra. Except for these hills, the country is otherwise flat. On the bank of Banas river there are sand dues which rise to heights to 20 to 30m above the plains.

Bisalpur Dam is situated 17 Km. from Deoli. The water storage cape city of this dam is 315.50 R.L Meters. in the perfect the total catchment area have be 27726 sq.km. with gross storage capacity of 1095 MCM. about 240 MCM water will be utilized for drinking purposes and about 425 MCM (Tentative) for irrigation use. The dam has 38.705 TMC water storage capecity its water covering area is of 212 sq.km. Beside providing water to Jaipur, Ajmer, Nasirabad, Beawar, Kishangarh etc. This dam will provide irrigation facilities to Deoli, Tonk, Todaraysing and Uniara Tehsils. due to dam subsoil water level also rise in Deoli,Tonk,Malpura and Todaraysing which will result in increasing the agricultural produce.

Drainage

The district is drained by Banas river and its tributaries. The Banas river enter into Tonk district at Negria in Deoli tehsil from where it takes a serpentine course dividing the district in roughly two parts, two third of the area falling on its north and one-third on its south until it leaves the district at Sureli near Barawara station.

River Banas

River Banas originates in the khammor hills of the aravalli range (about 5 km. from kumbhalgarh) and flows along its entire length through Rajasthan. Banas is a major tributary of the river Chambal the two rivers meeting near village Rameshwar in khandar block in sawai madhopur district. The total length of the river is about 512 km.

River Dai

River Dai originate in the southeastern slopes of the Aravalli range near Nasirabad tehsil of Ajmer District. It southeast for about 40 km. and east about 56 km. in Ajmer district and for a short reach through Tonk district, before joining Banas river near Bisalpur village in tonk district.

River Mashi

River Mashi originates in the hills near kishangarh in Ajmer district. It flows east and than

south for about 96 km. in partly hilly and partly plain areas of ajmer and tonk district before joining Banas river near tonk.

River Sohadara

River Sohadara originates in the hills east of ajmer. It flows east wards for about 100 km. in tonk district before joining mashi river near Dhundia village.

River Dheel

River Dheel originates in the plains near Bauli village in tonk district. The river flows generally from norh to south in jaipur, tonk and Sawai Madhopur district.

Rainfall

The annual normal rainfall of the district is 668.3 mm. the following table shows the annual rainfall and deviation from normal rainfall :-

Years	Rainfall (in mm)	Premont variation from Normal Rainfall
2007	552.8	- 17.3
2008	582.8	- 12.8
2009	348.4	- 47.8
2010	791.2	+ 18.4
2011	867.4	+ 29.8
2012	904.00	+ 34.92
2013	882.8	+ 32.30
2014	796.0	+ 23.62
2015	784.3	+ 22.45
2016	775.46	+ 19.48

Sources land record tonk.

Objectives of the Study

The study was undertaken with the following objectives:-

1. To assess the under hydrogeological conditions of Tonk District.
2. To study the ground water scenario in the district.
3. To suggest some approaches for quality management and conservation the Tonk District ground water.

Review of literature

Process-based simulation model methods involve mathematical models that approximate the behavior of substance in the sub surface environment. They predict how long a contaminate will take to reach a given depth and the amount of contaminante by mathematically modeling the processes influencing contaminante fate and transport (Hamerlinek al 1998). Loague et.al.(1998) conducted a study on simulation of DBCP ground water contamination in fresno county, cali-fornia using PRZM-2. Most of their data consisted of approximations and many assumptions were made for different factor effecting transport and fate of DBCP in soil process based methods refer to approaches that either simulate or other wise take into account physical process of water movement and the associated fate and transport of contaminante (focazio etal.2003). These processes are used either to defermine intrinisic susceptibility of an aquifer or to asses the vulnerability of ground water to a targeted contaminante. There fore process-based methods account for one or few important processes but do not account for all processes controlling vulnerability (Focazio et al. 2003). Harbaugh et. al. (2000) developed. MODFLOW, a computer modeling code that solves the governing equations of ground water flow.

Burkart and Kolpin (1993) examed influence of a variety of Hydrogeology and land use factors on the concentratione of nitrate and atrazine in shallow aquifer over an area over an area encompassing portions of twelve states in the Midwestern U.S. They sought to identify correlations between individual factor, such as aquifer type or depth to ground water.

All the information upto my lenowledge is writter in this paper.

Database and Methodology

The study is based on secondary data. The data has been collected from central ground water department. Hydrological department of tonk. for the present study the data has been analyzed block wise.

Soil land use and Irrigation Practices

The soil in the district varies from sandy loam to loam in Niwai block and part of Tonk block and from clay loam to loan in the remaining area. The national council of applied economic research regards the district as having undifferent tiaped soil.

Total reporting area for land utilization purpose is 717960 hectares. Net cultivated area of the district is 397385 hectares which is 55.35% whereas total cultivated area is 467395 hectares which is 65.10% the total geographical area of Tonk district. In the district 26048 hect. for forest 73425 hect. for non agricultural use, 89825 hect. cultivable land and 131277 hect. Padat at land (fallow land) is available.

Canals and tube well are the main source of irrigation in the district during 2010-11, the net irrigated area in the district was 191126 hect. of which 13.93 percent was irrigated by canals and tube well. Other source constituted open wells and the percentage of area irrigated by them are 5.83 %.

Ground Water Scenario

Ground water occurs mostly under phreatic conditions. In alluvial areas, ground water generally occurs under water table condition where as in hard rock and crystalline rocks, it is under slight pressure. The weathered zone below the water table acts good storage for ground water.The movement of weathered zone, joints, fissures, fractures, bedding planes and other structurally weak zones in hard rock and grain size distribution in alluvium. The movement is further controlled by the extent, size, and openness. Continuity and interconnection of frectutres. Quaternary alluvium, Phyllies sonist and granitic gneisses are the major hydrogeological formation in the district.

The hydro geological properties of gneiss's and mica-schist are almost similar. The joints, fractures and foliation planes control the ground water movement in this rock. The total area of potential zones in the district is 6525.72 sqkm out of which 1093.06 sqkm. falls under non-comm and. The hydrogeolical formations having small area extent (less tham 50 sq.km) has not beendemarcale-rcated as separate potential zone so no separate assessment of such small patches has been made as those patches have been merged with their surrounding potential zones.

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Blockwise Details Hydrogeological Information of Tonk District

Deoli Block

Deoli block covers an area of 1271.00 sq. km in the southern part of the district. The main Hydrogeological formations of the block are older alluvium and mica schist the average yield of the wells filled with pump set is 70,000 liter per day and without pump 30,000 liters per day. The average discharge of the tube wells is 70m^3/day. In general the chemical quality of ground water is potable. The block Deoli as a whole fall under "Safe" category with stage of ground water development 88.24%.

Malpura Block

Malpura block covers an area of 1521.00 sq.km. The main hydrogeological formation of the block are mica schist and gneisses.Two potential zones have been delineated in the block viz, "Sc(Nc)" and "Gn(Nc)". The average yield of the wells filted with pump set is 60,000 liters perday and without pump 25,000 liters per day. The average discharge of the tube wells is 60m^3/day. in general the chemical quality of ground water is potable.

The block Malpura a whole has been categorized as "OVER-EXPLOITED" with stage of ground water development as 146,99%.

Niwai Block

Newai block cavers on area of 1031.60 sq.km The main hydro geological formation of the block are older alluvium and mica schist. The average yield of the wells fitted with pump set is 90,000 liters per day and without pump 50,000 liters per day. The average discharge of the tube wells is chemical in 90m^3/day general. The chemical quality of ground water is potable.

The block Newai's a whole has been categorized as "OVER EXPLOITED" with stage of ground water development as 110.57%

Todaraisingh Block

Todaraysing block covers an area of 1019.40 sq.km. The main hydrogeological formation of the block is mica schist and gneisses. The average yield of the wells fitted with pump set is 60,000 liters per day and without pump 30,000 liter per day. The average discharge of the tube wells is 50m^3/day in general the chemical quality of ground water is potable.

The block todaraysing as a whole has been categorized as "Safe" with stage of ground water development as 79.37%

Tonk Block

Tonk block covrs an area of 1467.69 sq.km. The main hydrogeological formation of the block are older alluvium and mica schist four potential zones have been delineated in block vix; "Ao(Nc)", "Ao(c)", Sc(Nc)" and "Sc(c)^2"

The average yield of the wells fitted with pump set is 80,000 liters per day and without pump 30,000 liters per day. The average discharge of the tube wells is 80m^3/day. In general the chemical quality of ground water is potable. The block todaraysing as "Safe" with stage of ground water development as 85.66%

Uniara Block

This block covers an area of 987.50 Sq. km. The main hydrogeological formation of the block is older alluvium. mica schist and gneisses. Six potential zones have been delineated in the block viz, "Ao(Nc)" "Ao(c)", "SC(NC)", SC(c)", "GN(NC)" and Gn(c)". The average yield of the wells fitted with pump set is 80,000 liters per day and without pump 30,000 liters per day. The average discharge of the tube wells is 80m^3/day. In genral the chemical quality of ground water is potable. The block todaraysingh a whole has been categorized as "Over Exploited" with stage of ground water development as 103.96%

Water Level

Ground water level in Tonk District (2011 to 2017) (According Mansoon) in mbgl.

Table 1

Years / Water level	WL Pre	WL Post	Flu Pre Post
2011	11.92	5.89	6.09
2012	8.94	7.10	1.83
2013	8.77	6.09	2.87
2014	8.58	5.08	3.96
2015	8.94	7.11	1.71
2016	9.55	5.49	3.90
2017	9.05	6.03	2.96

Sources: - Department of hydro geologist - mbgl meter below ground level.

Post momsoon water level 2016 (Block wise)

Table (1:2)

Block	Deol	Malpura	Newai	Todaraysingh	Tonk	Uniara
Average RL(M)	28.23	26.51	30.22	26.75	27.18	28.19

Sources: - Hydrology dept. Tonk. RL = Reduce level.

In order to study the behaviour of water table in the district, 17 national network hydrograph station have been established by CGWB. These stations are monitored 4 times a year i.e. January, May, August and November. In a greater part of the district, the depth to water range between 1.71 to 11.92 mbgl. Depth to water table in the district is shallowest i.e. 1.71 mbgl is at 2015 in flu pre post of monsoon. Where as it is deepest i.e. 11.92 mbgl at 2011 in wl pre post of monsoon. In general, it has been observed that water table is shallower in the vicinity of tanks and bandhs and it is deeper in rivers and valley fill areas.

As out of 6 blocks of Tonk district, 1 block (Uniara) is categorized as "Over exploited" and remaining 5 block (Deoli, Malpura, Niwai, Todaraysingh and Tonk) are categorized as "critical" hence additional development of ground water in this area normally should not be done, Only very restricted and planned ground water development can be taken up in these areas to avoid becoming overexploited.

Recommendation

1. As out of 6 block of tonk district. 1 block (Uniaara) is categorized as "Over exploited" and reaming 5 blocks (Deoli, Malpura, Niwai, Todaraysingh and Tonk) are categorized as "Critical" hence additional development of ground water in this area normally should not be

done. Only very restricted and planned ground water development can be taken up in these areas to avoid becoming overexploited.

2. The stage of ground water development in the district as a whole is 96.39% and there fore practically no scope is left for the construction of new ground water structures for irrigation purposes, except for domestic and drinking water supply hence ground water should be used judiciously taking into account moderm agriculture water management techniques by cultivating crops that need less watering such as wheat (Raj911), Barly (RD2508), Makka(Maize) (Mahi kanchan), jowar (CSH 1,6 and 14), Bajara (HHB 67260), Moong (K 581), Soya been (Pusa 16), Til (RT 46), Groundnuts (RG 141), Mustard (Pusa Bold) and use of sprinkler system and drip irrigation should be encouraged.
3. The small-scale former in the area should be encouraged for the use of common ground water structures for optimum use of ground water resources for irrigation purposes.
4. Cultivators should also be made aware and encouraged to adopt suitable cropping pattern using modern techniques by extension services for getting maximum agrriculture production through minimum withdrawal.
5. The suitable artificial recharge structures like subsurface barriers across the river beds should be constructed so the ground water run off may be arrested and impounded in the subsurface reservoir for meeting various sectoral demands.
6. Alluvial formation along Banas river has good water storage and transmission capacity in comparison to hard rocks in the district. So different techniques of artificial augmentation of ground water resources can be adopet such as rain water harvesting and construction of subsurface barriers / check dams / percolation tanks etc. in the district which may increase the recharge to ground water body.
7. Maximum stress should be given for preparation of regional water supply scheme from Bislpur dam water of maximum irrigation facilitated by surface water available in the district so to reduce stress on ground water resources.
8. Mass awareness programme should be taken up to educate public in adopting water saving practices and conservation of water.

Conclusion

The present study summarizes the hydrogeological condition in tonk district. It highlight the problem of ground water in tonk district, which is the source of irrigation in the district. As out of 6 blocks of tonk district, I block (Uniara) is categorized as "Over exploited" and remaining 5 blocks are categorized as "Critical" hence additional development of ground water in this area normally should not be done, Only very restricted and planed ground water development can be taken up in these areas to avoid becoming over exploited in the district there hydro geological units have been indentified viz. Alluvium (Older alluvium) schist's and gneisses, While having identified viz. Alluvium (Older Alluvium), schist's and gneisses, while having a view on categorization of potential zones on the basis of stage of ground water development, it is found that the older alluvium in non command area of Deoli, Tonk and Uniara is "Over exploited" where as in Niwai block it is "Critical". The command area of older alluvium potential zone in Tonk and Uniara blocks categorized as "Critical" with the stage of ground water development 92.93% in tonk block and 87.62% in Uniara block.

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