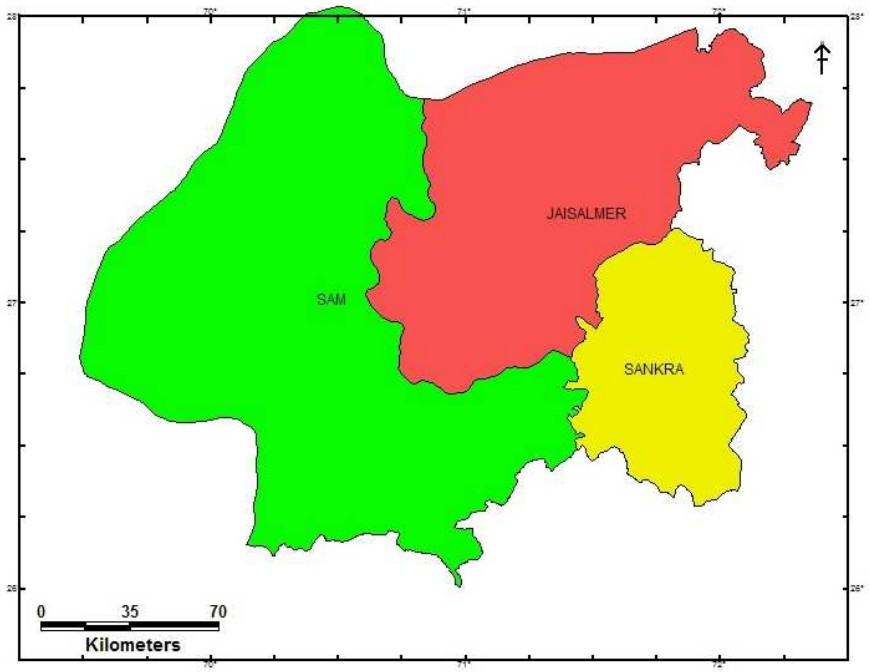
GOVERNMENT OF INDIA
MINISTRY OF WATER RESOURCES
CENTRAL GROUND WATER BOARD

GROUNDWATER SCENARIO



JAISALMER DISTRICT, RAJASTHAN

Western Region
Jaipur
2013

DISTRICT AT A GLANCE – JAISALMER DISTRICT, RAJASTHAN

S. No.	Item	Information	
1	**GENERAL INFORMATION**		
	(i) Geographical area (sq km)	38401	
	(ii) Administrative Division (As on 31.3.2007)		
	Number of Tehsils	03	
	Number of Blocks	03	
	Number of Villages	756	
	(iii)Population (As per 2011 Census)	669919	
	(iv)Average Annual Rainfall(2001-2011)	206 mm	
2	**GEOMORPHOLOGY**		
	Major Physiographic Units	Sand Dunes, Aeolian & Alluvial plains, Ridges and Hillocks.	
	Major Drainage	No major river except ephemeral nallas	
3	**LAND USE (ha) (2010-11)**		
	Forest area	44873	
	Land not available for cultivation	511152	
	Other uncultivated land excluding fallow land	2451331	
	Fallow land	106113	
	Net sown area	725685	
	Total cropped area	877585	
	Area sown more than once	151900	
4	**MAJOR SOIL TYPE**	Desert soil, sand dunes, red desertic soil, saline soil of depressions and lithosols	
5	**AREA UNDER PRINCIPAL CROPS** (AS ON 2010-11)	**Crops**	**Area under crop (ha)**
		Bajra	191205
		Jowar	2552
		Pulses other than gram and tur	13140
		Rapeseed & Mustard oil seeds	69288
		Wheat	15127
		Groundnut	11221
		Gram	79529
		Condiments & spices	16292
6	**IRRIGATION BY DIFFERENT SOURCES**		
	Source	Net irrigated area (ha)	Gross irrigated area (ha)
	Tubewells	41878	75484
	Other wells	569	598
	Canals	58860	156384
	Other sources	22	22
	Total	101329	232488

S. No.	Item	Information
7	**NUMBER OF GROUND WATER MONITORING WELLS OF CGWB** (As on March 2012)	
	Number of Dug wells	33
	Number of Piezometers	29
8	**PREDOMINANT GEOLOGICAL FORMATIONS**	Aeolian sand, Alluvium, Tertiary Sandstone, Lathi, Jaisalmer, Baisakhi, Badesar, Parewar and Haboor formations, Granite (Post Delhi)
9	**HYDROGEOLOGY**	
	Major water bearing formation	Quaternary Alluvium, Tertiary Sandstone, Lathi sandstone, Jaisalmer sandstone, Badesar sandstone, Parewar sandstone and Granite
	Depth to water level (Pre-monsoon, 2011) (mbgl)	1.85 – 108.86
	Depth to water level (Post-monsoon, 2011) (mbgl)	1.24 – 116.1
10	**GROUNDWATER EXPLORATION BY CGWB** (As on 31.3.2012)	
	Number of wells drilled (EW, OW, SH, PZ)	EW – 96, OW- 17, SH- 16, PZ- 20
	Depth Range (m)	7 – 422.45
	Discharge (liter per second)	2– 3859
	Transmissivity (m^2/day)	397 – 2211
	EC µS/cm at 25^0C	18 – 38800
11	**GROUND WATER QUALITY**	
	Presence of chemical constituents more than permissible limit (EC>1500 µS/cm at 25° C, F>1.5 mg/l, NO_3> 45 mg/l)	EC, NO_3, F
12	**DYNAMIC GROUND WATER RESOURCES (March, 2009) in MCM**	
	Annually replenishable ground water resource	72.1216
	Net Ground Water Availability	68.3625 excluding saline
	Net Annual Ground Water Draft	94.5896 excluding saline
	Stage of Ground Water Development	138.36 %
13	**GROUND WATER CONTROL AND REGULATION**	
	Number of Over-exploited blocks	02
	Number of Critical Blocks	Nil
	No of Blocks Notified	Nil
14	**MAJOR GROUND WATER RELATED PROBLEMS AND ISSUES**	Water level decline, quality problem, less recharge due to less and uneven rainfall
15	**MASS AWARENESS AND RAIN WATER HARVESTING TRAINING PROGRAMMES CONDUCTED BY CGWB**	Mass Awareness Program- one (Jaisalmer) Training Program -Nil

Ground Water Information
Jaisalmer District

Contents

List of Figures

List of Tables

Ground Water Information
Jaisalmer District

1.0 Introduction

District Jaisalmer is located within a rectangle lying between 26°.4' – 28°.23' north parallel and 69°.20'-72°.42' east meridians. Covering an area of 38,401 sq km, it is the largest district of Rajasthan and one of the largest in the country. The breadth (East-West) of the district is 270 km and the length (North-South) is 186 km. The length of international border attached to District is 471 Kms. The district is bound by Pakistan on its North and West, Barmer on South, Jodhpur on East and Bikaner on North-East. Population of the district is 669919 and density of population is 17 persons per sq.km. Administrtaive map of Jaisalmer district is presented in Fig. 1.

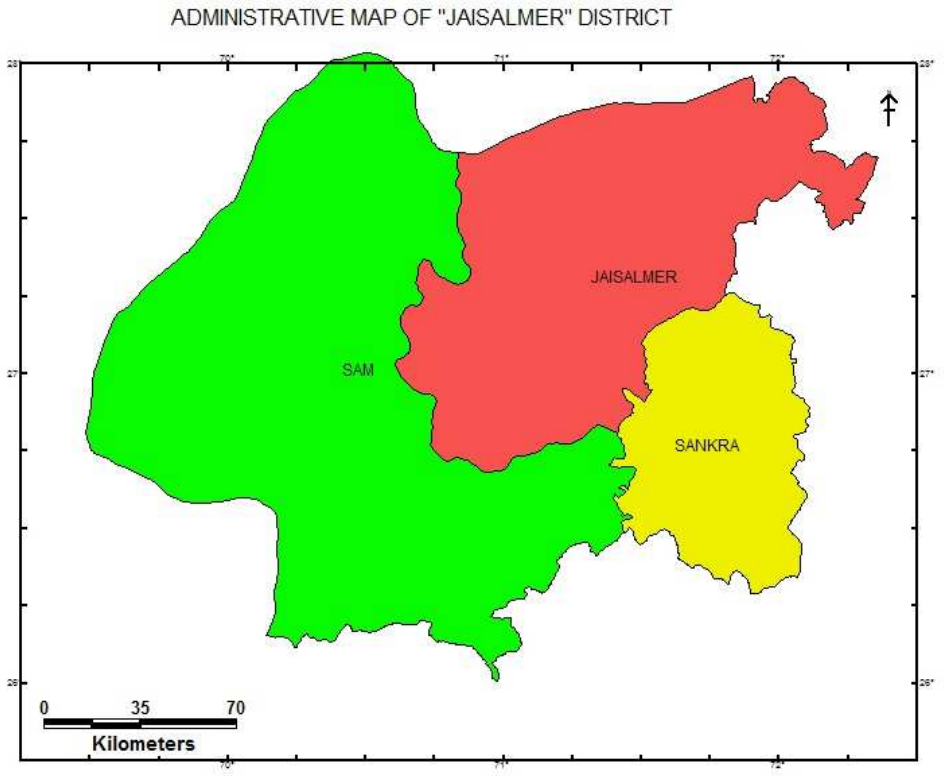


Fig. 1: Administrative map of Jaisalmer district

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 during 2003-04. Ground water exploration and construction of tubewells was taken up under UNDP Phase I (1967-71) in Lathi basin in the district. During this project, a number of production wells were constructed. Central Ground Water Board has so far drilled 96 exploratory wells, 17 observation wells, 16 slim holes and 20 piezometers. Since 1973, monitoring of water levels is being carried out four times a year during the months of January, May, August and November. Samples for water quality analyses are collected during the month of May. Ground water regime is being monitored through 62 National Hydrograph

Network Stations. Salient features of ground water exploration in the district are given in Table 1.

Table 1: Salient features of ground water exploration in Jaisalmer district

Type of well	No.	Depth drilled (m)	SWL (m)	Transmissivity (m^2/day)	Discharge (lpm)	EC (micromhos/cm) at 25°C
EW	96	7 – 422.45	-2.84 – 135	397 - 2211	2 – 3859	18 – 38800
OW	17	64 – 333.2	-2.84 – 103.21		100 – 2000	1510 - 9200
PZ	20	59 – 383.13	9.9 – 130		19.8 - 3027	870 – 7430
SH	16	104.99 – 607.47				1524 – 6522

2.0 Rainfall & Climate

The district experiences arid type of climate. Normal rainfall in the district during the period 1951-2000 is 181mm. Mean annual rainfall during the period 2001 – 2011 has been higher than the normal rainfall. Annual rainfall data of the district is given in Table 2. 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, extremes of heat in summer and cold in winter are the characteristic of the desert. Both day and night temperatures increase gradually and reach their maximum in May and June. The temperature varies from 48 degrees 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 in the month of June and lowest in the month of December.

Table 2: Annual rainfall data of Jaisalmer district (2001 – 2011)

(Rainfall in mm)

Station	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Average
Fatehgarh	333.0	44.5	324.0	148.0	190.0	527.0	187.0	342.0	97.0	396.0	493.0	280.14
Jaisalmer	321.0	63.0	178.0	47.3	220.5	512.8	195.2	173.5	91.0	309.0	277.0	217.12
Nokha	155.0	48.0	209.0	91.0	275.0	59.0	385.0	181.0	175.0	395.0	326.0	209.00
Pokaran	294.3	48.5	194.0	85.0	154.0	141.0	401.0	423.0	84.0	540.0	487.0	259.25
Ramgarh	121.0	9.0	212.0	29.0	57.0	157.0	178.0	139.0	100.0	386.0	162.0	140.91
Sam	79.0	51.0	163.0	77.0	114.0	256.0	184.2	88.0	64.5	226.5	104.0	127.93
Average	217.2	44.0	213.3	79.6	168.4	275.5	255.1	224.4	101.9	375.4	308.2	205.73

3.0 Geomorphology & Drainage

Jaisalmer district is a part of the 'Great Thar Desert'. The terrain around Jaisalmer town, within a radius of about 60 km is stony and rocky. The area is barren, undulating with its famous sand dunes. There are no rivers worth the name in the area nor are there any perennial streams in the area. Small nallas are purely seasonal and ephemeral with the result that there is lack of effective discharge in the event of heavy precipitation.

4.0 Soil, Land Use & Irrigation Practices

Soils of the district are classified as follows:

- 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 occurring in major part of the district.
- Sand dunes: These are non-calcareous soils, sandy to loamy sand, loose, structure less and well drained. These occupy northern, western, southwestern, northeastern parts of the district.
- 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. These soils occur in eastern, central and southeastern parts of the district.
- Saline soil of depressions: This type of soil is 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.

4.1 Land-use Pattern

The total reported area as per data available with Dte. of Economics & Statistics, Ministry of Agriculture, GOI as on 2010-11 is 383914 hectares. The district is poor in forest cover, with forests occupying only 11.7 % of the total reported area of the district. Agriculture is the main occupation of the rural population in the district. Net cultivable area of the district is 725685 hectares whereas nonagricultural land area including fallows land is 2661075 hectares. The land use pattern is given in Table 3.

Table 3: Land use pattern in Jaisalmer district (2010-11)

S. No.	Item	Area covered (ha)
1	Total Reporting area	3839154
2	Area under Forest	44873
3	Land not available for cultivation	511152
4	Permanent pasture and other grazing lands	103631
5	Land Under miscellaneous tree crops & groves not included the net area sown	298
6	Cultivable waste land including fallow land	2453515
7	Net area sown	725685
8	Area sown more than once	151900
9	Gross Cropped Area	877585

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 21% of the net sown area is being utilized 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.

4.2 Irrigation and Water Resources

Ground water and IGNP canal are the only source of irrigation in the district. Maximum irrigated area is in Jaisalmer block. Minimum area under irrigation is in Sankara block due to poor ground water potential.

Indira Gandhi Canal enters Jaisalmer district near village Nachana and flows towards western direction. It has a command area falling to the north of the canal. At Mohangarh, the main canal ends and further westward extension of canal is known as Sagarmal Gopa Branch which takes southward bend near Ramgarh and is called Gadra Road Sub Branch. Major irrigation in the area is through Nachana Branch System, Sagarmal Gopa Branch System, Shaheed Birbal Shakha System and part of Charanawala Branch System.

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 granite followed by Mesozoic and Tertiary formations consisting of sandstone, shale, conglomerate. Mesozoic formations comprise of Lathi, Jaisalmer, Baisakhi, Bhadesar and Parewar formations. Abur formation of Cretaceous age, Sanu sandstone, Bandha and Khuiala limestone of Tertiary period are also present in the district. These formations are overlain by Pleistocene to Recent alluvium consisting mainly of clay, sand and silt.

5.2 Hydrogeological Set Up

Hydrogeological formations forming aquifer in the district vary from Proterozoic to Quaternary in age (Fig. 2). The main water bearing formations in the district are granites, Lathi sandstone, Tertiary sandstone and Quaternary alluvium. In Quaternary alluvium, ground water occurs under semi-confined to unconfined conditions, in semi- consolidated Tertiary and Mesozoic formations, it occurs under unconfined to confined conditions and in weathered and fractured zones in hard rocks, it occurs under phreatic conditions. Hydrogeological characteristics of aquifers in Jaisalmer district are briefly described in Table 4.

Table 4: Hydrogeological characteristics of aquifers in Jaisalmer district

Age	Formation	Lithology	Aquifer Disposition
Quaternary	Unconsolidated	Aeolian sand & alluvium comprising of gravel, sand, silt, kankar & clay	Fairly thick, discontinuous, regionally extensive, unconfined to confined aquifer down to 300 mbgl
Cenozoic to Mesozoic	Semi-consolidated	Sandstone, shale with intercalated limestone, siltstone, claystone, Lathi Sandstone and shale	Thick, discontinuous unconfined to confined aquifer down to 390 mbgl. Thick, discontinuous, unconfined to confined Lathi aquifer down to depth 440 mbgl
Lower Paleozoic to Upper Proterozoic	Consolidated sedimentaries (Marwar Super-group)	Sandstone, limestone, shale	Discontinuous unconfined to confined aquifer down to 300 mbgl
Proterozoic	Consolidated intrusives	Granite	Ground water restricted to weathered residuum, fractures joints. Discontinuous unconfined aquifer down to 80 mbgl.

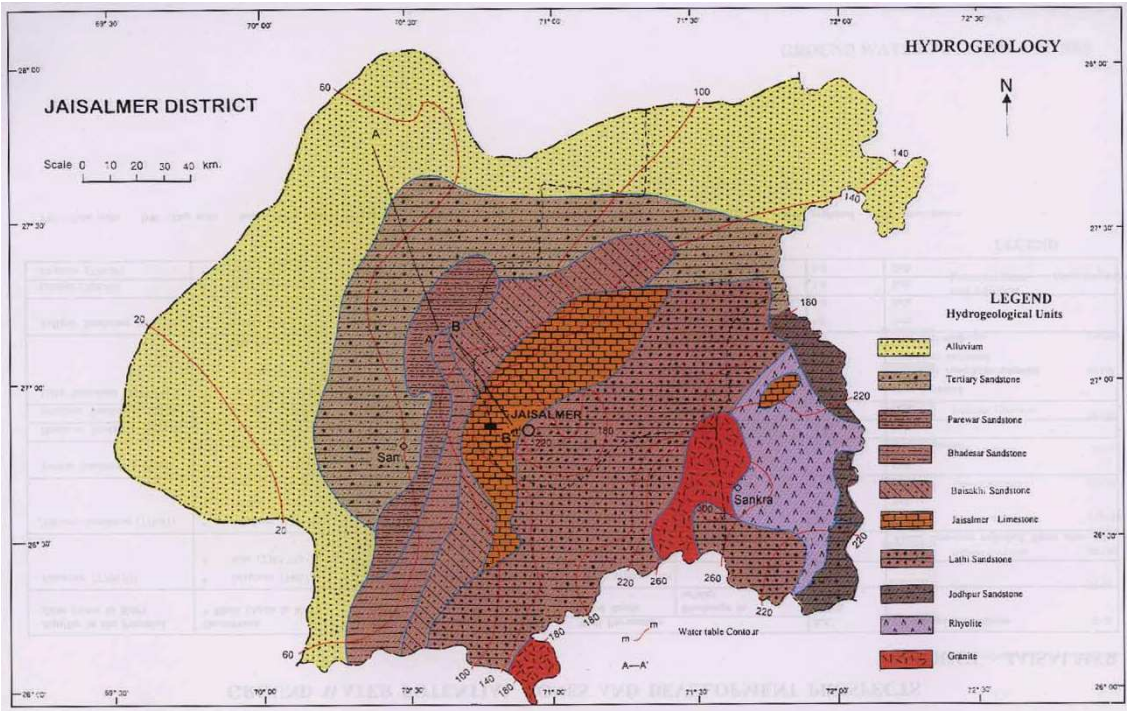


Fig. 2: Hydrogeological map of Jaisalmer district

Ground water conditions in different hydrogeological units are discussed below.

Granites

Granites form aquifer system in southeastern part of Jaisalmer district. They are practically impervious and ground water is restricted to the weathered residuum, fractures, joints etc. Bored wells fitted with hand pump and large diameter dug wells are feasible only at selective locations.

Marwar Super Group

The consolidated sedimentary formations belonging to Marwar Super Group (Upper Proterozoic to lower Palaeozoic) consisting of sandstone, shale and limestone form aquifer in eastern part of Jaisalmer district. Ground water occurs in primary porosity of sandstone and secondary porosity of sandstone and limestone. Depth to water level varies from 45m to 60m and yield of wells varies from 1 to 3 litres per second (lps).

Cenozoic & Mesozoic formations

The semi-consolidated formations belonging to Mesozoic and Cenozoic groups comprise of Lathi formation, Jaisalmer formation, Baisakhi formation, Bhadesar formation, Parewar formation, Abur formation and Tertiary formation.

Lathi sandstone is the most productive aquifer system in the district. Lathi basin covers an area of 7500 sq km, out of which only 3270 sq km area has usable quality of ground water. 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 supplies water locally to villages. The depth to water level and piezometric head ranges from 30 to over 120 m. The perched water table occurs between 6 and 30 mbgl. The piezometric surface is shallower in area north of Jaisalmer-Pokaran road due to topographic depression.

The piezometric surface ranges from 540 m amsl near Bhopa to about 490 m amsl north of Jaisalmer-Pokaran road and south of Jaisalmer. The piezometeric gradient ranges from 0.1 m/km to 1.6 m/km.

Three saturated zones are encountered in the depth range of 67-100m, 150-200m & 240-280m. Depth to water level ranges from 30 m to 125 m. Transmissivity of Lathi aquifer ranges from 100 to 2000 m^2/day. Yield of wells varies from 20 to more than 40 lps Quality of ground water is generally fresh except in peripheral area of the basin. Lathi aquifer can sustain medium to high capacity tube wells.

Jaisalmer formation forms aquifer in the central part of Jaisalmer district. In limestone and sandstone with shale intercalations, ground water occurs under unconfined to confined conditions. Artesian ground water conditions occur around Rupsi, Ramkunda Pohara and Baramsar villages. Depth to water level varies generally from 10 to 70 m. Yield of the formation is generally less than 5 lps.

Baisakhi, Bhadesar, Parewar & Abur formations are predominantly clayey and shaley. These formations do not form hydrogeologically significant units. They form aquifers in small isolated patches only. Depth to water level varies from 20 to more than 100 m. Yield of formations is generally less than 4 lps.

Tertiary formations comprising of Sanu, Khuiala and Bandha formations are predominantly argillaceous in nature consisting of fine grained sandstone, limestone, shale, clay, fuller's earth and gypsum. The major part of the formation contains saline ground water. Tertiary sandstone forms potential aquifer in Sanu area of district. Depth to water level varies from 50 to more than 80 m. Yield of the formation is generally less than 10 lps.

Quaternary formation

Quaternary sediments comprising of unconsolidated aeolian sand and alluvium are important due to their widespread occurrence. The sediments are comprised of sand, silt, clay, gravel, calcareous and ferruginous concretions and occur in northern, western and southern parts of the area. Sand, gravel and admixture of these form fairly thick, extensive, discontinuous potential aquifers in western and northern parts of Jaisalmer district. However a major part of alluvium contains saline ground water. Ground water occurs under unconfined to confined conditions down to 300 mbgl. The perched water table condition occurs at shallow depth in clay beds and *kankars* which arrest the rain water of local precipitation. The Depth to water level varies from less than 10 m to more than 60 m and becomes shallower towards the northwest. Yield of the wells is generally less than 10 lps.

5.3 Groundwater System Behaviour

5.3.1 Depth to water level

During pre-monsoon (May, 2011), the depth to water level in the district varied largely from 1.85 to 108.86 mbgl. Over a major part of the district, water levels are deeper (more than 20 m). Water levels more than 40 m were recorded in northern and southern parts of the district. Shallow water levels less than 10 m have been registered in localized pockets in the district (Fig. 3).

During post-monsoon period (November, 2011), the depth to water level varied from 1.24 to 116.1 mbgl. Wells in major parts of Jaisalmer and Sam blocks registered water levels deeper than 40 mbgl (Fig. 4).

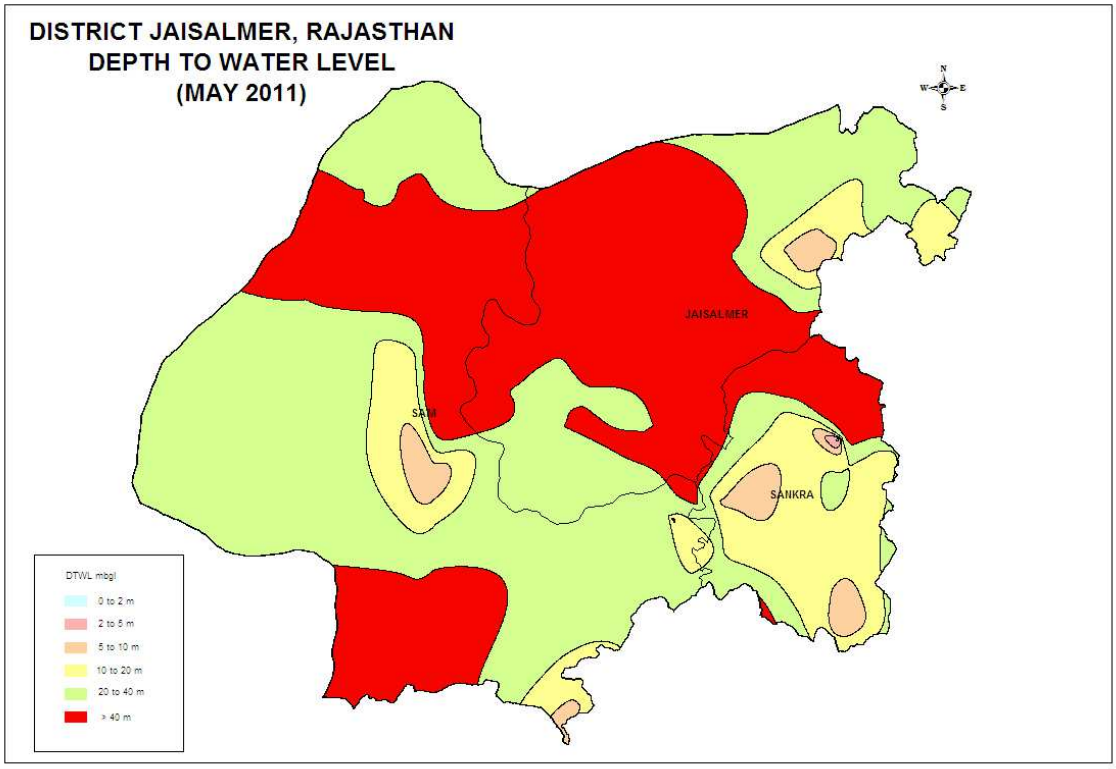


Fig. 3: Depth to water level map (May, 2011)

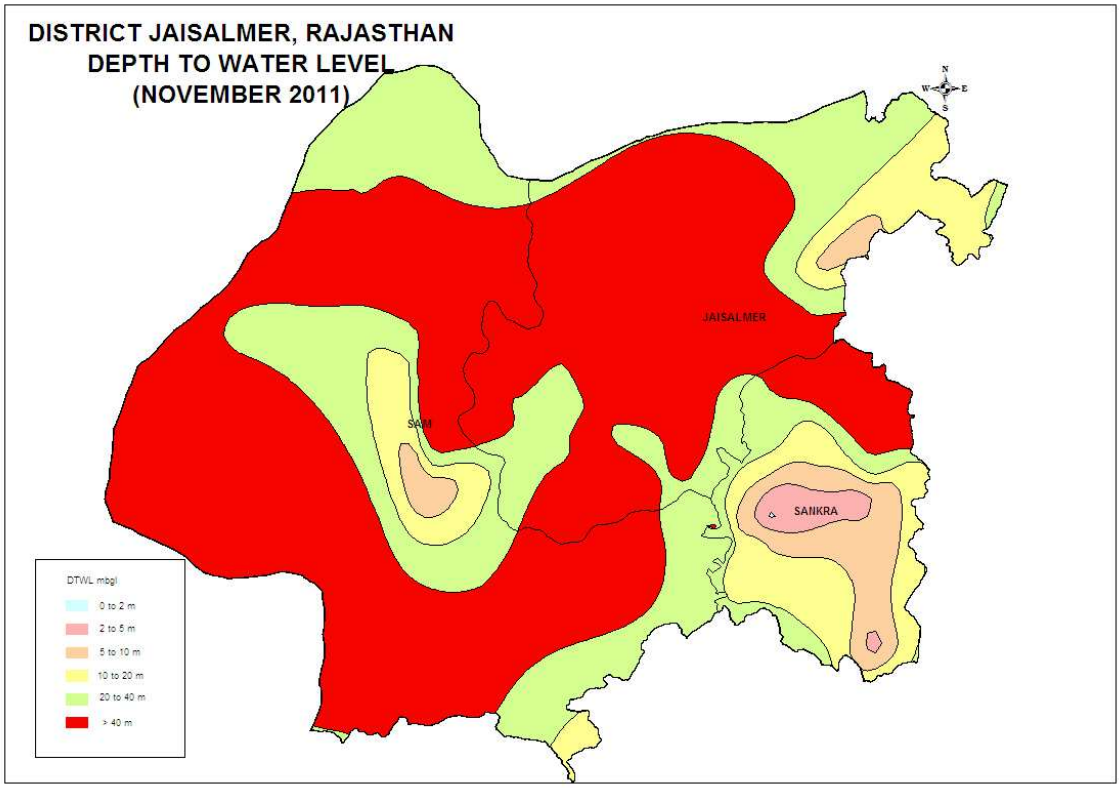


Fig. 4: Depth to water level map (November, 2011)

5.3.2 Seasonal Water Level Fluctuation

Analysis of water level data of Premonsoon and Postmonsoon period during 2011 indicates that 65% of the wells monitored have registered rise in water levels and the

remaining 35% wells have registered fall. Rise of 0-2 m has been observed in 38 % wells, 2-4 m in 12% wells and more than 4 m in 15% of wells. Fall of 0-2 m has been registered in 30 % wells and the remaining 5 % wells have registered fall of 2 to 4 m (Fig. 5).

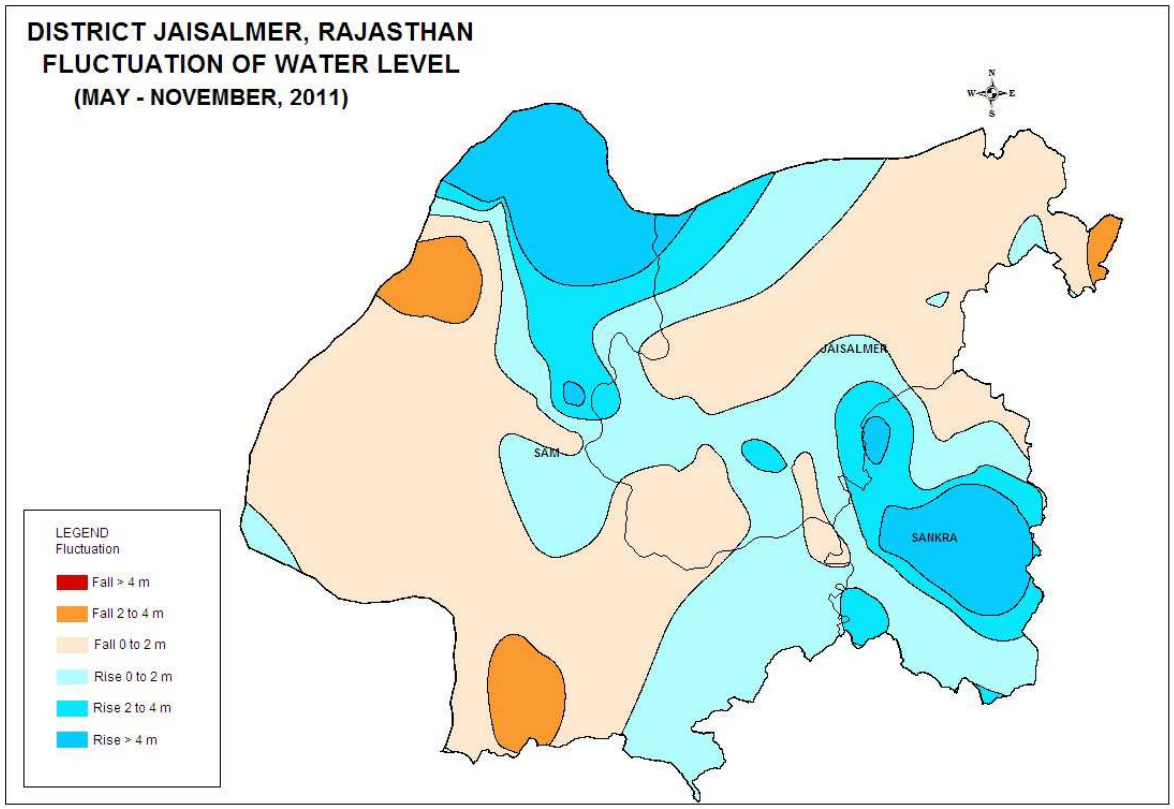


Fig. 5: Seasonal water level fluctuation map (May – November, 2011)

5.3.3 Long term water level fluctuation

Analysis of decadal pre-monsoon water level data for the period May 2002- 2011 indicates that, in general, declining trend in water levels has been registered in most parts of Jaisalmer and Sankara blocks and some part of Sam block. The maximum decline was in Jaisalmer block while maximum rise was recorded in Sam block. The declining trend ranges from 0 to 25 cm/ year while the rising trend varies from 0 to 50 cm/year (Fig. 6).

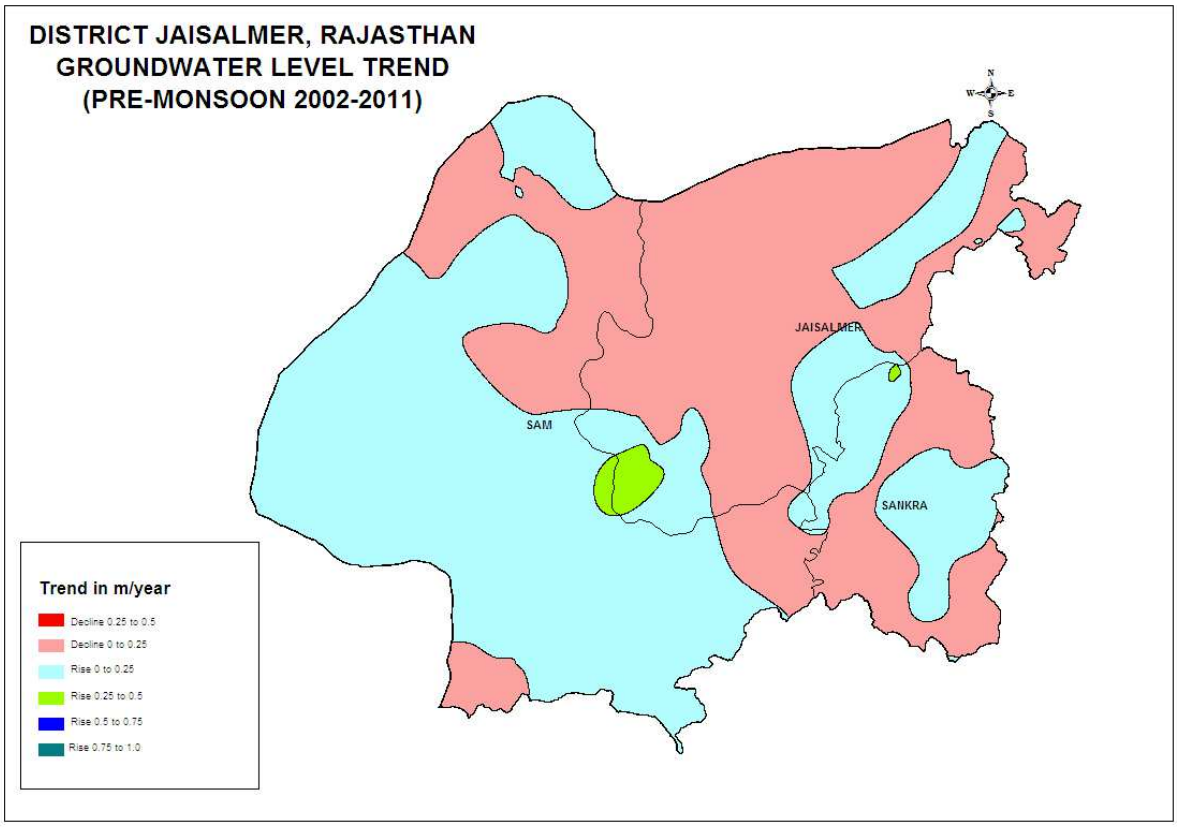


Fig. 6: Decadal pre-monsoon water level trend map (May, 2002 – May, 2011)

6.0 Ground Water Quality

The single most important criteria of ground water quality is salinity, which at the very first instance determines whether the water can be used for drinking and domestic purposes. The quality of ground water in the area varies largely from fresh to saline. There is a wide range in the salinity of ground water in the phreatic and confined aquifers.

In Jaisalmer district, Electrical Conductivity (EC) varies from 870 µS/cm at 25°C at Khuiyala to 9800 µS/cm at 25°C at Kharia Kua. The eastern, western and southern parts have comparatively better quality of water where EC is less than 3000 µS/cm at 25°C (Fig. 7). The quality of ground water in northern, northwestern and southeastern parts of the district is saline. In Lathi formation area of Jaisalmer district, ground water quality is generally fresh except in peripheral areas of the basin. As the Lathi aquifer acts as a single hydraulic unit, vertical variation in quality is minimal and ground water is fresh at all levels. In Ranau-Ghantiyali, Tanot-Kishangarh, Longewala-Ghotaru area in northwestern part of the district, fresh water zone overlies saline zones at places. In a small area northeast of Jaisalmer town, quality of deeper aquifers is better than phreatic zone. Chloride concentration has been found to vary in accordance with EC from 99 – 2935 mg/l.

Fluoride content in ground water varies from 0.3 mg/l at Khudi to 4.23 mg/l at Bhadriyas. High fluoride area (greater than 1.5 mg/l fluoride) exists in northeastern and eastern parts of the district covering major part of Sankara and northern half of Jaisalmer block (Fig. 8).

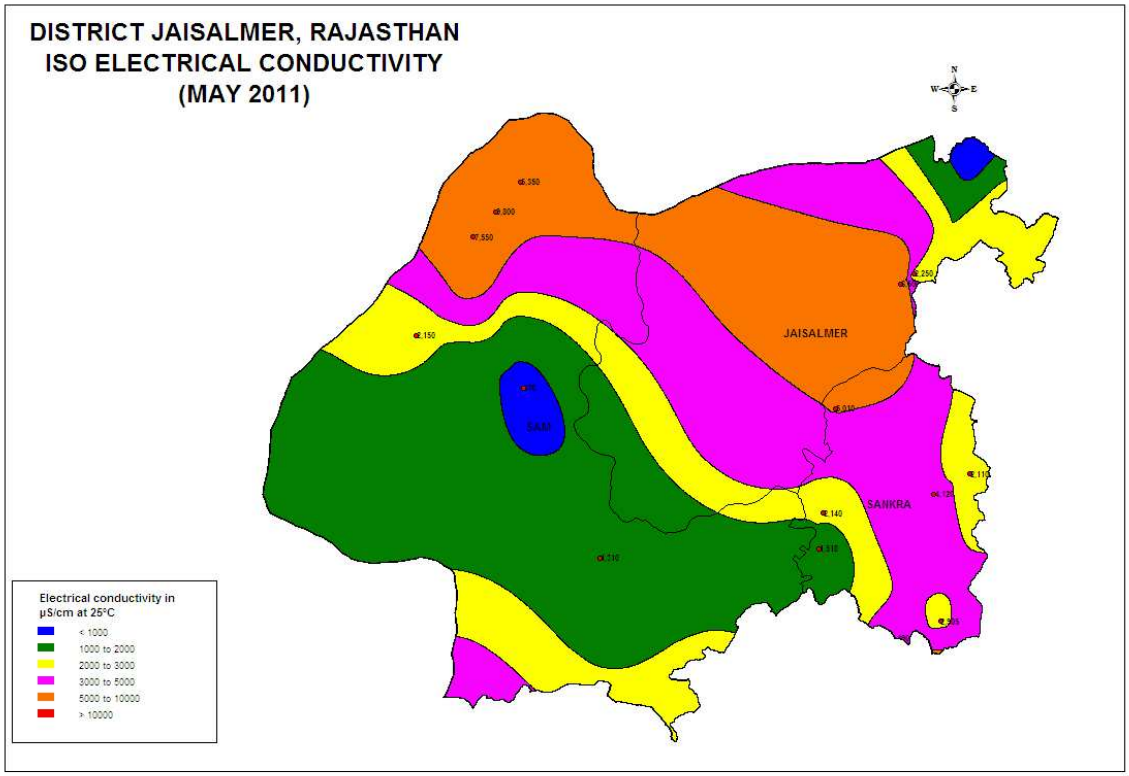


Fig. 7: Iso Electrical Conductivity map of Jaisalmer (May, 2011)

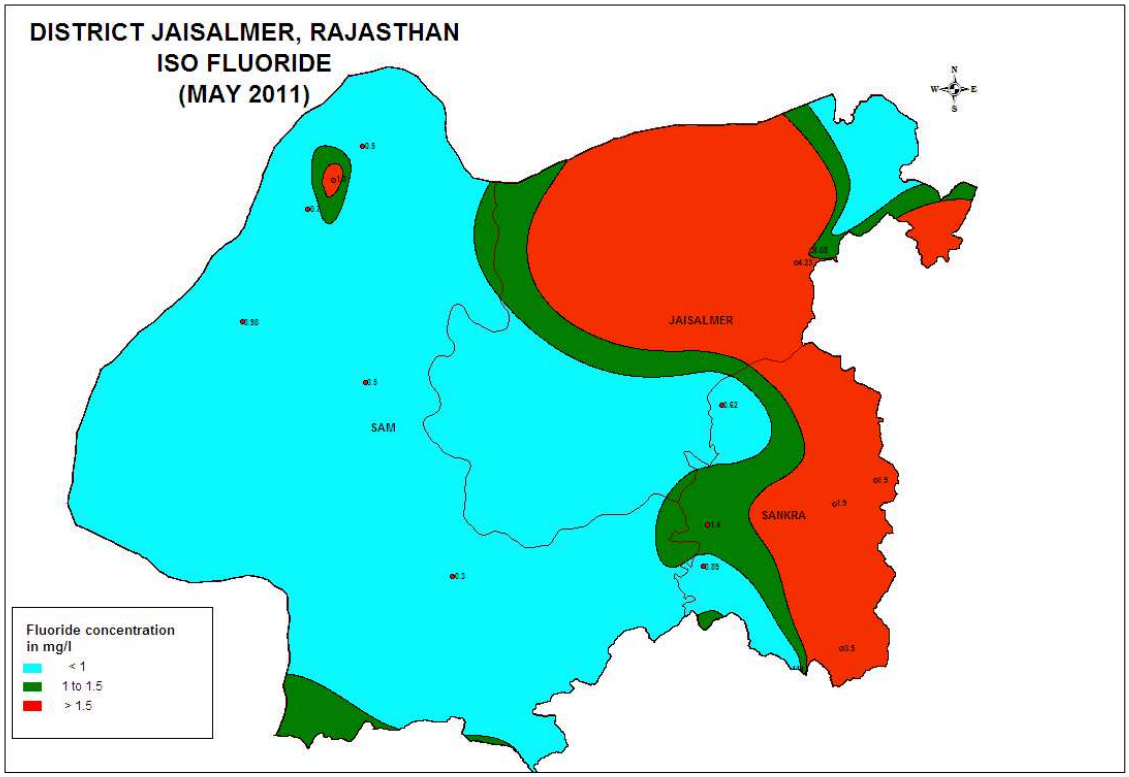


Fig. 8: Iso Fuoride map of Jaisalmer (May, 2011)

Iron content in ground water has been found to vary from 0.04 mg/l at Lawa to 2.1 mg/l at Bhaisada. Iron concentration in excess of maximum permissible limit of 1 mg /l has been observed in localized pockets in Jaisalmer block and adjoining areas of Sam and Sankara blocks in the southern part of the district (Fig. 9).

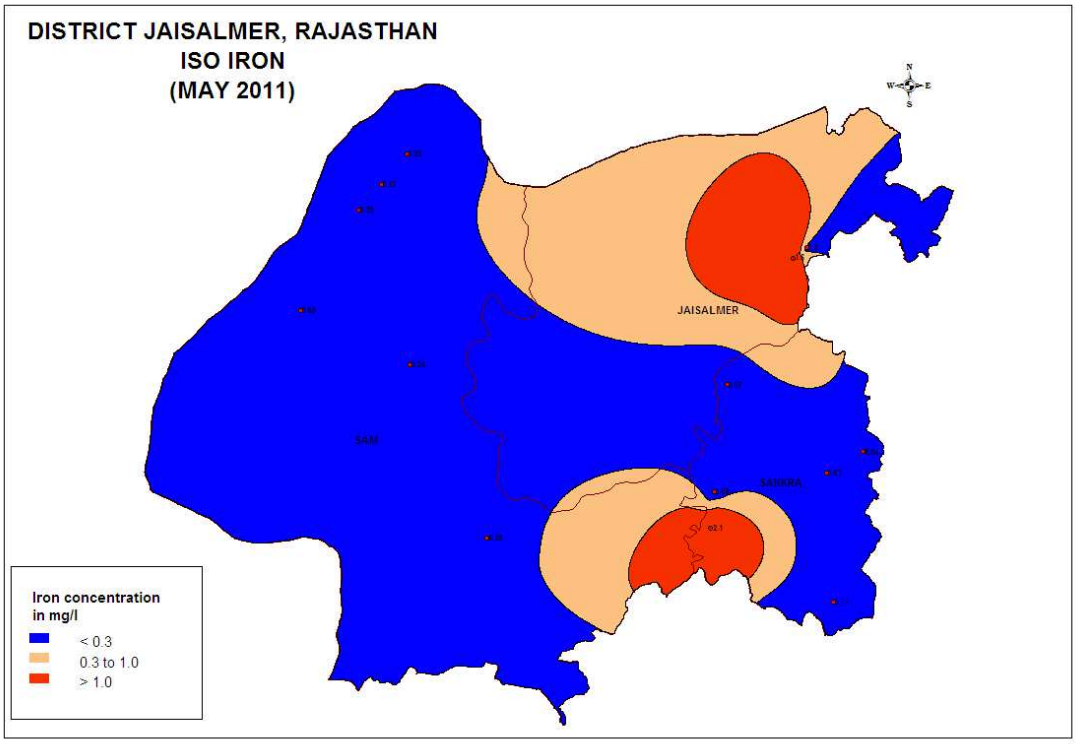


Fig. 9: Iso Iron map of Jaisalmer (May, 2011)

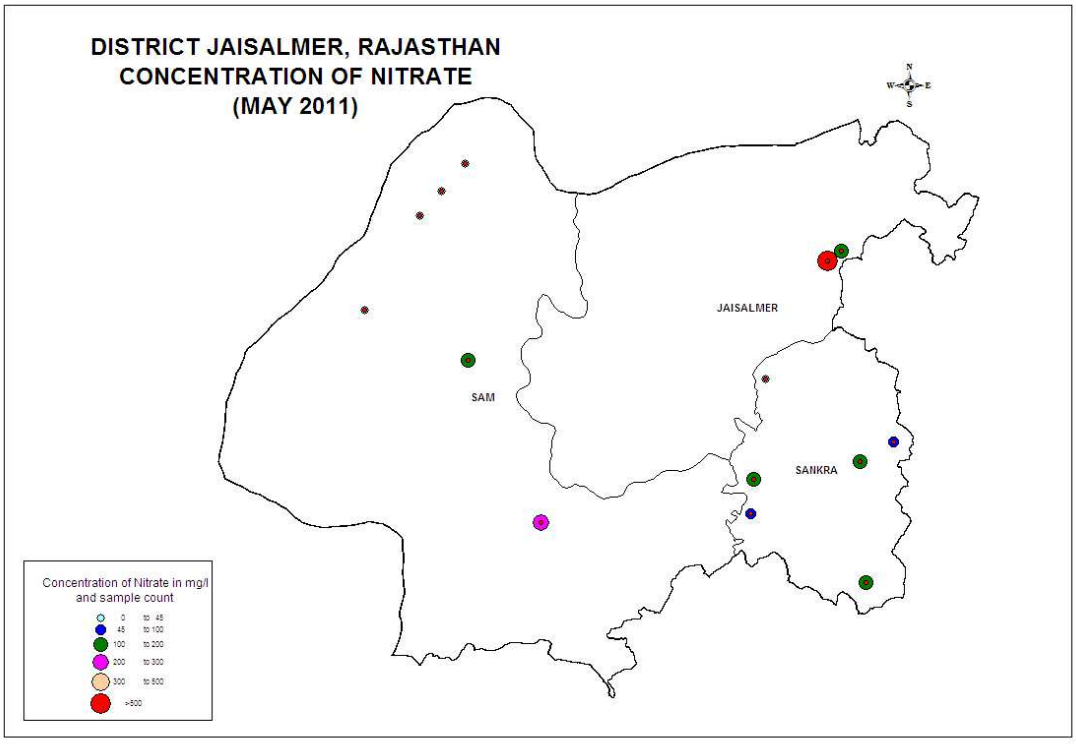


Fig. 10: Nitrate distribution map of Jaisalmer (May, 2011)

Nitrate concentration in ground water has been found to vary from 10 mg/l at Lawa to 229 mg/l at Khudi. In about 64% of the samples analysed, nitrate in excess of the maximum permissible limit of 45 mg/l has been reported (Fig. 10).

7.0 Ground Water Resources

Central Ground Water Board and Rajasthan Ground Water Department (RGWD) have jointly estimated the ground water resources of Jaisalmer district (as on 2009) based on GEC-97 methodology. Ground Water Resource estimation has been carried out for 12090 sq. km. area excluding saline area. The total annually replenishable resource of the district has been assessed to be 72.1216 MCM and net annual ground water availability has been estimated to be 68.3625 MCM. Gross annual ground water draft for all uses has been estimated to be 94.5896 MCM with stage of ground water development at 138%. Ground water resources of saline areas falling in all the three blocks have been assessed separately. Annually replenishable saline ground water resource has been assessed to be 163.1824 MCM and net annual saline ground water availability has been assessed to be 150.2323 MCM against which gross ground water draft has been estimated as only 3.2877 MCM with stage of ground water development at only 2.19%. Block wise availability of annually replenishable fresh ground water resources are given in Table 5.

Table 5: Ground water potential of Jaisalmer district (As on 2009)

Block	Area of Block	Type of Area	Potential Zone Area	Net Annual Ground Water Availabi-lity	Existing Gross Ground Water Draft for Irrigation	Existing Gross G.W. Draft for Dom. & Ind. Use	Existing Gross Ground Water Draft for all uses	Stage of G.W. Develo-pment.	Category
	(Sq.Km.)		(Sq.kms)	(mcm)	(mcm)	(mcm)	(mcm)	(%)	
Jaisalmer	11505.00								
Total of block (Excl. Saline)		NC	2510.22	22.9984	39.2592	10.1576	49.4168	205.92	O.E.
Saline			8994.78	70.8921	0.0000	0.3825	0.3825		
Sam	21111.00								
Total of block (Excl. Saline)		NC	7960.65	26.3869	6.0335	9.8921	15.9256	60.35	Safe
Saline			13150.35	46.1285	1.5325	0.4500	1.9825		
Sankra	5529.00								
Total of block (Excl. Saline)		NC	1619.17	17.9773	24.2556	4.9917	29.2473	162.69	O.E.
Saline			3909.83	33.2116	0.5150	0.4034	0.9237		
Total of District (Excl. Saline)			12090.04	68.3625	69.5483	25.0413	94.5896	138.36	
Total of District (Saline)			26054.96	183.4438	2.0475	1.2359	3.2887	2.19	
O. E. – Over-exploited NC – Non Command									

8.0 Status of Ground Water Development

Ground water and canal water are the principal sources of irrigation in the district. Ground water development in the district is being done by dug wells and tube wells. The stage of ground water development in various blocks of Jaisalmer district varies

from 60 to 206 percent which indicates that the scope for ground water development is already exhausted, mainly in Jaisalmer and Sankara blocks. Only Sam block falls in safe category and has scope for further ground water development. The major part of the block has saline quality of ground water. Therefore, ground water resource needs to be developed in systematic manner for domestic use only. Out of 3 blocks, 2 fall under "Over-exploited" category and 1 block falls under safe category.

9.0 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 the most potential aquifer i.e. Lathi formation has witnessed 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 has been observed during last 10 years.

10.0 Ground Water Management Strategy

10.1 Ground Water Development

Quaternary alluvium, Tertiary sandstone, Lathi sandstone 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 northwestern part of the district. Depth and diameter of the dug well and bore well depend on formation and geomorphology. However, general depth of dug well and bore well ranges from 20 to 80 m and 250 m respectively. Formation wise details of ground water structures are given in Table 6.

Table 6: Formation wise details of ground water abstraction structures

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	200-300	
Lathi sandstone	50-300	100-500	40-80	200	2-3	200-400	
Granite	10-50	50-100	20-40	80	4-5	200	

10.2 Water Conservation and Artificial Recharge

Precious Groundwater resources have to be conserved for sustainable availability. Artificial recharge measures need 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 rain water, reduce soil erosion and check runoff velocity.

11.0 Recommendations

- Heavy ground water withdrawal from potential zone areas of Chandan - Bhairawa - Lathi area for agriculture and drinking use, where stage of ground water development has reached more than 100%, has to be controlled by preventing further development.
- Awareness programme to educate about conservation of precious ground water resources and training on rain water harvesting will be beneficial to check decline in water level and justified use.
- Financial assistance for ground water development in over-exploited, critical and semi-critical area should not be encouraged.
- Use of water saving devices like sprinklers, close field distribution channels etc. should be promoted.
- 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.
- 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.
- Salt resistant crops can be sown in the area having brackish ground water.
- In Sam block, which falls under safe category, further ground water development, is suggested through financial institutions.
- In areas underlain by Tertiary and Lathi formations, deep ground water exploration is suggested by suitable rigs.
- 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.
- Large-scale recharge potential exists 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.
- Small check dams or earthen dams, at suitable sites, may be constructed to store rainwater. This will increase recharge to ground water which will ultimately result in increase of yield of wells.