जल वर्ष 2007 Water Year 2007

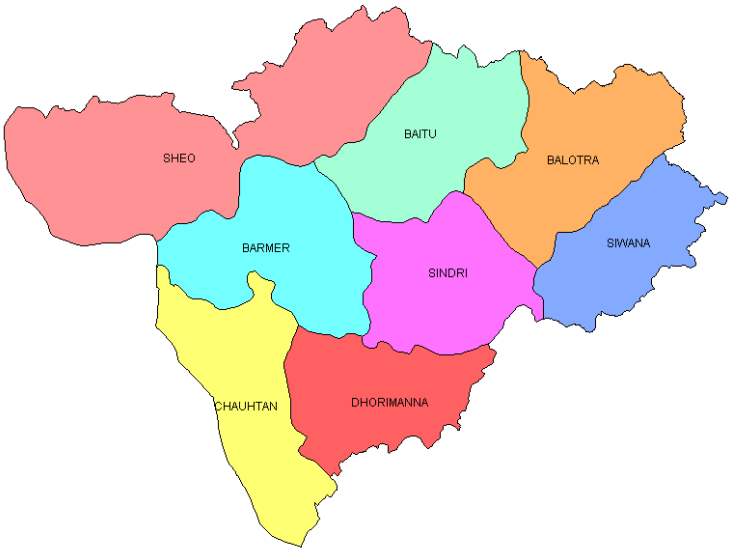
स्वच्छ सुरक्षित जल – सुन्दर खुशहाल कल

CONSERVE WATER - SAVE LIFE

CENTRAL GROUND WATER BOARD

Ministry of Water Resources
Government of India

GROUNDWATER SCENARIO



BARMER DISTRICT, RAJASTHAN

Western Region
Jaipur
JULY, 2008

DISTRICT AT A GLANCE – BARMER DISTRICT, RAJASTHAN

S No	Item	Information	
1	**GENERAL INFORMATION**		
	(i) Geographical area (sq km)	28,387	
	(ii) Administrative Division (As on 31.3.2007)		
	Number of Tehsils	08	
	Number of Blocks	08	
	Number of Villages	1941	
	(iii)Population (As per 2001 Census)	19,64835	
	(iv)Average Annual Rainfall(1971-2005)	281.8 mm	
2	**GEOMORPHOLOGY**		
	Major Physiographic Units	Sand Dunes, Aeolian & Alluvial plains, Ridges and Hillocks.	
	Major Drainage	Luni River	
3	**LAND USE (sq km) (2004-05)**		
	(a) Forest Area	316.77	
	(b) Net Sown Area	14544.91	
	(c) Cultivable Area	4334.89	
4	**MAJOR SOIL TYPE**	1.Desert soil 2.Sand dunes 3.Red desertic soil 4.Saline soil of depressions 5.Lithosols & Regosols of hills	
5	**AREA UNDER PRINCIPAL CROPS** (AS ON 2005-06)	**Crops**	**Area in ha**
		Bajra	913012
		Moth	225246
		Moong	50574
		R & M	21965
		Wheat	12158
		Jowar	1439
		Barley	84
		Taramira	100
		Gram	17
6	**IRRIGATION BY DIFFERENT SOURCES**		
	Source	**No. of structure**	**Gross Irrigated Area in hectare**
	Dug wells	19977	151093
	Tube wells/Bore wells	856	
	Tanks/Ponds		-
	Canals		-
	Other Sources		10673
	Net Irrigated Area (ha)	96206	
	Gross Irrigated Area (ha)	161766	
7	**NUMBER OF GROUND WATER MONITORING WELLS OF CGWB**(As on May 2007)		
	Number of Dug wells	62	
	Number of Piezometers	40	

8	**PREDOMINANT GEOLOGICAL FORMATIONS**	Aeolian sand, Alluvium, Tertiary sandstone, Lathi sandstone and Barmer sandstone (Mesozoic), Malani rhyolite, granite and Jalore Siwana granite (Post Delhi)
9	**HYDROGEOLOGY**	
	Major Water bearing formations	Quaternary alluvium, Tertiary sandstone, Lathi sandstone, Malani rhyolite and granite
	Depth to water level (Pre-monsoon, 2006) (mbgl)	5.60 – 111.90
	Depth to water level (Post-monsoon, 2006) (mbgl)	0.90 – 111.75
	Long term water level trend(1997-2006)	+ 0.02 to - 0.04 m/yr
10	**GROUNDWATER EXPLORATION BY CGWB** (As on 31.3.2007)	
	Number of wells drilled (EW, OW, SH, PZ)	EW – 54, OW- 8, SH- 5, PZ- 22
	Depth Range (m)	18 – 457
	Discharge (liter per second)	Negligible – 23.66
	Storativity	-
	Transmissivity (m^2/day)	100 to >2000 m^2/day in Lathi sandstone
11	**GROUND WATER QUALITY**	
	Presence of chemical constituents more than permissible limit (EC>1500 m mhos / cm at 25^0 C, F>1.5 mg/l, No3> 45 mg/l)- area in sq.km	EC – 500 F – 1500 No3 – 700
12	**DYNAMIC GROUND WATER RESOURCES (March, 2004) in mcm**	
	Annual Replenishable Ground Water Resources	256.4579
	Net Annual Ground Water Draft	267.0082
	Projected Demand for Domestic and Industrial Uses up to 2025	81.2021
	Stage of Ground Water Development	104.11%
13	**GROUND WATER CONTROL AND REGULATION**	
	Number of Over-exploited blocks	05
	Number of Critical Blocks	02
	No of Blocks Notified	-
14	**MAJOR GROUND WATER PROBLEMS AND ISSUES**	1. Water level decline 2. Quality Problem 4. Industrial pollution 5.Less recharge due to scanty and uneven rainfall
15	**MASS AWARENESS AND RAIN WATER HARVESTING TRAINING PROGRAM CONDUCTED BY CGWB**	A. Mass Awareness Program Nil B. Training Program Nil

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DISTRICT GROUND WATER BROCHUER
BARMER DISTRICT

1.0 INTRODUCTION

The district is situated between 24^0 40' 00" & 26^0 32' 00" North latitude and 70^0 05' 00" & 72^0 52' 00" East longitude covering geographical area of 28,387 sq km. It the second largest district in the State covering about 8.29% of its total area. The district as a whole forms part of the Great Indian Thar Desert. The district is divided into four sub-divisions. There are eight blocks in the district namely Baetu, Balotra, Barmer, Chohtan, Dhorimanna, Siwana, Sheo, Sindhari. The district has 2 Municipalities, 225 Gram Panchayats and 1941 Revenue Villages. It is surrounded by Jaisalmer in the north, Jalore in the south, Pali and Jodhpur in the east and Pakistan in the west. Total population (as per 2001 census) of the district is 19,64,835 out of which 18,19,431 is rural population and 1,45,404 is urban population. Decadal population growth rate of the district is 36.90 (1991-2001). Population density of the district is 69 persons/sq km. The district is known for its bentonite, lignite and petroleum mineral wealth.

Systematic Hydrogeological survey in the district was carried out during the year between 1959 and 1961 by Geological Survey of India and by Central Ground Water Board between 1975 and 1977. Reappraisal hydrogeological survey of district was carried out from 1986-87 to 1995-96 and Micro level hydrogeological survey in the district was carried out from 2003-04. Under exploratory program 54 exploratory boreholes and 5 slim holes have been drilled. Since 1973, monitoring of water level is being carried out four times a year from presently 102 National Hydrograph Network Stations.

2.0 RAINFALL & CLIMATE

The district experiences arid type of climate. Mean annual rainfall (1971-2005) of the district is 281.8 mm whereas normal rainfall (1901-1971) is lower than average rainfall and placed at 277.5 mm. Almost 90% of the total annual rainfall is received during the southwest monsoon, which enters the district in the first week of July and withdraws in the mid of September. As the district lies in the desert area, extreme of heat in summer and cold in winter is the characteristic of the desert. Both day and night temperature increases gradually and reaches their maximum values in May and June. The temperature varies from 48 degree in summer to 2 degree in winter. Atmosphere is generally dry except during the monsoon period. The humidity is highest in August with mean daily relative humidity is 43%. The annual maximum potential evapotranspiration in the district is 1850 mm and it is highest (260 mm) in the month of May and lowest (77 mm) in the month of December.

3.0 GEOMORPHOLOGY & DRAINAGE

Geographically, the area as a whole forms a part of the Great Indian Desert. A part from a small off shoot of the Aravalli hills in the east, the area is a vast sandy tract. The country west of Luni River represents sandy plain dotted with bold hills. A

well defined valley is one of which is observed along Barmer-Gadra road to the east of Kharin. Pachpadra, Sanwarla and Thob are the major salt lakes in the district. A salt lake locally called Rann is located east of Redana village. The surface elevation of the district varies from 70m amsl at Sindhari to 457 m above mean sea level at Ghonia village.

The only major drainage course in the area is Luni River, which flows from Samdari, passing through Balotra. The river is ephemeral, flowing only in response to heavy precipitation. In the year of drought there is no run off.

4.0 SOIL, LAND USE & IRRIGATION PRACTICES

Soils of the district are classified as follows:

1. **Desert soil:** Desert soil area is occupied by alluvium and wind blown sand, yellowish brown, sandy to sandy loam, loose, structure less, well drained with high permeability and lies in northern, western and central part of the district.

2. **Sand dunes:** These are non-calcareous soil, sandy to loamy sand, loose, structure less and well drained. It lies in northern, western and central part of the district.

3. **Red desertic soil:** These are pale brown to reddish brown soils, structure less, loose, and well drained. Texture varies from sandy loam to sandy clay loam and lies in eastern and south eastern part of the district.

4. **Saline soil of depressions**: This type of soil found in salt lakes. They are dark grey to pale brown, heavy soils with water table very near to the surface and are distinctly saline.

5. **Lithosols & Regosols of hills:** This type of soil found in isolated hills as lithoslopes. These soils are shallow with gravels very near to the surface, high textured, fairly drained, reddish brown in color and lies in south eastern part of the district.

Land-use Pattern- The total reported area as per village record is 28,17,332 hectares and about 54.48% of the total area are being cultivated. The district is very poor in forest covering an area of 31677 hectares, which forms only 1.1% of the total area of the district. Agriculture is the main occupation of the rural population in the district. Net cultivable area of the district is 14,54,491 hectares whereas non agriculture land area including fallows land is 6,54,452 hectares.
The land use pattern is given below:

Land-use Pattern (2004-2005)		
Classification	**Area (Hectares)**	**Percentage**
Total reported area	2817332	100.00
Areas under forest	31677	1.12
Area under non agriculture use	433489	15.38
Permanent pastures and other grazing lands.	202739	7.19
Miscellaneous trees crops and Groves	301	0.01

not included in the net area Sown.		
Non agricultural Land including Fallows	654452	23.22
Net area Sown	1454491	51.62
Area sown more than one time	90762	3.22
Total area Sown	1545253	54.84

Crops- The district comes under arid zone of the State and on account of non-availability of adequate water, cropping pattern is, by and large, single only. Only 3.22% of the net cultivated area are being utilised for double / multiple cropping. The total area under Kharif crop is 1190284 hectare and area under Rabi crop is only 34329 hectares. During Kharif, Bajra, Jowar, Moong and Moth are the main crops cultivated and during Rabi Wheat, Barley, Mustard and Taramira are the main crop in the district.

Area under principal crops during 2005-06[Area in Hectares]

Crops	**Area in hectares**
Bajra	913012
Moth	225246
Moong	50574
R & M	21965
Wheat	12158
Jowar	1439
Barley	84
Taramira	100
Gram	17

Irrigation and Water Resources- Ground water is only source of irrigation in the district. Net area of irrigated land works out to 96206 hectare and gross area irrigated is 161766 hectares. Major portion of the irrigation is being carried out with the help of wells tube wells. There are about 856 tube wells and 19,977 wells are being used for irrigation in the district. Maximum irrigated area is in Chohtan block followed by Siwana, Dhorimanna, Sindhari and Sheo. Minimum area under irrigation is in Baitu block due to poor ground water potentials.

Source wise irrigation facilities:

Source	**No. of structure**	**Gross Irrigated Area in hectare**
Dug wells	19977	151093
Tube wells/Bore wells	856	
Tanks/Ponds	-	-
Canals	-	-
Other Sources	-	10673

5.0 GROUND WATER SCENARIO

5.1 Geological Framework

Geologically, the district is underlain by intrusive rocks at the basement (Post Delhi formation) consisting of Jalore and Siwana granite & Malani rhyolite and

granite followed by Mesozoic and Tertiary formations consisting of sandstone, shale, conglomerate. Mesozoic is consisting with Lathi series of Jurassic and Abur series of Cretaceous period. Tertiary is consisting with Akali and Kapurdi series of Eocene period. These formations are overlain by Pleistocene to recent alluvium consisting mainly clay, sand and silt.

5.2 Hydrogeology

The main water bearing formations in the district are rhyolites and granites of post Delhi; Lathi sandstone, Tertiary sandstone and Quaternary alluvium. In quaternary alluvium, ground water occurs under semi confined to unconfined conditions, in semi consolidated tertiary and mosozoic formations it occurs under unconfined to confined conditions and in weathered and fractured zones in hard rocks under phreatic conditions.

Though groundwater occurs in all the formations but the most productive are the Lathis, Barmer sandstones and the Quaternary sediments. The Territories, which are predominantly clayey and argillaceous, are not found as productive except locally in the sandstone horizon. In general, the fractured and weathered zones in hard rocks form poor aquifers.

Consolidated formations:

Consolidated formations include intrusive of Malani rhyolite and granite and Jalore & Siwana granites of Post Delhi. It lies in north western part of district, south of Siwana and entire western part of Barmer up to Harsani. It forms the poor aquifer. Ground water occurs under water table condition in fractured and weathered residum down to a depth of 99 m. The rhyolites are partially impervious. They are sparingly jointed and weathered into a clayey impervious residum lessen the water bearing capacity. The rocks have secondary porosity and the water yielding capacity of rock units diminishes with depth. Yield of dug wells taping rhyolites is lowest and ranges from 15 to 50 m^3/day.

Two exploratory, one peizometer and 4 production wells have been constructed in consolidated formation. The depth of drilling / depth of wells vary from 37.94 to 171.00 m. and discharge of wells is meager indicating the poor potentiality of aquifer.

Semi consolidated formations:

Semi consolidated formations encompass Tertiary formation (alternate layers of clay and shale associated with fuller's earth) is unproductive aquifer. Lathi sandstone forms the most potential aquifer.

Lathi sandstone: Lathi sandstone forms the most potential aquifer and is constituted of medium to coarse grained sandstone with subordinate amount of gravel. It covers the total area of 7500 sq. km and the extent of saturated Lathis with utilizable quality of ground water comprises about 3270 sq. km. The aquifer portion of the Lathi formation ranges in thickness from less than 100 m in the east to over 800 m in the northern part, east of Jaisalmer. There are generally three aquifers in

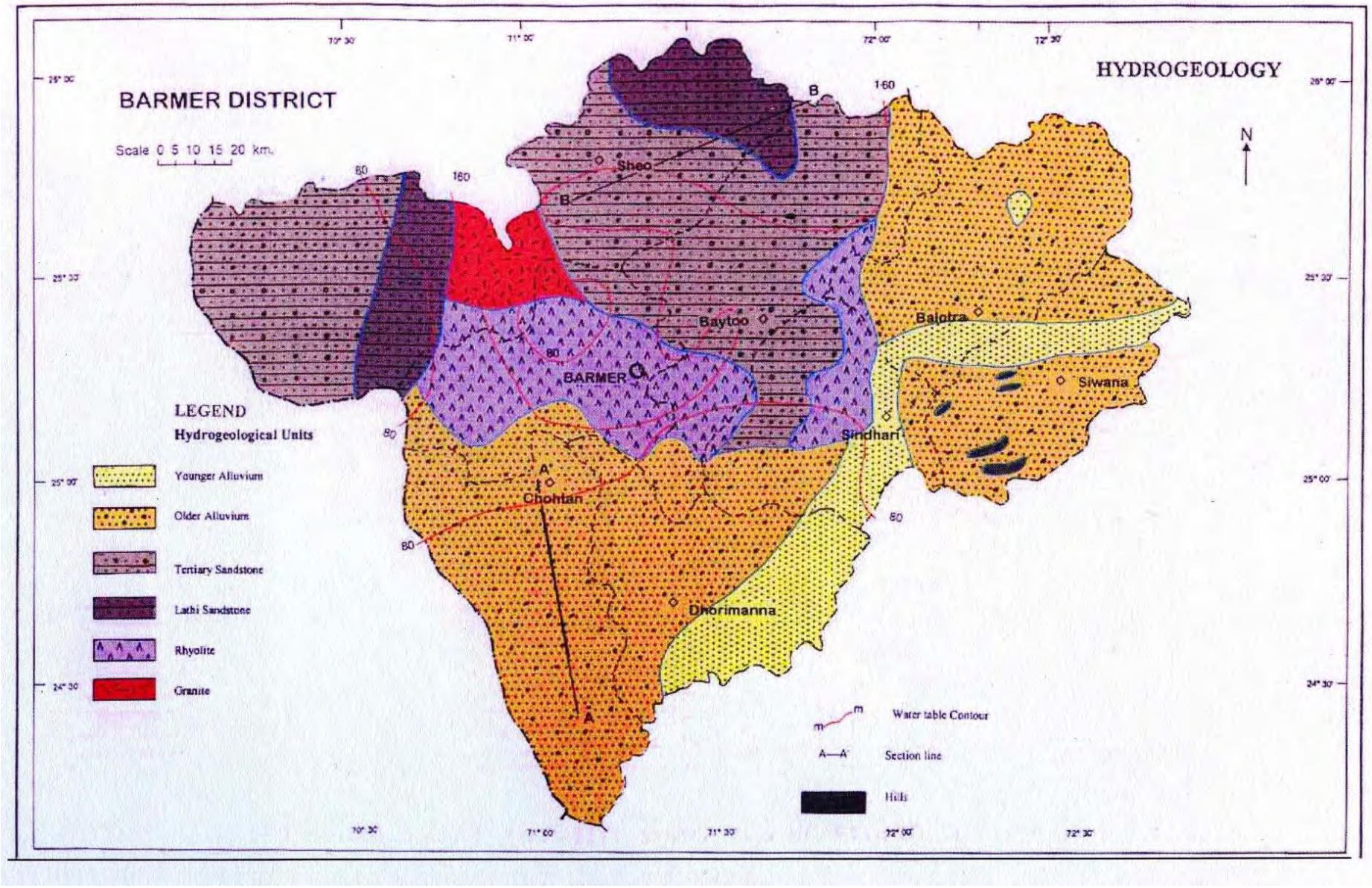
the depth ranges of 67 to 100 m, 150 to 200 m and 240 to 280 m which are in hydraulic continuity. The ground water in Lathi occurs under perched as well as main water table conditions and under confined condition. The eastern part of Lathis is unsaturated, except for perched saturated zone which supply water locally to villages. The depth to water level and piezometric heads ranges from 30 to over 120 m. The perched water table occurs between 6 and 30 mbgl. The piezometeric surface is shallower in area north of Jaisalmer-Pokaran road due to lower topography. The piezometric surface ranges from 540m amsl near Bhopa to about 490m.amsl north of Jaisalmer-Pokaran road and south of Jaisalmer. The piezometric gradient ranges from 0.1 m/km to 1.6 m/km.

In semi consolidated formation, 24 exploratory, 3 observation wells, 5 slim holes and 6 piezometers have been drilled. Depth of exploratory drilling varies from 82 to 347 m having depth of wells from 109 to 240 m. Discharge of wells especially in Lathi aquifer in its northern part varies from 303 to 852 lpm for draw down ranging from 2 to 12 m, while in south wards and towards south west area, the discharge of wells having saturated thickness of 15.85 (at Bhimda) to 123 m (at Bothia-II) varies from 632 to 1420 lpm indicating high potentiality of the aquifer. The transmissivity of the Lathi aquifer ranges from less than 100 to over 2000 m^2/day being comparatively higher in the northern part. Wells tapping the aquifer have high specific capacities ranging mostly from 150 to 500 lpm / m.

Tertiary Formation: Tertiary formations consisting of alternative layers of clay and shale associated with fuller's earth are unproductive aquifers. The boreholes tapping these formations were abandoned due to very poor yield and due to salinity of formation water. The piezometric level varies from 5.95 m. in the south (Dhanau borehole) to 111.25 m in the north (Gunga borehole). Boreholes tapping the fine grained sandstone in the territories yielded between 182 lpm (Karim Ka Par borehole) and 189 lpm (Dhanau Borehole) i.e. for draw down of 10.6 and 12.37 m respectively.

Unconsolidated Formation

Unconsolidated formation includes Quaternary alluvium that is most extensive, forms the potential aquifer and covers entire southern part and extreme western portion of the district. The exploration drilling data indicate that alluvium is composed of heterogeneous sequence of sand, silt, clay and kankar with occasional tongues and lenses of gravel and cobbles. The thickness of alluvium varies from 40 to 100 m. except at borehole at Padru in Balotra block where it was found maximum of 140.20 m, where even bed rock was not encountered. The ground water occurs under water table condition to semi confined condition. The perched water table condition occurs at shallow depth in clay beds and kankars which arrest the rain water of local precipitation. The piezometric surface lies between 5.51 and 49.87 mbgl. The perched water table condition prevails in central north and eastern part of district. A total of 28 exploratory, 5 observation wells, 15 piezometers and 9 production wells have been drilled in unconsolidated formation. The exploratory drilling data indicate that the depth of drilling ranges from 18 to 457 m with 18.0 m to 290 m depth of wells. Discharge of wells varies from 22 to 1409 lpm for draw down ranging from 6.0 m to 35.0 m.


HYDROGEOLOGY
BARMER DISTRICT
Scale 0 5 10 15 20 km.
N
Sheo
Baytoo
Barmer
Bajotra
Siwana
Sindhari
Chohtan
Dhorimanna
LEGEND
Hydrogeological Units
Younger Alluvium
Older Alluvium
Tertiary Sandstone
Lathi Sandstone
Rhyolite
Granite
Water table Contour
Section line
Hills

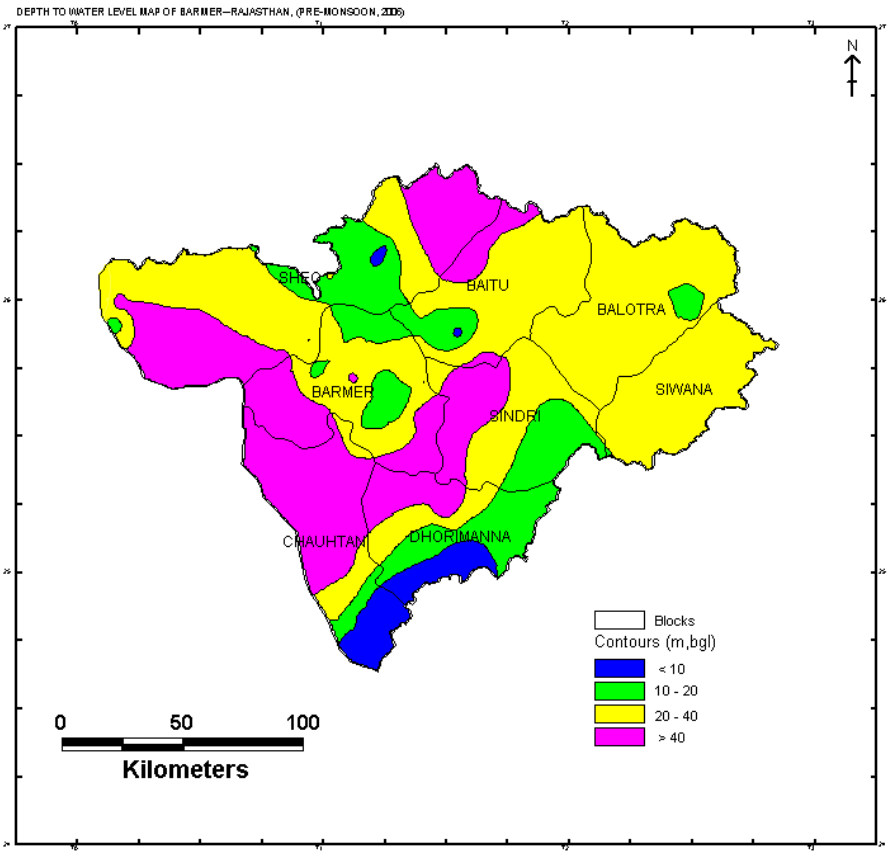
Depth to Water Level

Depth to water level (2006) in the district, monitored on 102 stations, ranges from 5.60 to 111.90 m bgl and 0.90 to 111.75 m bgl during pre monsoon and post monsoon, 2006, respectively. Block-wise depth to water level is as follows:

Block	Pre-monsoon water level in m bgl		Post-monsoon water level in m bgl		Water level fluctuation in m (Pre– Post)			
					Rise		Fall	
	Min	Max	Min	Max	Min	Max	Min	Max
Baetu	8.34	57.80	23.61	56.75	0.80	3.83	-	-
Balotra	14.40	24.03	14.12	28.48	0.22	7.62	4.45	4.45
Barmer	10.43	71.35	1.30	59.70	0.30	19.10	1.40	1.40
Chohtan	5.80	67.47	3.60	66.71	0.76	7.34	7.80	7.80
Dhorimanna	5.60	58.61	3.50	57.71	0.90	3.11	0.38	0.40
Sheo	7.59	111.90	0.90	111.75	0.08	13.80	1.29	4.00
Sindhari	16.70	63.66	14.10	63.44	0.22	2.60	-	-
Siwana	25.68	38.80	25.04	25.04	0.64	0.64	-	-
District	**5.60**	**111.90**	**0.90**	**111.75**	**0.08**	**19.10**	**0.38**	**7.80**

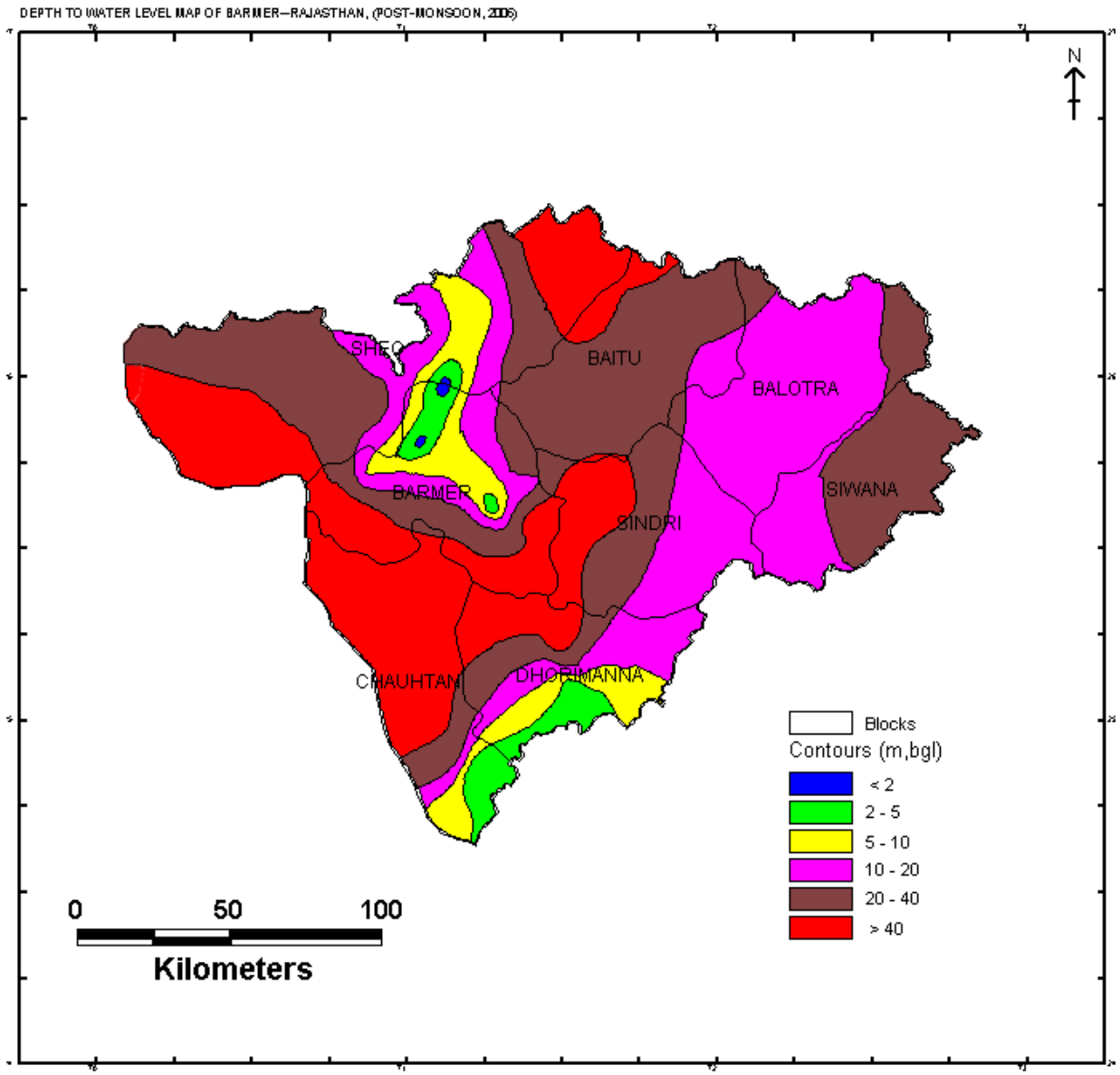
During pre monsoon, shallow water level 14.40 to 38.80 m bgl exists in Balotra and Siwana blocks. In Baitu, Barmer Chohtan, Dhorimanna, Sheo and Sindhari blocks water level was 5.60 to 76.50 m bgl.

DEPTH TO WATER LEVEL MAP OF BARMER DISTRICT (PRE-MONSOON-2006)



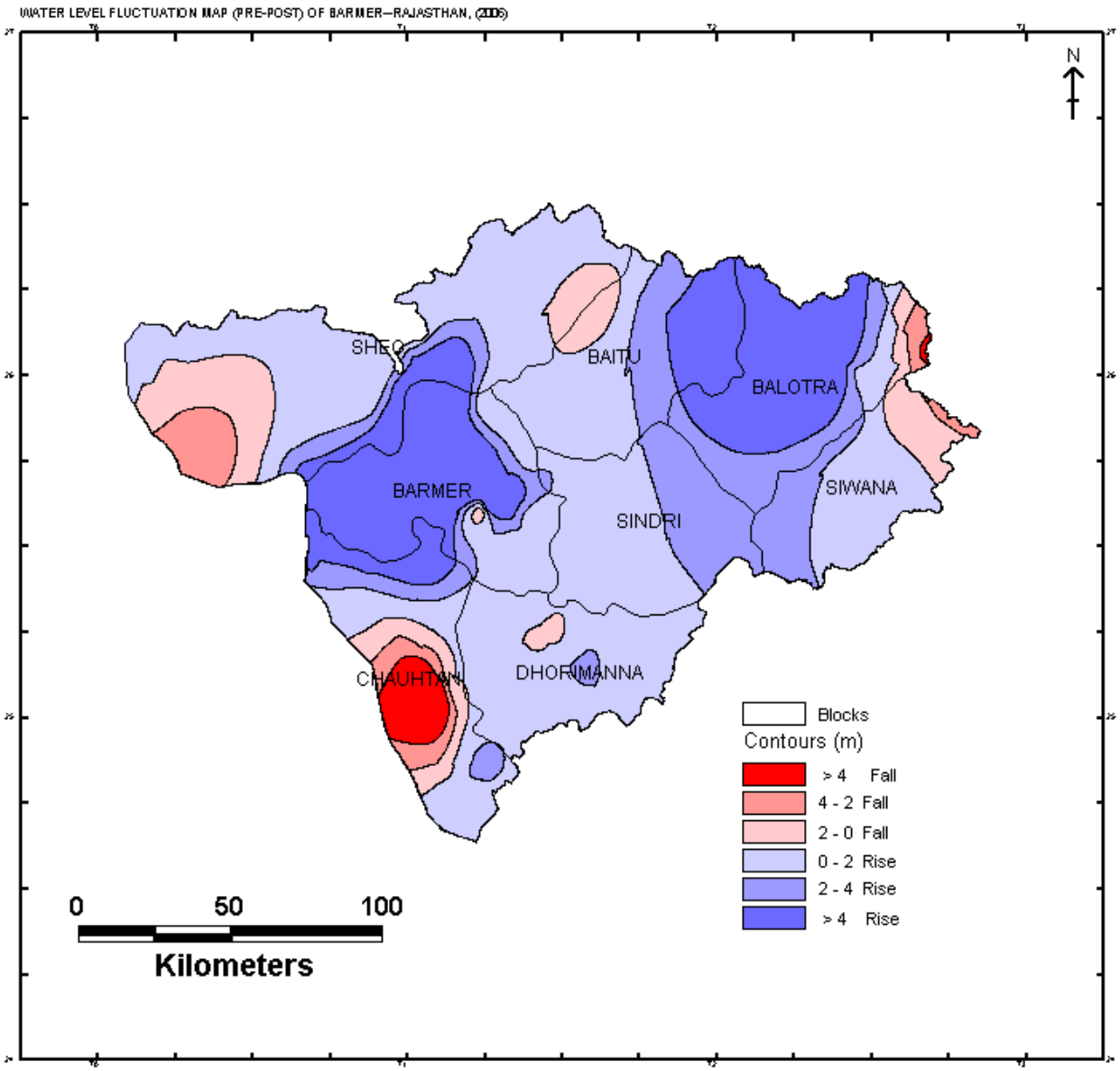
During post monsoon, shallow water level 14.12 to 28.48 m bgl exists in Balotra and Siwana blocks. Baitu, Barmer Chohtan, Dhorimanna, Sheo and Sindhari blocks water level was 0.90 to 76.50 m bgl.

DEPTH TO WATER LEVEL MAP OF BARMER DISTRICT (POST-MONSOON-2006)



Seasonal fluctuation of pre & post monsoon, 2006 indicates rise in all the blocks except central and western part of the Chohtan block and extreme western part of Sheo block only due to widespread and good rainfall. Out of this, rise in water level more than 10 m was observed in Barmer and Sheo blocks due to heavy rainfall in the month of August 2006.

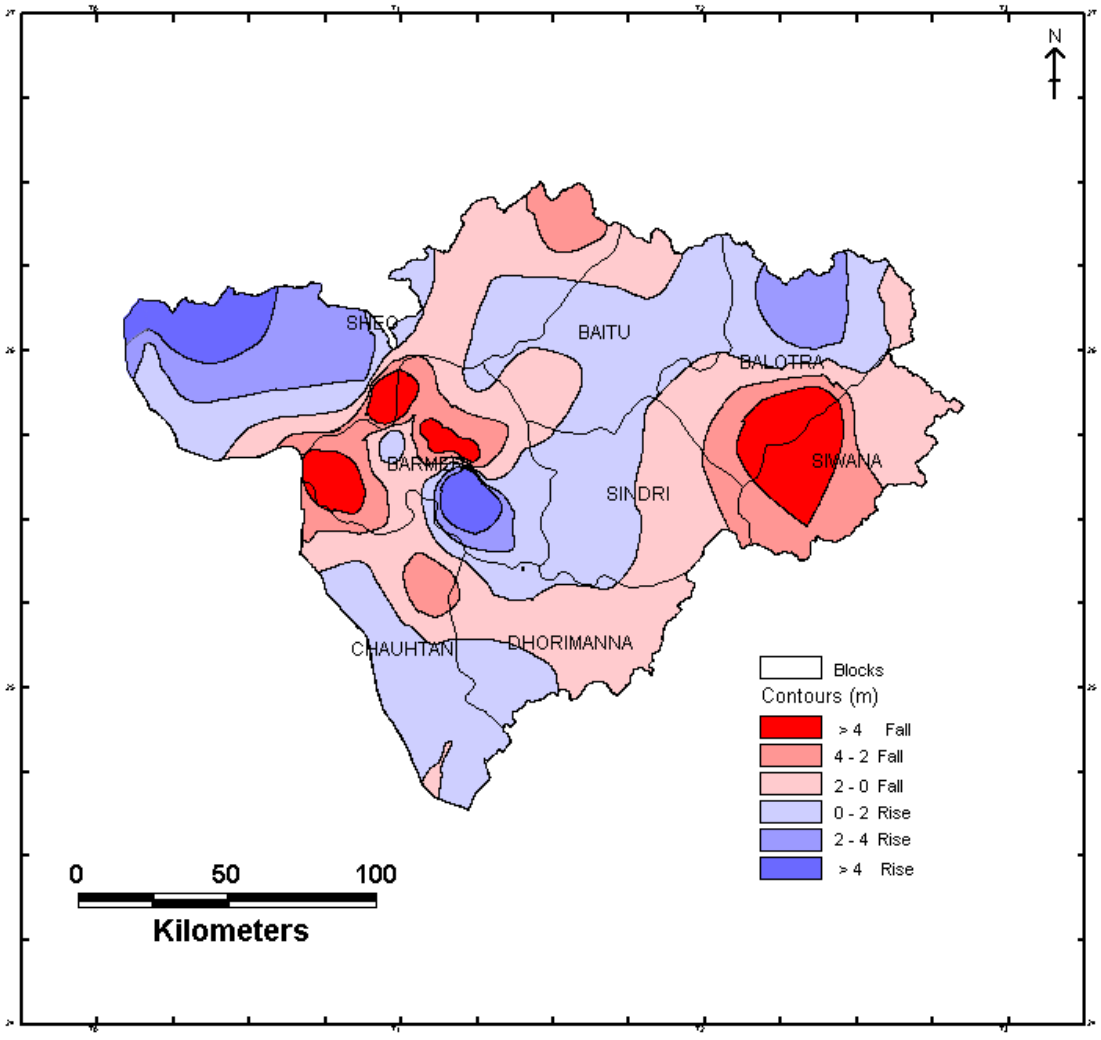
WATER LEVEL FLUCTUATION MAP (PRE-POST, 2006) OF BARMER DISTRICT



Long term pre monsoon (1997-2006) water level data of Hydrograph Stations show rise and declining trend of 0.02 and 0.04 m/year. During post monsoon decadal trend shows rise & decline of 0.03 and 0.02 m/year respectively. Long term change in ground water regime in the district it is observed that over a major part of the district lying in eastern and western part of the district shows maximum decline. Block-wise pre & post monsoon decadal trend is as follows:

Block	Pre Monsoon Trend (m/yr)		Post Monsoon Trend (m/yr)	
	Rise	Fall	Rise	Fall
Baetu	0.02	0.06	0.03	0.02
Balotra	0.02	0.08	0.02	0.04
Barmer	0.01	0.04	0.04	0.05
Chohtan	0.03	0.02	0.03	0.02
Dhorimanna	0.02	0.02	0.02	0.00
Sindhari	0.01	0.01	0.01	0.01
Siwana	-	0.03	-	-
Sheo	0.02	0.04	0.09	0.02
Total	**0.02**	**0.04**	**0.03**	**0.02**

WATER LEVEL FLUCTUATION MAP OF BARMER--RAJASTHAN, (MAY-2006- DECADAL MEAN)



Block-wise Long term pre monsoon (1997-2006) and pre & post monsoon 2006 water level trend observed in State Ground Water Department key wells is as follows:

S. No.	Block	Change in Water level in m. Pre monsoon 1997-2006 (+ rise) (- fall)	Change in Water level in m. Pre & Post monsoon 2006 (+ rise) (- fall)
1	Baetu	-3.82	+0.86
2	Balotra	-7.21	+1.55
3	Barmer	-1.38	+3.20
4	Chohtan	-2.34	+0.01
5	Dhorimanna	-2.74	+0.61
6	Sheo	-2.49	+1.80
7	Sindhari	-6.19	+0.60
8	Siwana	-15.76	+1.15
Total		**- 5.24**	**+1.22**

This significant decline is observed due to increased ground water draft. In Siwana block water level decline of more than 15 m has been noticed during last 10 years.

5.3 Ground Water Quality

The quality of ground water in water table aquifer varies widely from the composition of saline in Pachpadra salt lake to fresh water close to the hilly tract. Specific conductance ranges between 385 to 46,580 micro mhos/ cm. at 25°C. It has been observed that by and large, concentration of specific conductivity confirms broadly with that of chlorides. In greater part (about 60%) of the area, it is within 5000 micro mhos/ cm at 25°C. Higher values of specific conductance have been observed in the eastern parts of the district around Jasol, Central part around Hathi Tala and Sanwara, in northern part around Bisu kallan and in the north-western part around Napat. In general the quality of ground water deteriorates from upland and hilly tracts towards Luni River and its tributaries in the lower reaches and also in depressions in the vicinity of the saline lake.

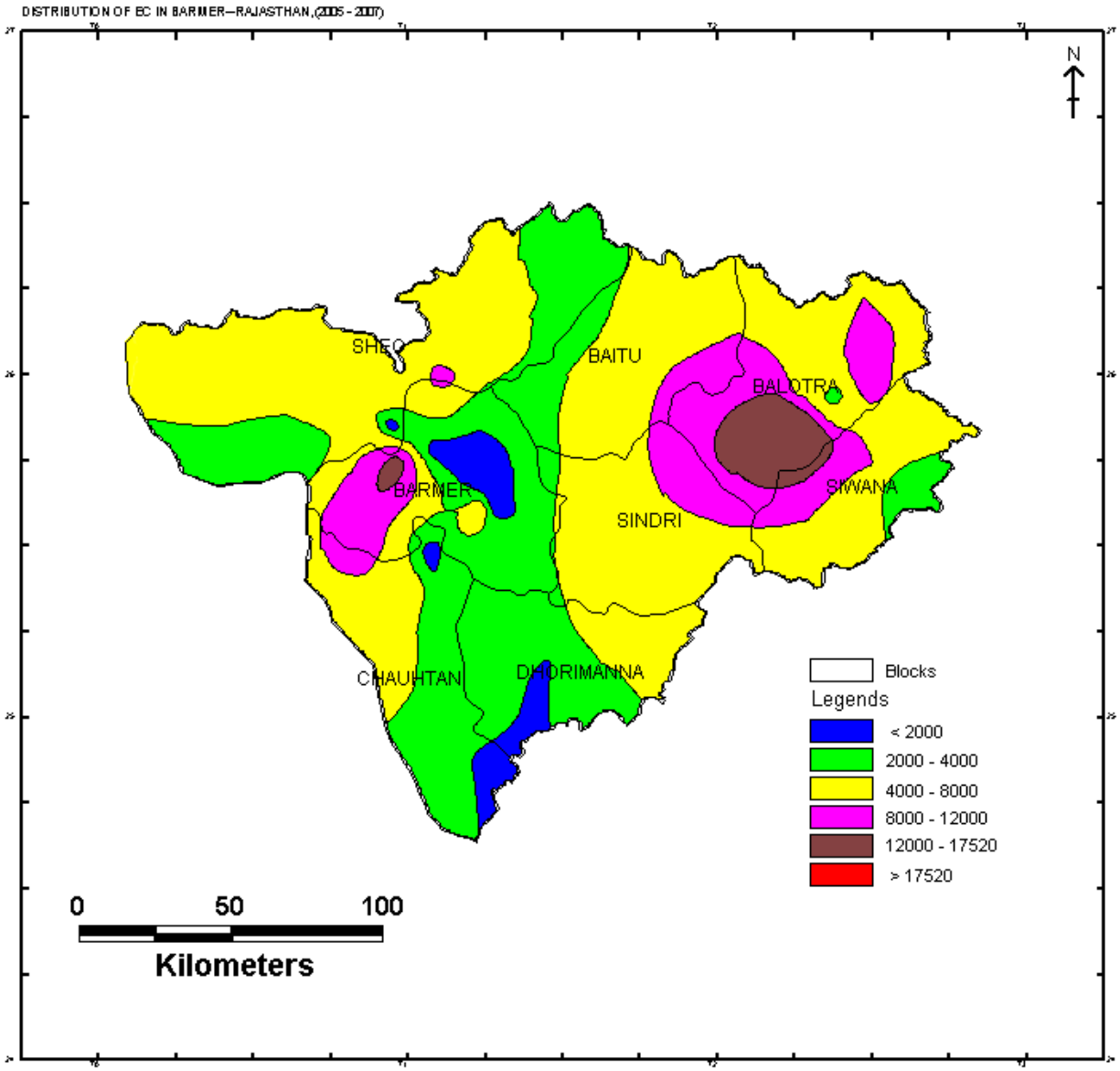
The chloride contents ranges from 10 to 19,099 ppm in phreatic aquifer and from 98 to 76470 ppm in deeper aquifer. Exploration has revealed that thickness of brine zone reaches up to about 60 m. The most extensive brine tract is between Thob and Chawa through Pachpadra. Vertically zonation in the salinity of formation water has been observed and given below:-

1. Fresh water at all levels is confined mainly to the area around Dhorimana and the alluvial tract between Balotra and Asotra.
2. Ground water is saline at all levels in the area between Thob and Chawa and around Sanwarla salt lakes.
3. Saline / brackish water is underlain by potable water in Bhimda and Ratri areas.
4. Fresh water underlain by saline water is in Balotra-Padru area.
5. In many parts of saline tracts especially close to tanks and streams, fresh water lenses over lies the saline water.

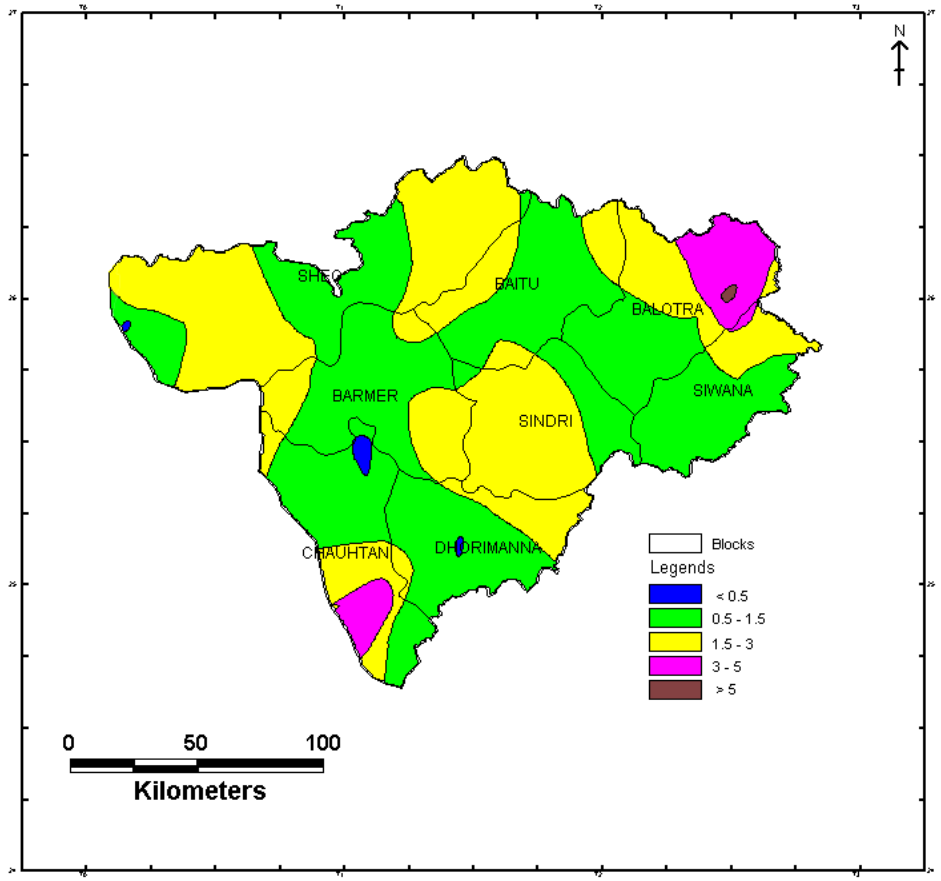
Fluoride in the ground water ranges between traces and 11.30 mg/l. In major part of the area, it is within the limit of 2.0 mg/l. except in small pockets in the central part around Chawa; in northern part around Kashmir and Sau Padam Singh; in north western parts around Sandra and in the southern parts around Shamu Ki Dhani.

The Nitrates in ground water varies widely. Its concentration ranges between traces to as high as 745 ppm. In north eastern part of the district the concentration of nitrate is under permissible limit.

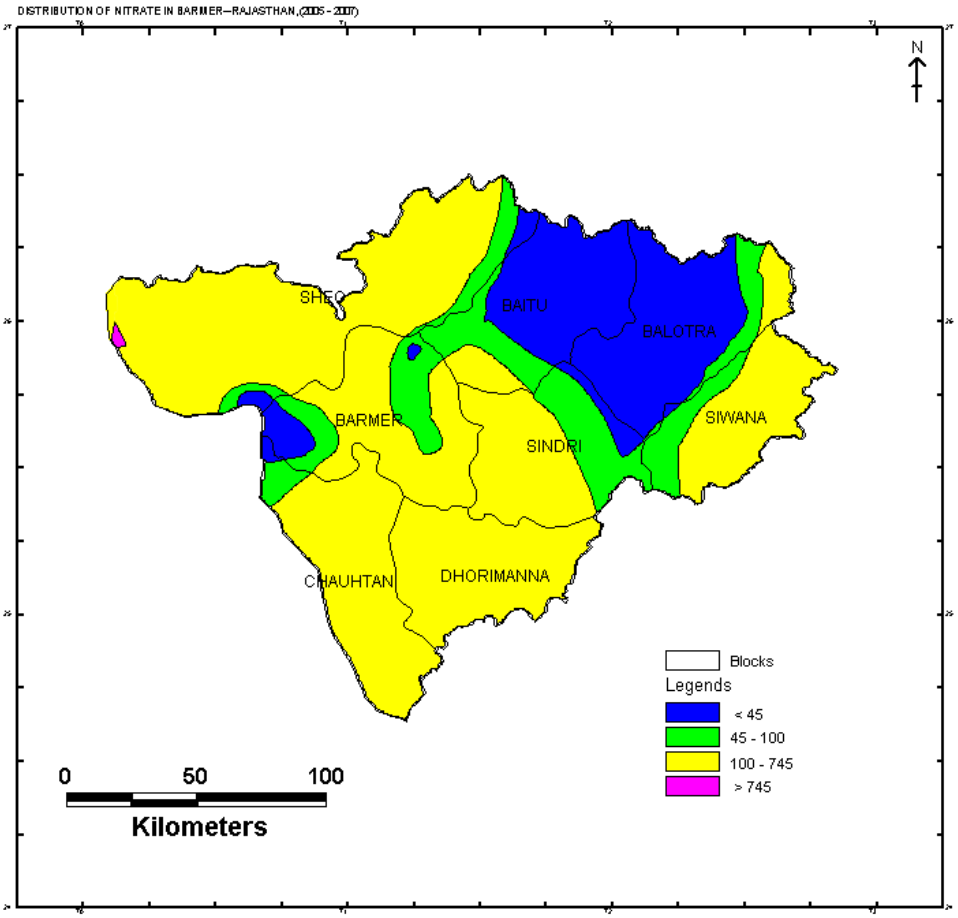
DISTRIBUTION OF ELECTRIC CONDUCTIVITY IN BARMER DISTRICT, RAJASTHAN



DISTRIBUTION OF FLUORIDE IN BARMER--RAJASTHAN,(MAY-2005)



DISTRBUTION OF NITRATE IN BARMER DISTRICT (MAY, 2005)

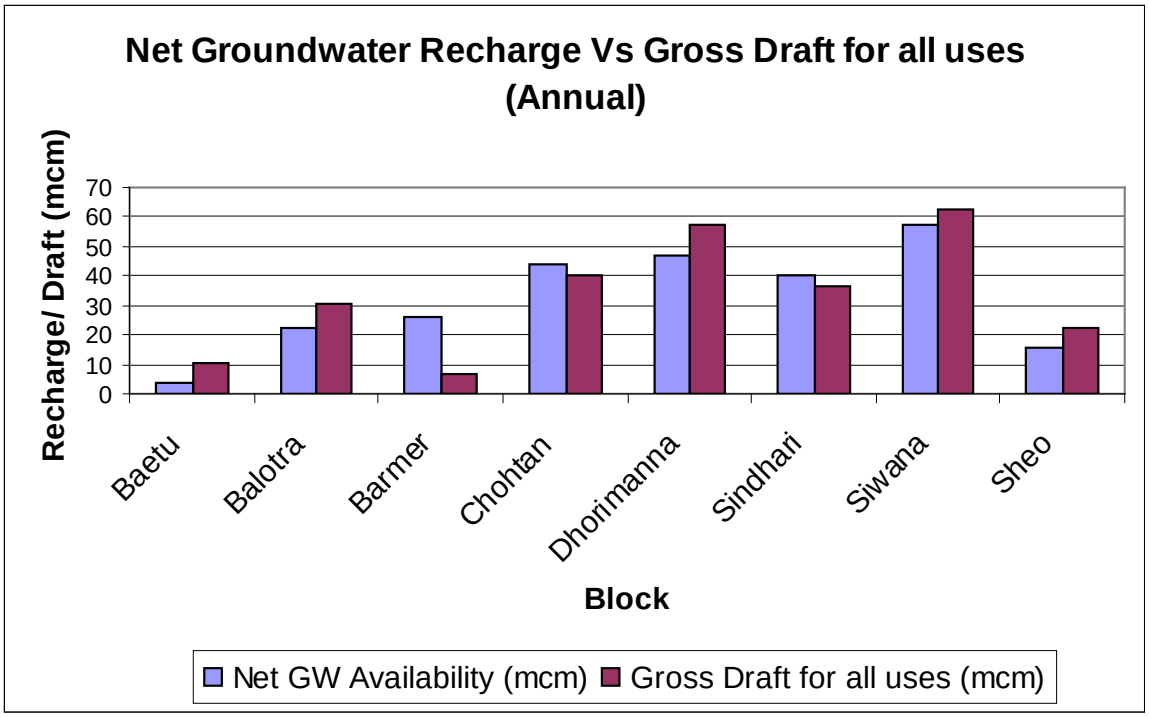


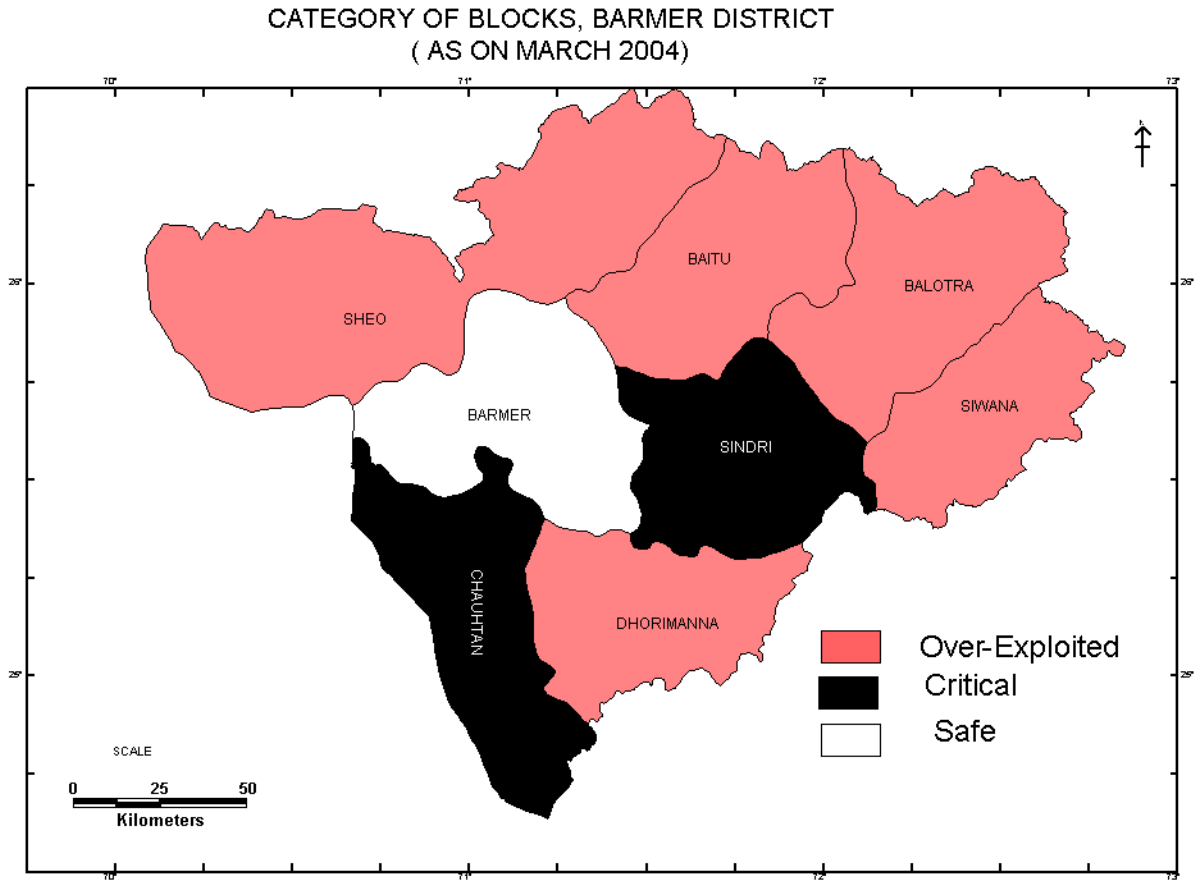
5.4 Ground Water Resources

Ground water resources have been reassessed as on 31.3.2004 based on Ground Water Estimation Committee (1997) are given below:

Table 7: Ground Water Potential of BARMER District (As on 31.3.2004)

Block	Area (Sq.Km)	Type of Area	Potential Zone Area (Sq.Km.)	Net Annual GW availability (mcm)	Agriculture Draft (mcm)	Dom. & Ind Draft (mcm)	Annual Gross Draft for All Uses (mcm)	Stage of GW Dev (%)	Category
BAETU	3228.03	NC	476.56	4.0633	2.0048	8.5404	10.5452		
		Saline	-	-	-	-	-		
BLOCK TOTAL (Excl. Saline)			**476.56**	**4.0633**	**2.0048**	**8.5404**	**10.5452**	**259.52**	**O.E**
BALOTRA	3471.47	NC	760.13	21.2404	23.4128	7.1061	30.5189		
		Saline	92.19	1.1614	0.1760	0.1695	0.3455		
BLOCK TOTAL (Excl. Saline)			**852.32**	**22.4018**	**23.5888**	**7.2756**	**30.8644**	**137.78**	**O.E.**
BARMER	3811.83	NC	1781.25	23.5243	1.5448	4.4328	5.9113		
		Saline	205.63	2.7185	0.1504	0.2742	0.4909		
BLOCK TOTAL (Excl. Saline)			**1986.88**	**26.2428**	**1.6952**	**4.7070**	**6.4022**	**24.40**	**SAFE**
CHOHTAN	3265.02	NC	2135.94	44.2899	34.4208	5.8926	40.3134		
		Saline	-	-	-	-	-		
BLOCK TOTAL (Excl. Saline)			**2135.94**	**44.2899**	**34.4208**	**5.8926**	**40.3134**	**91.02**	**CRITICAL**
DHORIMANNA	2668.32	NC	1528.00	38.2631	42.2208	3.1416	45.3624		
		Saline	597.06	8.5255	10.4096	1.7175	12.1271		
BLOCK TOTAL (Excl. Saline)			**2125.06**	**46.7886**	**52.6304**	**4.8591**	**57.4895**	**122.87**	**O.E.**
SINDHARI	3115.73	NC	504.69	20.0501	21.9600	1.4424	23.4024		
		Saline	573.44	19.9851	11.5840	1.7067	13.2907		
BLOCK TOTAL (Excl. Saline)			**1078.13**	**40.0352**	**33.5440**	**3.1491**	**36.6931**	**91.65**	**CRITICAL**
SIWANA	1981.52	NC	212.50	10.4935	10.9404	0.2988	11.2392		
		Saline	1212.50	46.6570	48.8832	2.2877	51.1709		
BLOCK TOTAL (Excl. Saline)			**1425.00**	**57.1505**	**59.8236**	**2.5865**	**62.4101**	**109.20**	**O.E.**
SHEO	6615.45	NC	2559.01	14.5042	8.2744	13.9559	22.2303		
		Saline	95.75	0.9818	0.0000	0.0600	0.0600		
BLOCK TOTAL (Excl. Saline)			**2654.76**	**15.4860**	**8.2744**	**14.0159**	**22.2903**	**143.94**	**O.E.**
TOTAL OF DISTRICT (Excl. Saline)			**12734.65**	**256.4579**	**215.9820**	**51.0262**	**267.0082**	**104.11**	
TOTAL OF DISTRICT (Saline)			**15441.09**	**265.8844**	**9.1955**	**3.1872**	**12.3827**	**4.66**	
O. E. – Over-exploited			NC – Non Command						


Net Groundwater Recharge Vs Gross Draft for all uses (Annual)
Recharge/ Draft (mcm)
70
60
50
40
30
20
10
0
Baetu
Balotra
Barmer
Chohtan
Dhorimanna
Sindhari
Siwana
Sheo
Block
Net GW Availability (mcm)
Gross Draft for all uses (mcm)


CATEGORY OF BLOCKS, BARMER DISTRICT
(AS ON MARCH 2004)
SHEO
BAITU
BALOTRA
BARMER
SINDRI
SIWANA
CHAUHTAN
DHORIMANNA
Over-Exploited
Critical
Safe
SCALE
0
25
50
Kilometers

5.5 Ground Water Development

Ground water is the only source of irrigation in the district. The ground water development in the district is being done by dug wells and tube wells. The present stage of ground water development in the district is 104.11%, which indicate that the scope of ground water development is already exhausted. Out of 8 blocks, 5 falls under “Over-exploited” category, 2 blocks under “Critical” category, 1 block under safe category.

Quaternary alluvium, Tertiary sandstone, Lathi sandstone, rhyolites and granites form the aquifer in different parts of the district. Ground water occurs under unconfined to semi-confined conditions. Confined conditions are also met sometimes at deeper levels in the north-western parts of the district. 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 20 to 80 m and 200 m respectively. A detail of groundwater structures is as follows:

Formation	Yield of Dug well (m^3/day)	Discharge of Bore well (lpm)	Depth (m)		Diameter		Type of pump/Water lifting devices
			Dug well	Bore well	Dug well (m)	Bore well (mm)	
Alluvium	20-100	100-300	40-60	100	2-3	200	Submersible/ Centrifugal pump
Tertiary sandstone	15-60	100-200	40-80	200	2-3	200-250	
Lathi sandstone	50-300	100-500	40-80	200	2-3	200-250	
Granite Rhyolites	10-50	50-100	20-40	80	4-5	200	

6.0 GROUND WATER DEVELOPMENT STRATEGY

6.1 Ground Water Development

The overall stage of ground water development of district as on 31.03.2004 is 104.11% (excluding saline) where as of saline ground water is 4.66%. Out of total eight blocks, 1 block (Barmer) fall in safe, 2 blocks (Chohtan, Sindhari) in critical and 5 blocks (Baetu, Balotra, Dhorimanna, Sheo, Siwana) in over-exploited categories. Nine exploratory and one observation wells in consolidated formation and 32 exploratory and 8 observation wells in unconsolidated formation are yet to be drilled in geographical gaps and unexplored areas. Deep ground water exploration especially in saline hazardous areas may be taken up to find out the aquifer geometry and also quality hazards.

6.2 Water Conservation and Artificial Recharge

Precious Groundwater resources have to be conserved for sustainable availability. Artificial recharge measure to be employed for augmenting ground water resources by roof top rain water harvesting, construction of sub surface barriers and anicuts at suitable locations. Inferior quality water can be blended with fresh water for irrigation use.

Watershed Development & Soil Conservation Department has constructed permanent (masonry) check dams under Irrigated Watershed Development Project to harvest rainwater, reduce soil erosion and check runoff velocity.

7.0 GROUND WATER RELATED ISSUES & PROBLEMS

Major part of the district is covered by hard formation such as Malani rhyolite and granite and Jalore & Siwana granites of Post Delhi. These have poor water yielding capacity. Also such areas suffer from water quality problem and in some of the areas ground water is highly saline. Villages located in such areas have the basic problem of drinking water requirement and the situation becomes very critical in summers and in drought years.

Another problem of concern in the district is that most of the potential zones have registered heavy ground water development causing lowering of water table and drying up of large number of shallow wells or reduction in their yields. Heavy decline of water level in the wells located in Lathi formation, Tertiary formation and Quaternary alluvium observed during last 10 years.

Balotra the second largest town of the district and developed as industrial center for textile processing. The textile processing industries generate industrial waste effluent, which contains toxic elements. The industrial effluent is left in river Luni. Industrial effluent has caused ground water pollution in down stream of the river Luni.

8.0 RECOMMENDATIONS

1. Heavy Ground water withdrawal from potential zones areas of Balotra, Dhorimanna, Sheo and Siwana for agriculture use, where stage of ground water development has reached more than 100%, it has to be controlled by preventing further development.

2. Awareness program to educate about conservation of precious ground water resources and training on rainwater harvesting will be beneficial to check decline in water level and justified use.

3. Financial assistance for ground water development in over-exploited, critical and semi-critical area should not be encouraged.

4. Use of water saving devices like sprinklers, close field distribution channels etc. should be promoted.

5. Modern agricultural management techniques have to be adopted for effective and optimum utilization of the water resources. This can be achieved by maintaining irrigation through minimum pumping hours as per minimum requirement of water by the crop and also selecting most suitable cost effective crop pattern.

6. High water requirement crops to be discouraged. Proper agriculture extension services should be provided to the farmers so that they can go for alternate low water requirement economical crops.

7. Salt resistant crops can be sown in the area having brackish to saline ground water.

8. Barmer block, which falls under safe category further ground water development is suggested in this area through financial institutions.

9. A close network of Piezometers should be established in over exploited and areas of heavy ground water development to precisely watch changes in ground water level for further planning.

10. In the Tertiary and Lathi formation areas of the district deep ground water exploration is suggested by suitable rigs.

11. Over a large part of the district, ground water quality is saline. Systematic ground water exploration is needed in such areas to locate fresh water pockets if any and yielding zones to meet water supply demand.

12. Traditional rainwater harvesting structures like Tankas, roof top rain water storage should be encouraged for day to day requirements which will reduce ground water draft.

13. Industrial effluent should be treated before being discharged in Luni River through an effluent treatment plant and to be recycled for industrial use.

14. Large-scale recharge potentials exist in depleted aquifers. Mega ground water recharge to such areas through outside surface water sources like lift canal from IGNP system or floodwater during excess rainy years be implemented.

15. Small check dams or earthen dams, 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.

16. Ground water Legislation should be framed and implemented for regulation and control of Ground water abstraction in over-exploited areas with immediate effect.

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