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Quality of Ground Water in Tonk District Rajasthan

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Abstract

Ground water is one of the most valuable natural resources which supports human civilization. Water is the important and valuable 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 factors. 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.[6] The Bislpur dam is used to provide irrigation facilities and increase ground water level at the Tonk district. The Bislpur dam is used to provide irrigation facilities and increase ground water quality laying special emphasis on the problems relating to ground water of the Tonk District. The present study summarizes the hydro geological 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, Ist 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 identified viz.

Keywords: Hydro geological conditions geodic and anthropogenic Activities Ground water potential.

Introduction

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

Ground water contains a wide variety of dissolved inorganic chemical constituents in various concentrations. Inorganic contaminants including salinity chloride, fluoride nitrate,

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iron and aresenic are importent in determining the suitability of ground water for drinking purposes.

Position of Ground Water at Tonk District

1. Hydrogeology :	Geneises Schists/Phylities and Alluvium
Water Bearing formation	2:75-33.43mbgl
Premonsoon Depth to water level (May 2011)	1.7-26.25mbgl
Post monsoon Dept to water level Nov, 2011	Rising trend 0.0032 to 0.045 m/year
Pre monsoon water level trend (2002-2011)	Falling trend 0.0088 to 0.078 m/year
2. Ground water exploration (As on 31-3-2012) wells drilled	19EW, 40W, 8PZ, 65H
Depth range	18.5 - 203 M.
Discharge	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 Replens able Ground water resource	467.5235 MCM
Net Annual ground water avialability	424.8792 MCM
Annual ground water draft (irrigation + domestic) [2]	418.1517 MCM
Stage of ground water development	98.42%

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.[3]

Study Area

Tonk, one of the erstwhile princely states of Rajasthan is located in its north eastern part between East longitudes 72^0 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 sitated on national highway no- 52 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 disitrict. The district comprises of 7 sub division a Tonk, Niwai, Deoli Uniara, Malpura, Todaraysing and Piplu. It has at tehsil viz. Tonk, Niwai, Deoli, Uniara, Malpura, Todaraysingh Pipllu and Dooni there are six village in the district 1214 (2011 census). Rural and under population of the district is 1103653 and 717723 respectively and 1421326 census 2011 areas us decennial growth of population in the district is 17.3% since 2001 or 24.27% since 1991.

Physiography

physiographical the areas is characterized by general flat to undulating topography with small isolated ridges running in north-east to south-west to south direction between Gar and Bonli 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 605.3 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 tehse 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, Todaraising, and Uniara Tehsil, due to dam subsoil water level also rise in Deoli, Tonk, Malpura and Todaraysing which will result in increasing the agricultural produce.[6]

Drainage

The district is drained by Banas river and its tributaries. The Banas river enter into Tonk district at Negadia 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. It runs for roughly 135 kms in the district. It is more than half a km in width and sometimes runs in 9 m deep channel it is more or less perennial. It develops a dendritic pattern and forms a deep gorge at Rajmahal, Its left bank is stable and rocky while the right bank is covered by alluvium. The Mashi and Sohadra area the major tributaries of Banas in the district, Both are ephemeral in nature. Hohadra is considered as an important river of the district as it feds the Tordi Sagar tank which is one of the biggest irrigation tank in Rajasthan. It joins Mashi River near village Dundia in Tonk district thereafter it meets Banas River near Galod village. There area also 2 other minor streams in the district namely khari & Dai, both are intermittent in nature and joins Banas river.

River Banas

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River Banas

River Banas originates in the khammor hills of the aravelli 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.

Catchments Area	45,833 km
Longitudes	$73^0$25' and $77^0$00'
Latitudes	24^0 15' and $27^0$20'
Tributaries	Berach and Menali on the right and Kothari, Khari, Dai, Dheel, Sohadara, Morel and Kalisil on the left

River Dai

River Dai :- River Dai originates in the southeastern slopes of the Aravalli range near Nasirabad Tehsil of Ajmer District. It flows southeast for about 40mn and east for about 56 km in Ajmer District and for a short reach through Tonk District before joining Banas River near Bisalpur Village in Tonk District.[7]

Catchments Area	3]015 km^2
Longitudes	$74^0$29' and $75^0$29'
Latitudes	$25^0$5 and $26^0$31'
Tributaries	A large number of nallahs join River Dai in Ajmer and Tonk District

River Mashi

River Mashi originates in the hills near Kishangarh in Ajmer District. It flows east and then south for about 96 km in partly hilly and partly plain areas of Ajmer and Tonk Districts before joining Banas River near Tonk.

Catchments Area	6335 km^2
Longitudes	$74^0$48' and $75^0$54'
Latitudes	$26^0$11 and $26^0$16'
Tributaries	Bandi (near Dudu and Sohadara)

River Shohadara

River Shohdara originates in the hills East of Ajmer. It flows eastwards for about 100 km in Tonk District before joining Mashi River near Dhundia village.

Catchment Area	1652 km^2
Longitudes	$75^0$0' and $75^0$44'
Latitudes	$26^0$06 and $26^0$26'
Tributaries	A number of Nallahs join the river

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 hydro geological quality of water of Tonk District.
2. To study the ground water quality in the district.
3. To suggest some approaches for quality management and conservation the Tonk District ground water.

Database and Methodology

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

Soil land use and Irrigation Practices

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

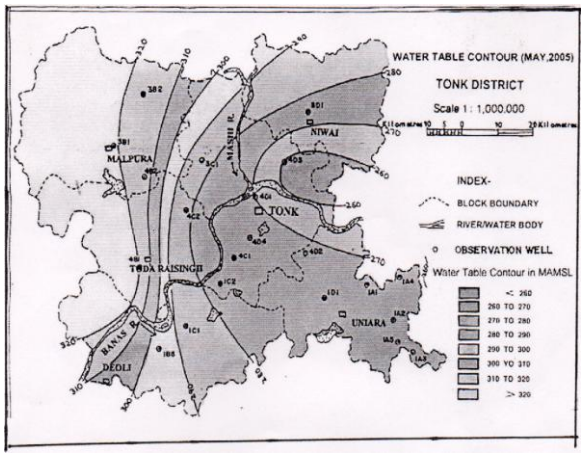
Total reporting area for land utilization purpose is 717960 hectares. Net cultivated areas of the district is 397385 hectares which is 55-35% whereas total cultivated area is 467395 hectares which is 65-10% the total geographical area of Tonk district in the district 26048 hect. for forest 73425 hect for non agricultural use 89825 hect. cultivable land and 131277 hect. Padat at land (fallow land) is available.[6]

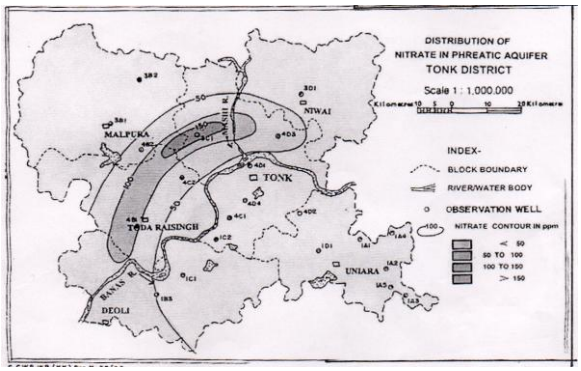
Canals and tube well are the main source of irrigation in the district during 2010-11, the net irrigated area in the district was 191126 hect. of which 13-93 percent was irrigated by canals and tube well. Other source constituted open wells and the percentage of area orrogated by them are 5.83% .

Quality of Shallow Groundwater

In general the chemical analysis results show that the shallow ground water is alkaline in nature the pH value range from 7.8 to 8.65 The bicarbonates range between 146 and 1098 ppm.

Carbonates are either not reported or are very meager i.e less than 85 ppm. Total hardness (as CaCO3) ranges between 90 and 680 ppm indicating thereby that the ground water





is moderately hard to very hard. Higher values of total hardness have reported from Hamirpur (680 ppm).

Specific conductance of ground water in the district ranges from 450 to 3940 micro mhos/cm at 25^0C it has been observed that by and large concentration of specific conductivity conforms broadly to that of chlorides. The distribution of E.C. in the ground water for the district is presented in greater part of the area, it is within 2000 micro mhos/cm at 25^0C. Higher values of specific conductance have been observed in the central part of the district around Hamirpur, Tonk and Sohela.

The concentration of chlorides in the major part of the area is with in 300 ppm higher value of chloride (978 ppm) has been reported from Hamirpur Fig, 24 shows the distribution of chloride concentration in the ground water of Tonk district. The ground water in the area falling in the central part of the district around Hamirpur, Tonk and Sohela has high concentration of chloride it has been observed that the areas covered by mica-schist have invariably high concentration of chloride which may be due to restricted drainage of ground water in that area. The

pockets having shallow water table in the canal command areas where evaporation of water increases the salt concentration of soil possess high concentration of chloride.

Calcium concentration is generally low in the whole district and it ranges from 12 to 96 ppm Majority of wells have calcium concentration less than 50ppm.

The magnesium concentration ranges between 9.7 and 180 ppm whereas sulphate concentration in the district ranges from 10 to 450 ppm. The sodium concentration in the ground water of the district varies from 31 to 870 ppm. Sodium content is generally with in the permissible limit except at few places (i.e Tonk and Sohela) where it exceeds 500 ppm. The potassium content is generally low, it ranges from 1 to 201 ppm. The places where high values of potassium are registered seem to be due to local pollution and partly due to well being not in use.

Fluoride ranges from 0.35 to 5.27 mg/l, major part of the district it is within the permissible limit of 2 mg/l set by ICMR except in a pocket in the central and south western parts of the district. Fig. 25 whows the distribultion of fluoride in the shallow ground water of Tonk district.

Nitrate is low in the district Invariably it is less than 200 ppm in the district which is lower limit set by ICMR). It ranges from 7.45 to 178 ppm. Fig. 26 shows the distribution of nirtate in the shallow ground water of Tonk district.

Quality of Ground Water from Deeper Aquifer

The groundwater exploration date indicates that the quality of groundwater obtained from tube wells in the district is generally fresh. The electrical conductivity value varies from 500micro mhos/cm at 25^0C at Bagri to 4380 micro mhos/cm at 25^0C at Tonk-III (Kali Paltan). Depth wise ground water quality doesnot show any appreciable changes as compared to the dug wells in the district concenrtation of fluoride varies from 0.28 mg/l (Uchakpura) to 7.30mg/l (Nareda Mundia Kallan-I) and nitrate varies from 4.72 ppm (Tonk) to 156 ppm (Kakod-II) in the water samples obtained from tube wells in the district.

Ground Water Resources

The ground water resource estimation has been done adopting revised methodology as suggested by the ground water resource estimation commitee (GEC1997) as on 31.03.2004.

Total area of the potential zones under difference aquifers (excluding saline) in. the district have been estimated of 6525.72 sq. km. Out of total 6525.72 sq. kn. area of potential zone, 5432.66 sq. km. is non-command and 1093.06 sq. km. is command area. Total area of saline zones in the district has been estimated of 295.00 sq. km. which is considered as non-potential area due to saline quality of formation water. The potential zones have been demarcated as older Alluvium (Ao), Schists(Sc) and Gneisses (Gn).

The net annual ground water availability for the district is 391.6293mcm/annum. The existing gross ground water draft for irrigation is 311.6809mcm/annum, whereas exiting gross ground water draft for Domestic & Industrial use is 65.8187 mcm/annum. The total existing gross ground water draft for all uses is estimated 377.4996mcm/ annum. The allocation of ground water for domestic and industrial requirement as on year 2025 has been estimated 131.7300 mcm. The net ground water availability for future irrigation development is estimated- 51.7817 mcm/ annum. The stage of ground water development for the district as a whole is 96.39% Out of 6 blocks of Tonk District, 1 block (Uniara) is categorized as "Over-exploited" and remaining 5 blocks (Deoli, Malpura, Niwai, Toda Raisingh and Tonk) are categories as "Critical"

Changing Scenario of Ground Water Resources in Tonk district

Ground Water resources	Year 1983-84	Year 1989-90	As on 1.1.2001	As on 31.3.2004	
Net annual GW availability	513.2905 mcm	436.2969 mcm	414.5310 mcm	391.6293 mcm	
Gross GW draft for irrigation	-	-	230.6505 mcm	311.6809 mcm	
Gross GW draft for dom. & indust. use	-	-	40.0198 mcm	65.8187 mcm	
gross ground water draft for all uses	202.1325 mcm (Net GW draft 141.4921mcm)	250.6443 mcm (Net GW draft 175.4502mcm)	270.6703 mcm	377.4996 mcm	
Allocation for Dom. & Ind. Req. sa on 2025	-	-	95.5775 mcm	131.7300 mcm	
BNet GW availability for futur irrig. Dev.	294.8048 mcm	260.8467 mcm	88.3030 mcm	-51.7817 mcm	
Stage of GW development	32.43%	40.21%	65.30%	96.39%	
Cate-gory of Blocks	Over-exploited	-	-	-	1 block (Uniara)
	Critical	-	-	-	5 blocks (Deoli, Malpura, Niwai, Toda raisingh and

					Tonk)
	Semi- critical	-	-	2 blocks	-
	Safe	6 blocks	4 blocks (Deoli, Niwai, Todaraisingh and Uniara)	-	

As out of 6 blocks of Tonk District, 1 block (Uniara) is categorized as "Over- exploited" and remaining 5 blocks (Deoli, Malpura, Niwai Todaraisingh and Tonk) are Categorised 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. Ground water should be used judiciously taking into account modern agriculture water management techniques by cultivating crops needing less watering and use of sprinkler system & drip irrigation should be encouraged The non-conventional source of energy should be utilized by use of windmills fitted with pump in dug cum bore wells.
2. Maximum stress should be given for preparation of regional water supply scheme from Bisalpur dam water & maximum irrigation facilitated by surface water available in the district so the stress on ground water resources can be reduced.
3. Presently there are 21 National Hydrograph Stations (NHS) covering the entire parts of the district This no. of NHS is too less & all the aquifers are not well represented. Besides it there are big gaps between the existing National Hydrograph Stations with the result that clear picture of ground water situation cannot be assessed. In order to have better coverage additional National Hydrograph Stations need to be established and monitored. It is recommended that more station should be established in all the blocks of the district for keeping a which over the behavior of water table. Further additional sufficient number of hydrograph stations should also be established in the area which will form command of Bisalpur project, so that effective monitoring of ground water regime can be established.
4. Ground water legislation must be implemented so that control on ground water draft can be ascertained.
5. early implementation of regulation on ground water use in the area.
6. Mass awareness programs should be taken up in almost all the areas of the district to educate public in adopting water saving practices & conservation of water.
7. in view of the above, the district should be notified for ground water control and regulation and
8. All the ground water abstraction ground structures should be registered.

Conclusion

The non command area of gneisses potential zone in Todaraisingh and Uniara block is categorized as "Over-exploited" where as in Malpura block it is categorized as "Critical". The command area of gneisses potential zone in Uniara block is categorized as "Critical". The stage of ground water development of district as a whole is 96.39% Out of 6 blocks of Tonk District 1 block (Uniara) is categorized as "over-exploited and remaining 5 blocks (Deoli, Malpura, Niwai, Todaraisingh and Tonk) are categorized as "Critical" As the stage of ground water development in the district as a whole is 96.39% & therefore practically no scope is left for the construction of new ground water structures for further exploitation for irrigation purposes except for drinking water supply.

A modern agricultural management has to be taken into account for effective water management techniques involving economic distribution of water by maintaining minimum pumping hours and also by selecting most suitable cost effective crop patterns i.e. for getting maximum agriculture production through minimum withdrawal. adopting proper soil & water management even the ground water with some what high total dissolved solids (TDS) may also be suitable for irrigation for salt tolerant crops.

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