



स्वच्छ सुरक्षित जल – सुन्दर खुशहाल कल

CONSERVE WATER - SAVE LIFE

**CENTRAL GROUND WATER BOARD**  
Ministry of Water Resources  
Government of India

## GROUNDWATER SCENARIO

# BANSWARA DISTRICT, RAJASTHAN



Western Region

Jaipur

March, 2009

## DISTRICT AT A GLANCE – BANSWARA, RAJASTHAN

S No	Item	Statistics		
<b>1</b>	<b>GENERAL INFORMATION</b>			
	(i) Geographical area (sq km)	5037		
	(ii) Administrative Division (As on 31.3.2007)			
	Number of Tehsils	5		
	Number of Blocks	8		
	Number of Villages	1524		
	(iii) Population (As per 2001 Census)	15,01,589		
	(iv) Average Annual Rainfall (1971-2007) in mm	935.5		
<b>2</b>	<b>GEOMORPHOLOGY</b>			
	Major Physiographic Units	Valley fills Pedimont zone, Padi plains, Buried Padi plains and Plateau.		
	Major Drainage	Mahi and its tributaries Anas, Haran and Chap.		
<b>3</b>	<b>LAND USE (sq km)</b>			
	(a) Forest Area	1236.67		
	(b) Net Sown Area	234		
	(c) Cultivable Area	322		
<b>4</b>	<b>MAJOR SOIL TYPE</b>			
<b>5</b>	<b>AREA UNDER PRINCIPAL CROPS (As on 2005)</b>		Crops	Area in ha
			Oil Seeds	9000
			Pulses	49000
			Food grain	247000
			Cotton	12000
			Sugarcane	350
<b>6</b>	<b>IRRIGATION BY DIFFERENT SOURCES</b>			
	Source	No of structure	Area in ha	
	Dug wells	22713	12690	
	Tube wells/Bore wells	465	2054	
	Tanks/Ponds	541	642	
	Canals	-	45170	
	Other Sources	-	14115	
	Net Irrigated Area (ha)		76854	
	Gross Irrigated Area (ha)		80655	

<b>7</b>	<b>NUMBER OF GROUND WATER MONITORING WELLS OF CGWB (As on 31.3.08)</b>	
	Number of Dug wells	24
	Number of Piezometers	17
<b>8</b>	<b>PREDOMINANT GEOLOGICAL FORMATIONS</b>	Granites, Gneisses and Schists of Bhilwara Super group, Phyllites, Schists and Quartzites of Aravalli Super group and Deccan traps.
<b>9</b>	<b>HYDROGEOLOGY</b>	
	Major Water bearing formation	Basalt. Limestones, Quartzites, Phyllite & Schist and Granite Gneiss.
	Depth to water level (Pre-monsoon, 2007) (mbgl)	1.60 – 13.25
	Depth to water level (Post-monsoon, 2007) (mbgl)	0.01 – 9.90
	Long term decline water level trend (1998-2007) in m/yr	0.114
<b>10</b>	<b>GROUNDWATER EXPLORATION BY CGWB (As on 31.3.2008)</b>	
	Number of wells drilled (EW, OW, Total)	EW-40 OW-3 Total-43
	Depth Range (m)	45 -154
	Discharge (liter per minute)	50 - 871
	Transmissivity (m <sup>2</sup> /day)	Few - 753
<b>11</b>	<b>GROUND WATER QUALITY</b>	
	Presence of chemical constituents more than permissible limit (TDS >2000ppm, F>1.5 mg/l, Nitrate>45.0mg/l)	TDS - Nil F - >20 % Nitrate- 50 %
	Type of water	Alkaline
<b>12</b>	<b>DYNAMIC GROUND WATER RESOURCES (March, 2004) in mcm</b>	
	Annual Replenishable Ground Water Resources	174.6797
	Net Annual Ground Water Draft	127.4697
	Projected Demand for Domestic and Industrial Uses up to 2025	24.7078
	Stage of Ground Water Development	72.97
<b>13</b>	<b>MAJOR GROUND WATER PROBLEMS AND ISSUES</b>	Quality problems in some areas and decline of water level in hilly terrain.

## **GROUND WATER SCENARIO DISTRICT - BANSWARA, RAJASTHAN**

### **1.0 Introduction**

Banswara district is located between 23° 11' and 23° 56' latitude and 73° 58' and 74° 49' longitude covering an area of 5037 sq.km. The district is part of Udaipur Division and is divided into 3 sub-divisions namely Banswara, Ghatol, Kushalgarh. Administratively the district is divided into 5 tehsils and 8 development blocks.

Total number of villages in the district is 1524 and it also has 3 urban towns. Rural and Urban population of the district is 1.39 lakh and 1.07 lakh respectively.

Systematic Hydrogeological survey in the district was carried out by Central Ground Water Board 1980. Reappraisal hydrogeological survey in parts of district was carried out during 2006 - 2007. Under exploratory programme 32 exploratory and 2 Observation wells were constructed in Aravalli and Bhilwara super groups of rock with 8 E W & 1 O W in Deccan traps. Since 1973, monitoring of water level is being carried out four times a year from 41 National Hydrograph Network Stations.

### **2.0 Rainfall & Climate**

Average annual rainfall (1971-2007) of the district is 935.5 mm. However normal rainfall for the period 1901 to 1970 is 870 mm. The annual rainfall gradually decreases from southern part to northern part. The maximum average rainfall is 1118 mm at Dhanpur and minimum average rainfall is 790 mm at Loharia.

The climate of the district is dry except S-W monsoon season. The cold season is from December to February and is followed by summer from March to June. From mid of September to end of November constitute post monsoon season.

The district experiences either mild or normal drought once in two years. Severe type of drought has been recorded very rarely. Most severe type of drought has never occurred in the district.

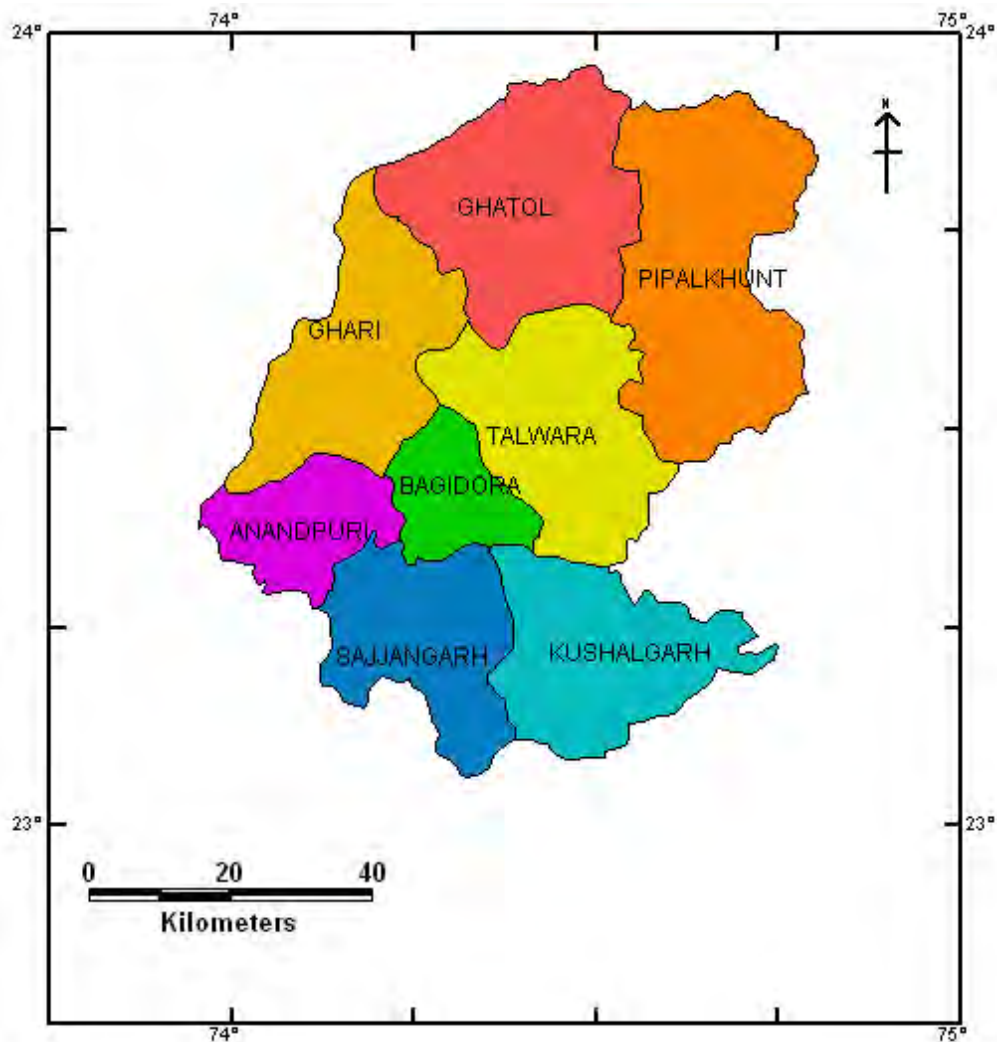
### **3.0 Geomorphology & Drainage**

The district is characterized by undulating topography. The eastern part is the extension of Malwa plateau & is comprising of high hills with intervening long and narrow valleys. In central part of the district undulating to rolling topography prevails. While in western part plain and rolling topography prevails. The general slop of the area is from east to west.

Geomorphologically the district is divided into following units:

Origin	Land Forms	Occurrence in the District
Fluvial	Valley Fills	Scattered in entire district mostly along drainage
Denudation	Pedimont zone	North and south part of Mahi dam
	Pediaplains	Main concentration in western margin
	Burried pediment	Scattered in entire district, main concentration in central part.
Structural	Plateau	Along eastern margin.
Hill	Denudational hill	In south west of the district.
	Structural hill	Mainly concentrated in south west.

### INDEX MAP OF JALORE DISTRICT



**Drainage:**

Banswara district falls in parts of Mahi basins. Tehsil wise distribution of basin area is given below:

Sl.No	Name of Tehsil	Area in Sq. Km.
1	Bagidora	517.8
2	Banswara	1190.3
3	Garhi	754.4
4	Ghatol	1657.7
5	Kushalgarh	806.4

The district is drained by Mahi River and its tributaries namely Anas, Haran and Chap in which Mahi and Anas are only perennial.

River Mahi enters the eastern part of the district south of village Ambapara & flows in the northerly direction It takes sudden westerly turn near Sarodia. At Dhalwara it takes a south westerly course, flowing on the boundary between Banswara and Dungarpur districts before it enters Gujrat state.

**4.0 Soils & Irrigation Practices**

The soils of the district fall under the following broad categories

- Black soil
- Red soil

Black soil found predominantly in the district mostly in eastern, southern, Central and eastern part. Red soil mostly found in western portion of district from north to south.

**Irrigation:**

The principal means of irrigation in the district are by canal in all tehsil except Kushalgarh. Canal irrigation is mostly by Mahi dam project. Where groundwater is used for irrigation and is utilized through dug wells, DCB's, and tube wells. Tanks also form as important source of irrigation in the district. Details of the gross irrigated area by different sources and number of structures have been given below:

Sl. No	Tehsil	Total Irrigated Area	Irrigated Area				Number of structures		
			Tube wells / wells	Ponds / Tanks	Canals	Others	Dug Well	Tube Well	Pond
1	Bagidora	13747	1520	457	10161	1589	1218	113	115
2	Banswara	19108	1802	642	13769	1187	1854	244	54
3	Garhi	18111	3745	576	9471	4319	2120	52	234
4	Ghatol	20649	3847	1715	11769	3318	2299	21	86
5	Kushalgarh	9040	2102	3236	—	3702	1318	35	52

## 5.0 GROUNDWATER SCENARIO

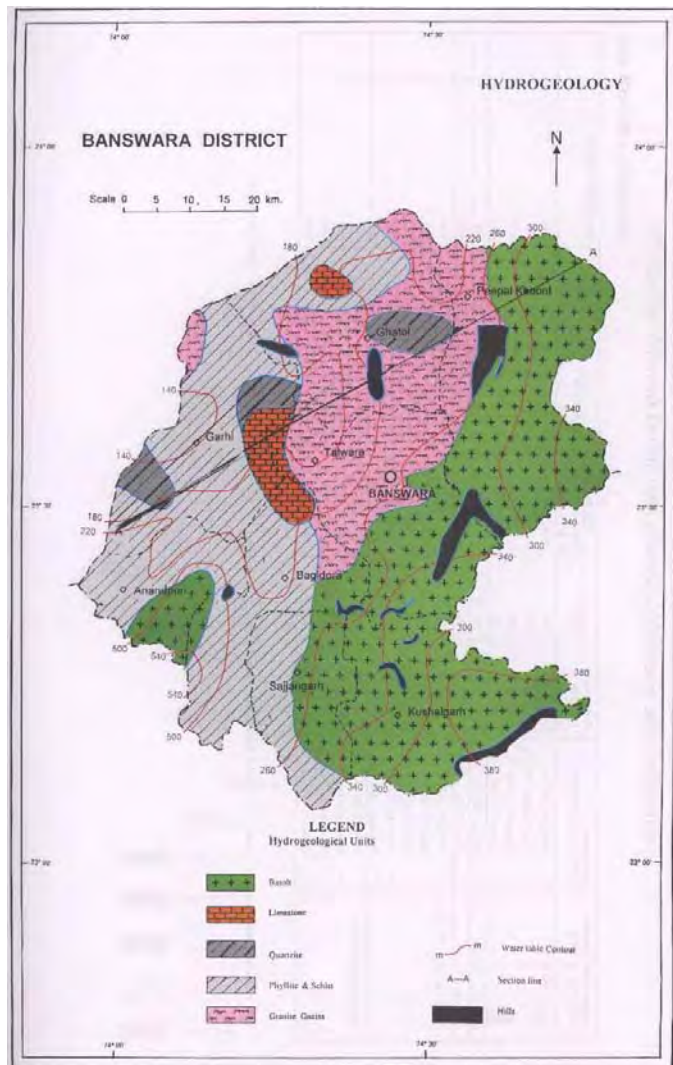
### Geological Framework

The geological set-up of the district is represented mainly by the rocks belonging to Archaean metamorphic complex, Aravalli super group and Deccan traps lava flows.

### Hydro-geological Condition:

Groundwater occurs under unconfined condition in saturated zone of rock formation. Its occurrence is controlled by topography, physiography and structural features of the geological formations. The movement of the groundwater in hard rock areas is governed by size, openness, interconnection and continuity of structural weak planes. Ground water movement takes places through pore space between grains. Water bearing properties of different aquifers are described below

### HYDROGEOLOGICAL MAP OF BANSWARA DISTRICT



### **Groundwater in Banded Gneissic Complex (Bhilwara Super Group)**

Banded gneissic complex includes rock assemblages of granite, gneisses, schists, pegmatite and amphibolites. Granite is medium to coarse grained, grey to pink colour in northern part, whereas due to intimate association with different rock types in the central part of the area, often change their original status. Gneisses are generally medium to coarse grained and crudely foliated. Schists are grey to greenish grey and medium to coarse grained. Occurred in parts of Pipal Khunt, Talwara and Ghatol block with small localized area in Garhi block.

Depth of open well in this aquifer is 20 to 25 m, with yield of well 40 to 100 m<sup>3</sup> / day and water level is less than 10 m.

### **Groundwater in Phyllite and Schist (Aravalli Super Group)**

Argillaceous facies of Aravalli Super Group known as Udaipur Group is represented by phyllites which are often carbonaceous and micaceous schists etc. These are generally soft and susceptible to weathering. The rock has varied mineralogical composition and physical characteristics and occupied western half of the district in Anandpuri, Bagidora, Garhi, Ghatol and Sajjangarh blocks.

Depth of open well in this aquifer is 20 to 25 m, with yield of well 35 to 80 m<sup>3</sup> / day and water level is less than 10 m and 15 m in Bagidora block

### **Groundwater in Quartzite (Aravalli Super Group)**

These comprise conglomeratic and gritty quartzite and contain pebbles and cobbles apparently derived from member of the gneissic complex. Bands of para amphibolites often occur in association and localized pockets in Garhi block.

Depth of open well in this aquifer is 20 to 25 m, with yield of well 40 to 100 m<sup>3</sup> / day and water level is less than 10 m.

### **Groundwater in Limestone (Upper Cretaceous)**

This formation is pale purple, massive to partial crystalline and contains quartz and concretions of chalcedony. Thickness of the aquifer is generally less than 10 m. Two localized pockets noticed in Talwara and Ghatol blocks.

Depth of open well in this aquifer is 20 to 25 m, with yield of well 25 to 30 m<sup>3</sup> / day and water level is less than 10 m.

### **Groundwater in Basalt (upper Cretaceous to Palaeocene)**

These are generally dark green to steel grey in colour, fine to medium grained and porphyritic at places. Basalt is hard, massive amygdaloidal to

vesicular type. Intratrapeans are not common, occasionally thin layer of reddish clayey material (red bole) occurs between the two flows. Occupies in Kushalgarh, Pipal Khunt blocks and extends in parts of Talwara and Sajjanagarh blocks.

Depth of open well in this aquifer is 15 to 25 m, with yield of well 35 to 75 m<sup>3</sup> / day and water level is less than 10 m.

### Deep Aquifer System:

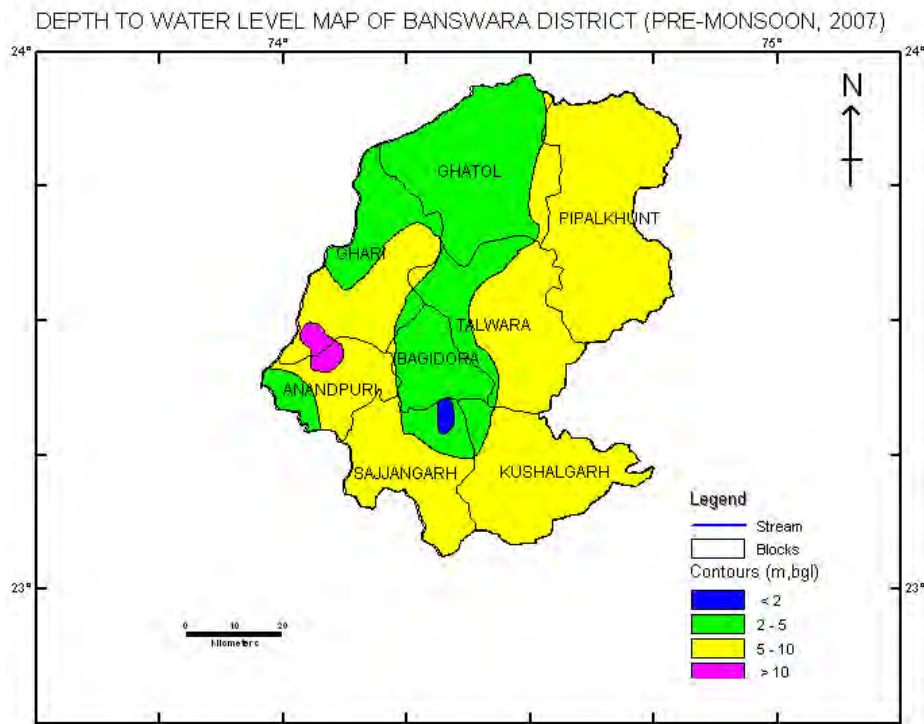
Exploratory drilling in the district mostly in hard rock ie, granite gneisses, phyllite schists, quartzite, limestone and basalts reveals that the depth of the bore well ranges from 45 to 154 m. Discharge of the bore well is 50 to 871 lpm with a drawdown of 1.13 to 29.65 m. The Transmissivity ranges from few to 753 m<sup>2</sup>/day.

### Groundwater Flow

General direction of ground water flow has been inferred from SE to NW or E to W. Hydraulic gradient varies considerably. It is the minimum around Bagidora (1.6 m/km). The southern peripheral area around Pipal Khunt generally has steeper gradient.

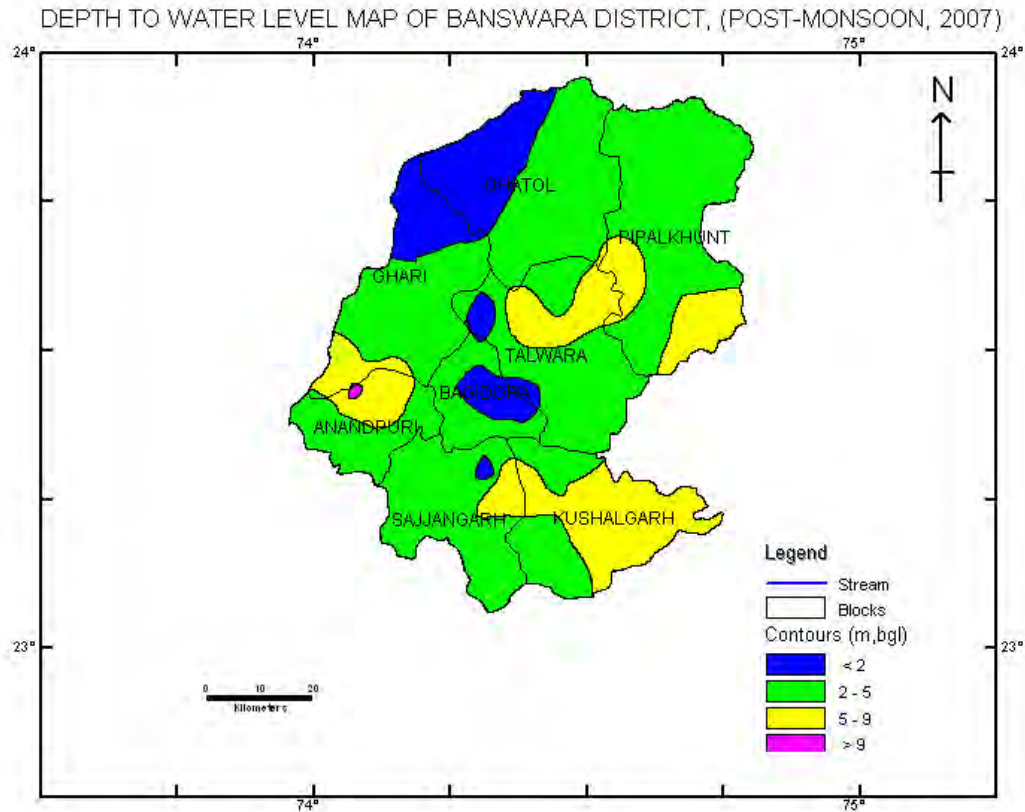
### Depth to Water Level (Pre Monsoon 2007)

The depth to water level varies widely depending upon topography, drainage, bedrock geology etc. Depth to water varies from less than 2 m to more than 10 m bgl. Water level is shallower in central part (1.60 m) of the district. In general DTW varies from 2 to 10 m in greater part of the district. Deep water levels (> 10 m) are observed in parts of Anandpuri and Garhi blocks.



### Depth to Water Level (Post Monsoon 2007)

During Nov.07 water level ranges widely from more than 5 to less than 10 m bgl. Water level is shallower in north eastern and central part of the district. In general DTW varies from more than 2 to 5 mbgl in entire district. The Deepest water level 9.9 mbgl observed in Anandpuri block.



Block	Pre Monsoon		Post Monsoon	
	Min	Max	Min	Max
Anandpuri	4.00	13.25	3.15	9.90
Bagidora	3.30	3.73	0.93	1.99
Garhi	4.60	11.23	2.55	7.34
Ghatol	2.34	6.05	0.01	4.92
Kushalgarh	6.57	9.10	4.17	5.73
Pipalkhunt	5.76	8.80	4.06	5.47
Sajjangarh	1.60	6.75	0.05	7.40
Talwara	2.43	9.58	1.10	8.63

## Water Level Fluctuation

**Seasonal fluctuation** in water level based on Pre and Post-monsoon 07' indicate that there has been rise in water level in district. Perusal of the fluctuation data indicate that major part of the district has recorded rise in water level of less than 4 m except in parts of Garhi where rise in water level more than four has observed.

Block	Water level fluctuation (Pre– Post)			
	Rise		Fall	
	Min	Max	Max	Max
Anandpuri	0.85	3.35	-	-
Bagidora	1.74	2.37	-	-
Garhi	1.65	4.42	-	-
Ghatol	0.16	2.43	-	-
Kushalgarh	2.37	3.42	-	-
Papalkhunt	1.48	3.33	-	-
Sajjanganrh	1.45	1.55	-	-
Talwara	1.28	3.85	-	-

**Decadal (1998-07) water level trend** has been worked out for Pre and Post Monsoon and has been given in the table. On comparing water level data majority of monitoring stations show rising trend ranging from 0.0875 m/yr to 0.6690 m/yr during pre-monsoon and fall ranging from 0.0363 to 0.5364 m/yr. Rise in water level is observed in most of the blocks in post monsoon. But fall during post monsoon observed only in Garhi, Ghatol and Pipalkhunt blocks.

Block	Pre Monsoon Trend (m/yr)		Post Monsoon Trend (m/yr)	
	Rise	Fall	Rise	Fall
Anandpur	-	-	-	-
Bagidora	0.0875	0.0688	0.2057	-
Garhi	0.6690	-	0.2677	0.4642
Ghatol	0.2571	0.0363	0.3726	0.0171
Kushalgarh	0.1607	-	0.2160	-
Pipalkhunt	0.2500	0.5364	0.2623	0.0981
Sajjanganrh	0.2656	-	0.3560	-
Talwara	0.1433	0.0975	0.1439	-

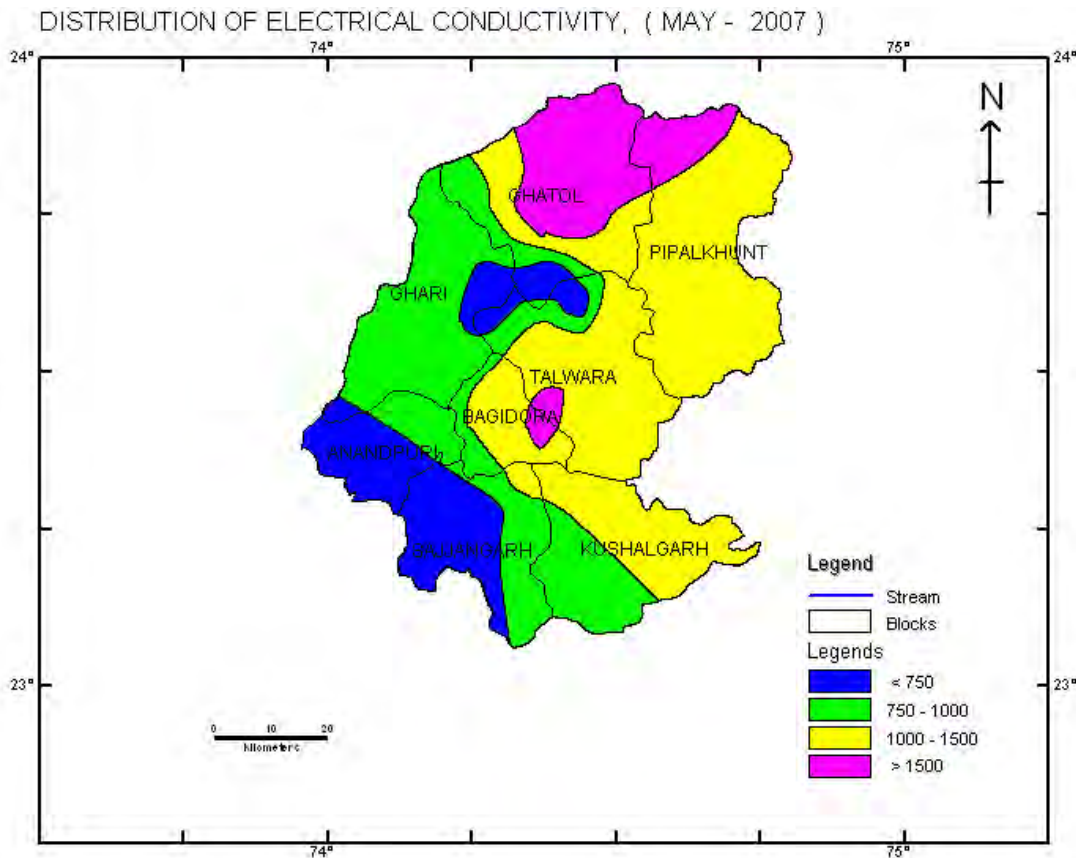
## Groundwater Quality

### Water Quality in Shallow Aquifer

Shallow groundwater of dug well zone is alkaline in nature with pH ranging from 7.25 to 7.67. The sp. Conductance is within 390 to 2340 mmhos/cm at 25°C but higher values more than 2000 mmhos/cm at 25°C at Sawania of Talwara block.

The Chloride content varies from 14 to 327 ppm. High Chloride content (>250ppm) has been observed at Sawania of Talwara block. The concentration of carbonate varies from negligible and bi-carbonate varies from 171 to 732 ppm. The fluoride content is generally within 1.5mg/lit in major part of the district. Higher concentration (>1.5mg/lit) is found at Banswara and Sawania of Talwara block. The concentration of Nitrate ranges from 0.10 to 225 ppm. Nitrate values in major part of the district are within 100 ppm. Higher values of nitrate occur at Bhugra, Dungria and Sawania.

The groundwater in the district is suitable for drinking and other domestic purposes.



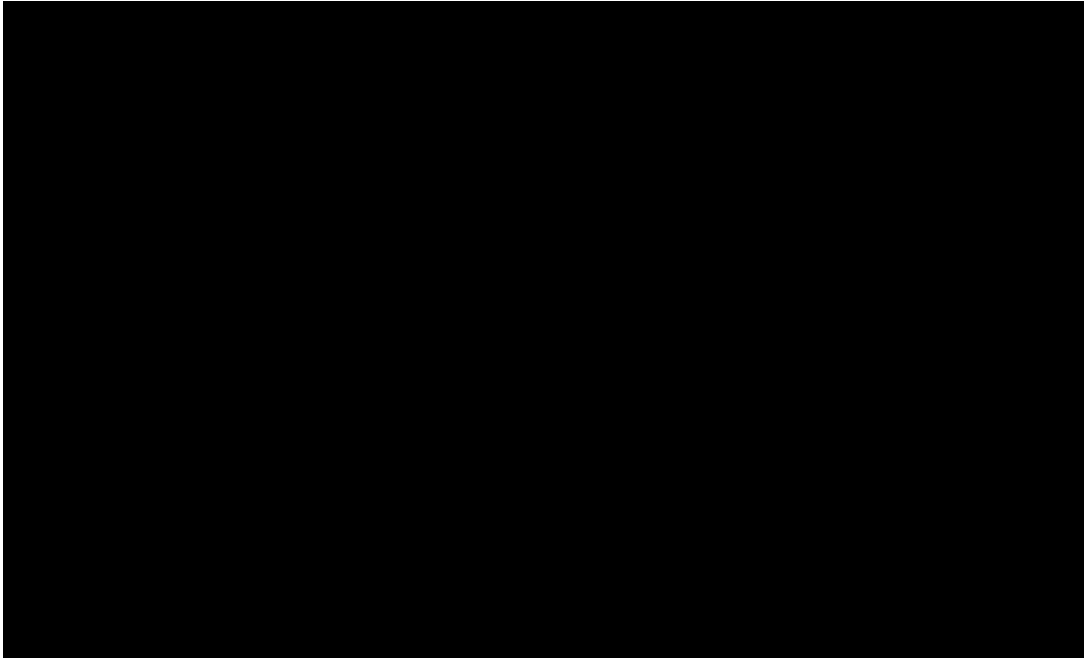
### Water quality in Deep Aquifer

Chemical analysis of water samples collected from tubewells show that quality is fresh and potable except at Navgavan. The sp. Conductance is generally less than 2000m mhos/cm at 25°C except at Navgavan (5000m mhos/cm at 25°C).

The concentration of Chloride is within permissible limit except Navgavan. The concentration of Fluoride is less than 1.5mg/lit in 29 out 40 tube well constructed by CGWB. Fluoride is more than 3 mg/lit occurred in Kalimagri, Burwa and Ramgarh.

## 6.0 Groundwater Resources

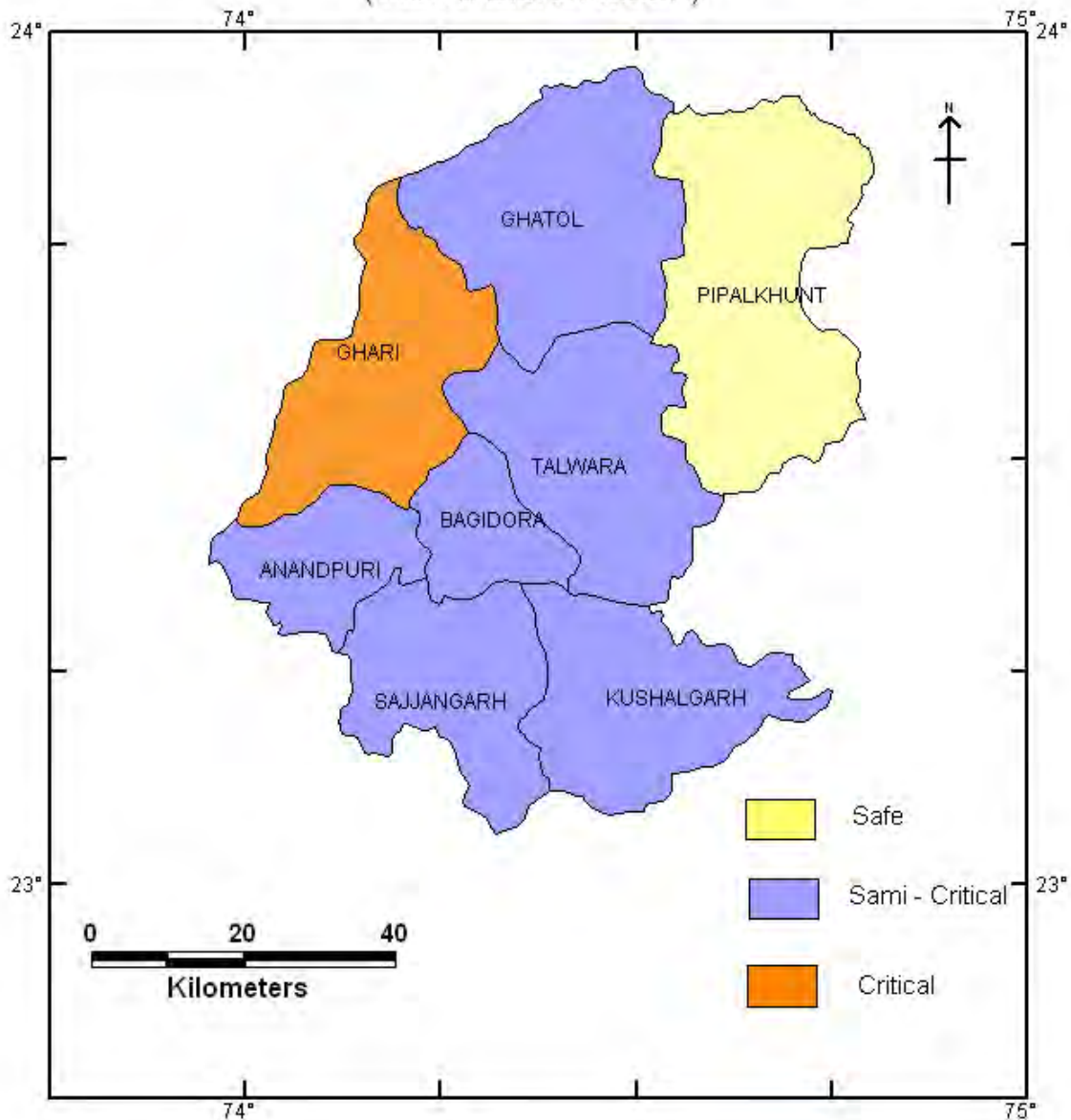
Groundwater resources have been estimated as per the norms recommended by GEC 97. While assessing the ground water resources saline and hilly areas have not been considered. Total groundwater resources based on water level fluctuation method is estimated to be 174.6797 MCM. Draft for all use is 127.4697 MCM and over all stage of development is 72.97 %.



Summarized block wise estimate of dynamic groundwater resources is given below:

Sl. No.	Assessment Unit	Net Annual Ground Water Availability (mcm)	Gross Ground Water Draft for All uses (mcm)	Stage of Ground Water Development %	Category
1	Anandpuri	11.1171	8.0356	72.28	S. Cr.
2	Bagidora	19.9977	14.7787	73.90	S. Cr.
3	Garhi	21.4549	19.7952	92.26	Critical
4	Ghatol	28.6904	23.1530	80.70	S. Cr.
5	Kushalgarh	16.3964	12.6792	77.33	S. Cr.
6	Pipalkhunt	32.0131	15.7623	49.24	Safe
7	Sajjangarh	10.4800	7.6848	73.33	S. Cr.
8	Talwara	34.5301	25.5809	74.08	S. Cr.
		<b>174.6797</b>	<b>127.4697</b>	<b>72.97</b>	S. Cr

## CATEGORY OF BLOCKS, BANSWARA DISTRICT ( As on March 2004 )



### 7.0 Status of Groundwater Development

Granite Gneiss, Phyllite & Schists, Quartzite, Limestone and Basalt form the aquifer in different parts of the district. Ground water occurs under unconfined to semi-confined condition. Depth and diameter of the dug well and bore well depends on formation and geomorphology. However, general depth of dug well and bore well ranges from 15 to 20 m and 200m respectively.

Details of groundwater structures is as follows:

Tehsil	Formation	Avg. Yield m <sup>3</sup> /day		Depth in m		Diameter Dug well,
		Dug well	Deepening By Blasting	Dug well	Deepening By Blasting	
Anandpuri	Ph/Sc	40-60	8-12 (additional)	20-25	3-5	3-5
Bagidora	Ph/Sc	50-70	8-12	20-25	3-5	3-5
Garhi	Gn	40-60	10-12	20-25	3-5	3-5
	Ph/Sc	50-75	8-12	20-25	3-5	3-5
Ghatol	Gn	50-80	10-12	20-25	3-5	3-5
	Ph/Sc	40-70	8-12	20-25	3-5	3-5
Kushalgarh	Basalt	50-75	6-10	15-20	3-5	5-5
Pipalkhunt	Gn	50-70	10-15	20-25	3-5	3-5
	Basalt	50-75	6-10	15-20	3-5	5-5
Sajjangarh	Ph/Sc	50-75	8-12	20-25	3-5	3-5
	Basalt	50-75	6-10	15-20	3-5	5-5
Talwara	Lst	70-90	15-20 (boring)	20-25	3-5 25-30	3-5 4"
	Gn	50-80	10-12	20-25	3-5	3-5
	Basalt	50-75	6-10	15-20	3-5	5-5

### Urban and Rural Water supply

Banswara district comprises 3 urban areas and each of them is facilitated by piped water supply. Status of urban water supply is given bellow :

Town	Population		Total Drinking water Production KLD	Service Level LPCD	Water Supply Interval
	Census 2001	2006			
Banswara	8308	96000	9600	100	Per day
Kushalgarh	10108	11000	770	70	Per day
Partapur	9947	11000	770	70	Per day

All the 1536 villages are benefited by water supply for drinking and domestic purposes. Status of rural water supply is given bellow ;

Tehsil	No. of populated villages	No. of villages benefited from schemes					No. hand pump in block
		Piped water supply	Regional water supply	Pump & tank scheme	TSS	Hand pump scheme	
Anandpuri	129	1	0	5	0	123	1440
Bagidora	169	6	1(2 village)	7	2	152	1899
Banswara	223	1	0	4	9	209	1791
Garhi	185	6	7(21village)	3	16	139	2304
Ghatol	230	4	1(3village)	6	1	216	2124
Kushalgarh	211	0	0	1	4	206	1323
Pipalkhunt	201	3	0	0	0	198	1305
Sajjangarh	188	0	2(6village)	1	0	181	1341

## 8.0 Ground Water Development Strategy

### Ground Water Development

Stage of ground water development in the district is 72.97 %, which indicate that there is scope of ground water development in the district. The stage of development in non command area is 68.72 % and in command area it is 90.61 %. As the district is covered by hard rock areas further groundwater development in non command area should be based on proper hydro-geological and geo-physical surveys.

### Water Conservation and Artificial Recharge

### Ground Water Management

Due to over development of groundwater further exploitation of this precious resource must be checked. Artificial recharge is a difficult task in the district as the country rock is composed exclusively of hard rocks, water level gradient is steep and storage capacity is low. Under such condition there is likelihood that recharged water will reappear as base flow. Any induced water application will create localized mound with no change in trend of declining water level in adjacent areas.

Since the stage of ground water development has already crossed 70%, for sustainable utilization of water resources conjunctive use of surface and groundwater is inevitable. Water Harvesting is the only solution through construction of bunds, anicuts, and rooftop harvesting structures. The area has undergone polyphase deformation in geological past, which has resulted in a complex structure (folded, faulted and jointed) that may not be conducive for such structures. Therefore, site of these structures should be selected carefully.

Impact assessment of water harvesting structures (WHS) reveals that there is increase in cropping area, cropping intensity, crop production and labor employment observed in the project area. Erosion from nalah bank minimizes. Cropping pattern and cropping intensity changed. Harvested water provides supplementary irrigation during long dry spell. In view of the above, such WHS programmes may be taken up in the district for further development of surface water and ground water resources to enhance agricultural production.

## **8.0 GROUND WATER RELATED ISSUES & PROBLEMS**

Almost entire district is facing problem of ground water scarcity. However, there are some areas vulnerable for pollution and depleted water table. Major issues in the district are as follows:

### **Groundwater Depletion Hazard**

Comparison of pre monsoon water level between 1998 & 2007 shows that two block namely Pipalkhunt and Ghatol has decline in water level during pre and post monsoon period . The long term depleting nature of water level causes reduction in storage, which leads to water scarcity in summer seasons.

### **Water Quality Hazard**

In the district, fluoride (>1.5 mg/lit) is found in 10% villages and habitation. The nitrate hazard more than 45 mb/lit is found in 50% of villages.

### **Occurrence of Drought**

The rainfall variation during last decade has been a critical water sector hazard. During 1998–07 the rainfall deficit years were 99, 00,01 and 02 and are classified as serious drought years. The constant rise in population, urbanization, industrialization and agricultural growth has caused decrease in per capita availability of water.

## **9.0 Recommendations**

1. Ground water draft is very high in all the blocks. Stage of ground water development in the district has reached 72.97% due to indiscriminate use. It has to be controlled by preventing further development.
2. Water scarcity is a perpetual phenomenon in Banswara. Permanent solution to drinking water problem should be devised using Mahi dam water.
3. Revival of traditional ground water storage system i.e. Baori, open wells, Tanka etc for rainwater conservation for use in day to day life will reduce ground water draft.
4. Awareness programme and training on rainwater harvesting will be beneficial to check decline in water level and justified use.
5. Taking advantage of uneven topography of the area, small WHS or earthen dams, upstream of irrigation commands, at suitable sites, may be

- constructed to store rainwater. This will increase recharge to ground water which ultimately result in increase of yield of wells.
6. Modern agricultural management techniques have to be adopted for effective and optimum utilization of the water resources. Maintaining irrigation through minimum pumping hours as per minimum requirement of water by the crop and also selecting most suitable cost effective cropping pattern can achieve this.
  7. Surface runoff can be harnessed by constructing tanks at feasible sites in the area occupied by the hard rock terrain for supplementing irrigation potential to increase the agricultural production.
  8. High water requirement crops be discouraged. Proper agriculture extension services should be provided to the farmers so that they can go for alternate low water requirement economical crops.

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