GOVERNMENT OF INDIA

MINISTRY OF WATER RESOURCES

CENTRAL GROUND WATER BOARD

GROUND WATER INFORMATION
JHALAWAR DISTRICT

RAJASTHAN

WESTERN REGION
JAIPUR

2013

JHALAWAR DISTRICT- AT A GLANCE

S.No.	Item	Statistics
1	**GENERAL INFORMATION**	
	Latitude (North)	$23^0$45'20" : $24^0$52'17"
	Longitude (East)	$75^0$27'35" : $76^0$56'48"
	Geographical area (sq km)	6928.00 sq. km
	Administrative Division (As on 31.3.2011)	
	Tehsils	Khanpur, Jhalrapatan, Aklera, Pachpahar, Pirawa, Gangdhar, Manohar Thana (7)
	Blocks	Jhalrapatan, Khanpur, Manohar Thana, Dag, Pirawa (6)
	No, of Villages (Revenue)	1618
	No. of Towns	8
	Population (As per 2011 Census)	Rural - 1181838 Urban - 229291 Total - 1411129
	Average Annual Rainfall	883.0 mm (1997-2006).
2.	**GEOMORPHOLOGY**	
	Major Physiographic Units	The district has 5 physical divisions namely Mukandhara range, hills of Dag, plateau region with low rounded hills, central plains of Pachpahar and Jhalrapatan, plain of Khanpur.
	Major Drainage	Chambal, Ahu, Kali Sindh & Parwan rivers.
3.	**LAND USE (ha) (As on 2010-11) (Source: Dte. Of Economics & Statistics, Ministry of Agriculture, GOI)**	
	Forest Area	126276
	Net Sown Area	327958
	Other uncultivable land excluding current fallows	92478
	Fallow land	23371
4.	**MAJOR SOIL TYPE**	(i) Black cotton soil (ii) lithosols (iii) Regosols
5.	**PRINCIPAL CROPS (Source: Dte. of Economics & Statistics, Ministry of Agriculture, 2010-11)**	
	Crop	**Average Yield (Kg/ ha)**
	Soyabean	240086
	Pulses	53052
	Wheat	70511
	Jowar	3617
	Coriander	85795
	Rapeseed & Mustard	32622
	Sesamum	7316
	Maize	40584
	Garlic	4567
	Citrus fruits	8971
	Soyabean	240086
6.	**IRRIGATION BY DIFFERENT SOURCES (Dte. of Economics & Statistics)**	
	Source	**Area irrigated (ha)**
	Tubewells	51866
	Other wells	147036
	Canal	6538
	Tanks	215

S.No.	Item	Statistics
	Other sources	2399
	Net area irrigated	208054
	Gross area irrigated	219115
7.	**NUMBER OF GROUND WATER MONITORING WELLS OF CGWB (As on May, 2012)**	
	Dugwells	26
8.	**PREDOMINANT GEOLOGICAL FORMATIONS**	Basalt, Sandstone, shale (Deccan trap & Vindhyan Super Group) and Quaternary alluvium
9.	**HYDROGEOLOGY**	
	Major water bearing formation +	Alluvium, Sandstone, Shale and Basalt.
	Depth to Water Level (Pre-monsoon, 2011) (mbgl)	8 to 16 mbgl.
	Depth to Water Level (Post-monsoon, 2011) (mbgl)	5 to 12 mbgl.
10.	**GROUND WATER EXPLORATION BY CGWB**	
	Number of wells drilled	EW-25, SH-3, PZ-1
	Depth drilled (m)	9.7 – 175
	Discharge (litre per minute)	30 – 2017
	Transmissivity (m^2/day)	9.3 to 249
11.	**GROUND WATER QUALITY**	
	Major quality problems	Excess Electrical Conductivity, Chloride, Fluoride at places
	Type of water	Alkaline
12.	**DYNAMIC GROUND WATER RESOURCES (As on March, 2009)**	
	Annually replenishable ground water resource	448.62 MCM
	Net Annual Ground Water Availability	397.91 MCM
	Annual Ground Water Withdrawal	478.37 MCM
	Stage of Ground Water Development	120.22%
13.	**MAJOR GROUND WATER PROBLEMS AND ISSUES**	Over-exploitation of ground water resources in 5 out of 6 blocks. Being underlain by hard rock formations, the area has limited availability of ground water and faces water scarcity during summer months.

Ground Water Information
Jhalawar District

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GROUND WATER SCENARIO
DISTRICT JHALAWAR, RAJASTHAN

1.0 Introduction

Jhalawar district is located between 23° 45' 20" and 24°52'17" North latitude and 75° 27' 35" and 76°56'48" East longitude covering an area of 6928 sq.km. The district is part of Kota Division and is divided into five sub-divisions namely Aklera, Khanpur, Jhalawar, Pirawa, and Bhawanimandi. Administratively the district is divided into 7 tehsils and 6 development blocks (Fig. 1). There are 1618 revenue villages and 8 urban towns in the district. Urban and rural population of the district is 2.29 and 11.82 lakhs respectively.

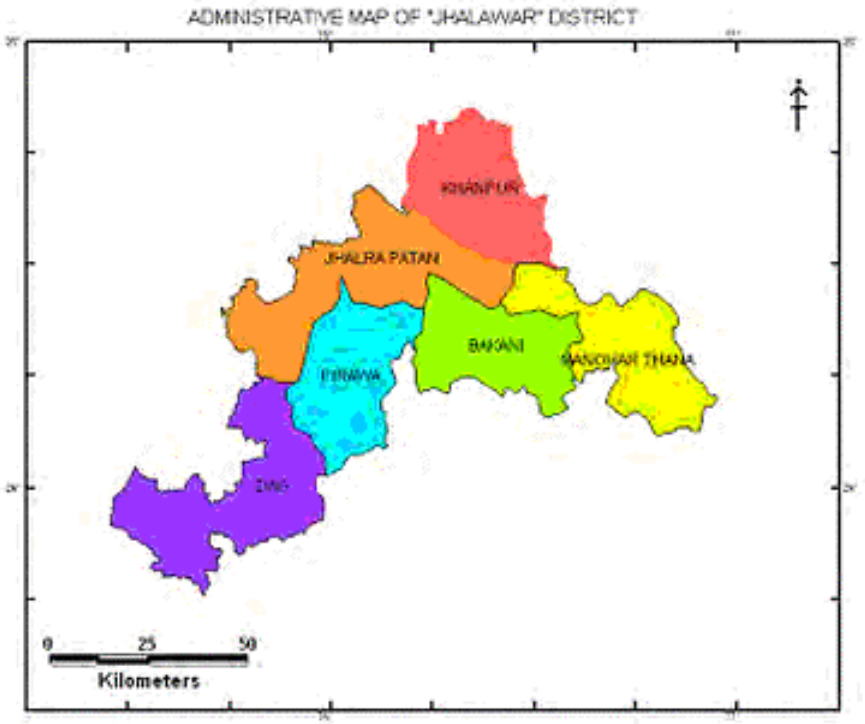

Figure 1: Administrative Divisions

Systematic Hydrogeological survey in the district was carried out by GSI between 1961 & 1964 and by Central Ground Water Board from 1978 to 1986. Reappraisal hydrogeological survey in entire district was completed by 1992. Under Ground Water Exploration programme, 25 Exploratory boreholes, 3 Slim holes and 1 Piezometer have been drilled. Since 1973, monitoring of water level is being carried out four times a year through 26 National Hydrograph Network Stations.

1.1 Rainfall & Climate

Average annual rainfall (1997-06) of the district is 883.0 mm. However normal rainfall for the period 1901 to 1970 is 934.5 mm. The western part of the district has lesser rains than the eastern part.

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. Period from mid of September to end of November constitutes post monsoon season. The droughts are in general of mild or normal type. However, severe type of droughts have been recorded at Manoharthana, Aklera, Khanpur, Bakani and Pirawa.

1.2 Geomorphology & Drainage

The district lies at the edge of Malwa plateau, an area of low hills and shallow plains. The district falls in following 5 physical divisions (Figure 2):

(1) The Mukandhara range
(2) The hills of Dag
(3) The plateau region with low rounded hills
(4) Central plains of Pachpahar and Jhalarapatan
(5) The plain of Khanpur between two arms of Mukandhara

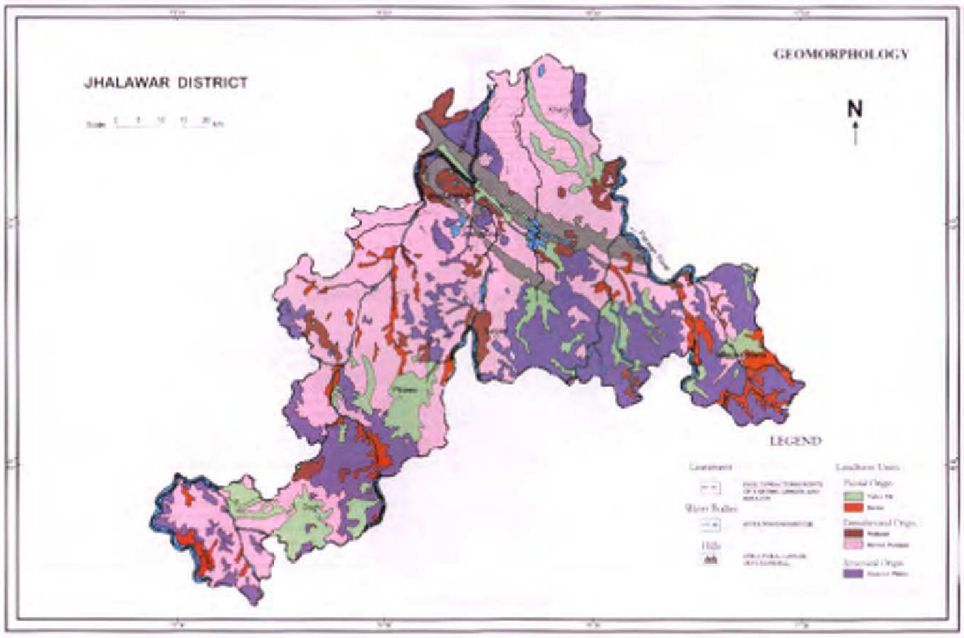

Figure 2: Physiography and Drainage

The whole of south Jhalawar has characteristics of the Malwa plateau, an area of rounded bare hills interspersed by plains. The Jhalawar plain stretches in a wide belt from Bhawani mandi in the west almost up to Asnawar in the east and is bounded in the northern, eastern and southern sides by the Mukandhara hills. Geomorphologically, the district is divided into various units as described in Table 1.

Table 1: Geomorphic units in Jhalawar district

Origin	Land Forms	Occurrence in the District
Fluvial	Valley Fill	Scattered in the entire district, more concentrated in south, west and central.
	Ravine	Along rivers Parwan, Ahu, Kalisindh and their tributaries
Denudational origin	Pediment	In small patches mainly in west, north east and central
	Burried pediment	Main concentration in northern, central, western and south
Hill	Structural hill	In central part.
Structural Plateau	Dissected plateau	Scattered in central and prominent in south west.

1.2.1 Drainage

The rivers and streams of the entire district belong to the Chambal system. Except in the Gangdhar tehsil, the general flow is from south to north. The rivers of Jhalawar may be divided into two groups: the western group and eastern group. The western rivers are Ahu, Piplaj, Kyasri, Kantli, Rawa, Kalisindh and Chandrabhaga. The eastern rivers

are Parwan, Andheri, Newaj, Ghar and Ujar. There are artificial lakes Kadila and Mansarovar. Generally speaking rivers have deep bed. With the result the water level is below that of the surrounding area. Drainage density in most part of the district varies from 0.5 to 0.7 km/km^2. Drainage density is from 0.7 to more than1km/km^2 in the southeastern and southwestern parts of the district. In the north central part of the district, it is low and ranges between 0.3 to 0.5 km/km^2.

1.3 Soils & Irrigation Practices

Almost entire district is underlain by black cotton soil except for a few small pockets in the north of district where recent alluvium in plain area and lithosols and regosols are present.

1.3.1 Irrigation:

The principal means of irrigation in the district are wells/tube wells, though some areas are irrigated by canals, tanks etc. Groundwater is the main source of irrigation and is utilized through dug wells, DCB's, and tube wells. Details of the net and gross irrigated area by different sources are furnished in Table 2.

Table 2: Area irrigated by different sources

(Area in Ha)

Source / Area	Canal	Tanks	Tubewells	Other wells	Other sources	Total
Net irrigated	6538	215	51886	147036	2399	208054
Gross irrigated	6538	232	54851	154922	2572	219115

(Source: Dte. of Economics & Statistics, Ministry of Agriculture)

2.0 Groundwater Scenario

2.1 Geological Framework

Jhalawar is underlain by rocks of Vindhyan super group and Deccan traps. About 60% of the district is covered by Deccan traps (Fig. 3). The Vindhyans comprise of lower and upper Vindhyans represented by Jhalrapatan sandstone, Suket shale and limestone, Kaimur sandstone, Rewa shale, sandstone and conglomerate, Ganugarh shales, lower Bhander sandstone and limestone.

The Vindhyan sandstone and shale form linear hills trending north west to south east. They are exposed around Jhalawar town and to its north east and north west. These rocks are overlain by twelve basaltic flows between 280 and 481metres mean reduced level. Around Dag and Kolvi, the flows have undergone wide spread laterization. Both fossiliferous and non fossiliferous clay, chert, limestone beds are also present.

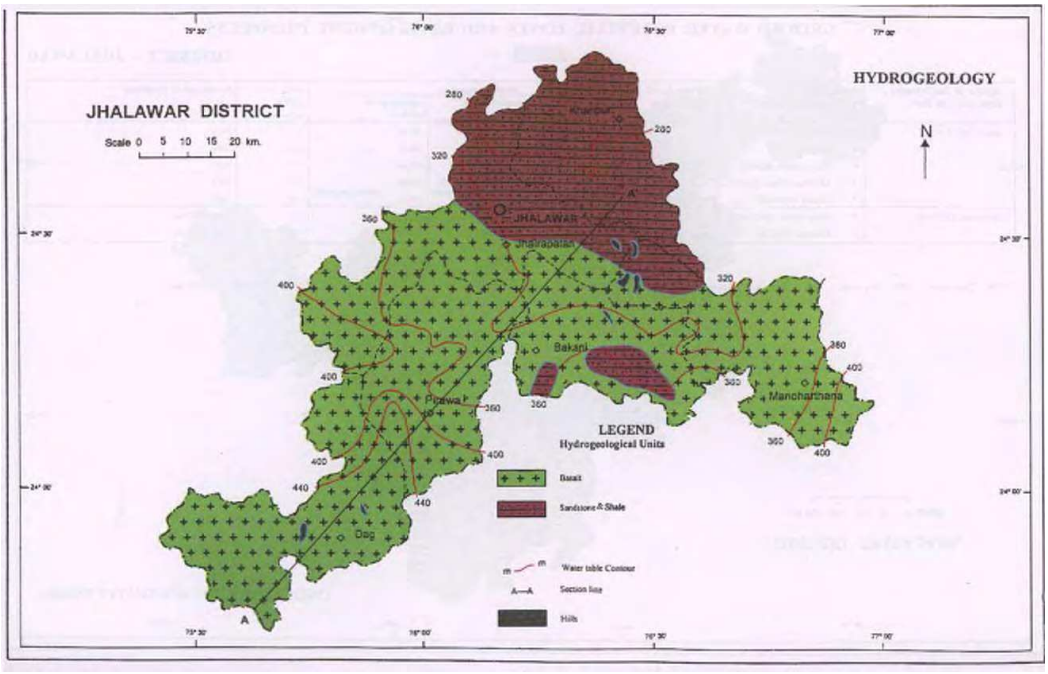

Figure 3: Geology

The entire Dag, Pirawa, Manoharthana and parts of Bakani and Jhalrapatan blocks are occupied by Deccan traps. The northern part of the district comprising of Khanpur block is occupied by sandstone and limestone of lower Bhander group. The main hill ranges comprising of shale, sandstone and conglomerates belong to Rewa and Kaimur groups of upper Vindhyan. Semri group belonging to Lower Vindhyan is exposed in parts of Jhalrapatan block.

2.2 Hydrogeology

Occurrence of ground water in the district is mainly controlled by the topographic and structural features present in the geological formations. Ground water occurs mainly under unconfined to semi- confined conditions in saturated zone of rock formation. Its occurrence is controlled by topography, physiography and structural features of the geological formations. Movement of ground water in hard rock areas is governed by size, openness, interconnection and continuity of structurally weak planes while in unconsolidated rocks ground water movement takes place through pore spaces between grains. Water bearing properties of different aquifers are described below.

2.2.1 Ground water in Vindhyan Super Group:

Vindhyan sandstones and shales mainly occur in northern part of the district. Sandstones (mostly of Bhander group) are the most widely distributed litho-units in the Vindhyan terrain of the district. Generally the sandstones and shales occur as alternate layers. The sandstone layers are low dipping, fine grained, compact and hard whereas shales are flaky in nature. Under favourable conditions, the contact of two formations yields water.

Within sandstone large dia. open wells are most feasible abstraction structures and yield of wells ranges from 50 to200 cu.m/ day. Specific capacity ranges from 20 to 200 litre/min/meter.

Ground water within Vindhyan shales occurs under water table conditions in the weathered zone and in fractures formed due to splintery nature of the shales. Large

diameter dug wells tapping shales yield only in the range of 20 to 80 cum/day. Dug wells at a stretch can run for 1 to 2 hours only. Horizontal boring in the dug wells also does not yield promising results.

2.2.2 Ground water in Deccan Traps:

The thickness of basalt ranges from a few meter to more than 200meter. Generally in Dag block, thickness of basalt is more than 200 meter. Ground water in weathered basalt occurs under water table condition. Thickness of weathering in basalt ranges up to a maximum of 20 meter. Large diameter wells are mainly feasible with an average yield of 100 to 120 cubic meter. Ground water in compact basalt occurs under water table condition in the joints and fractures. Yield of open wells ranges from 20 to 200 cubic meter per day. In vesicular basalt, ground water occurs in the vesicles, joints, fissures and cracks. Yield of open wells varies from 40 to 280 cubic meter per day. Vesicular basalts are soft in comparison to compact basalts. In amygdaloidal basalt, ground water occurs in cavities, fissures, cracks and joints. Yield of open wells ranges from a few to 330 cubic meter per day.

2.2.3 Ground water in Alluvium

Alluvial aquifer with limited thickness occurs along river courses like Ahu and Chhoti Kalisindh. Apart from this in some depressions also alluvium of limited thickness forms aquifer. It is comprised of sand, silt and gravel. Along river courses, pebbles are also found. Depth of open wells is maximum upto 18 meter and yield ranges from 100 to 200 cubic meter per day.

3.0 Depth to Water Level

The depth to water level varies widely depending upon topography, drainage, bedrock geology etc. During Pre-monsoon (May, 2011), depth to water level was found to vary from less than 8 to more than 16m bgl (Figure 4). Water level is shallower in southern part of the district. In general, the depth of water level increases from south to north.

During Post-monsoon (November, 2011), depth to water level in major part of the district was observed to be between 2 and 5 m bgl (Figure 5). Shallower water level below 2 m bgl was observed in parts of Khanpur, Jhalrapatan, Bakani and Manohar Thana blocks. Deeper water level in the range of 5 to 10 m bgl was observed in major part of Jhalrapatan and small areas in Dag, Pirawa and Manohar Thana blocks. Water level in the range of 10 to 20 m bgl was observed in isolated pocket in Manohar Thana block.

3.1 Water Level Fluctuation

Analysis of water level data of Pre and Post-monsoon 2011 indicates that there has been rise in water level in major part of the district (Figure 6). A perusal of water level fluctuation data indicates that major part of the district has recorded rise in water level of more than 4m.

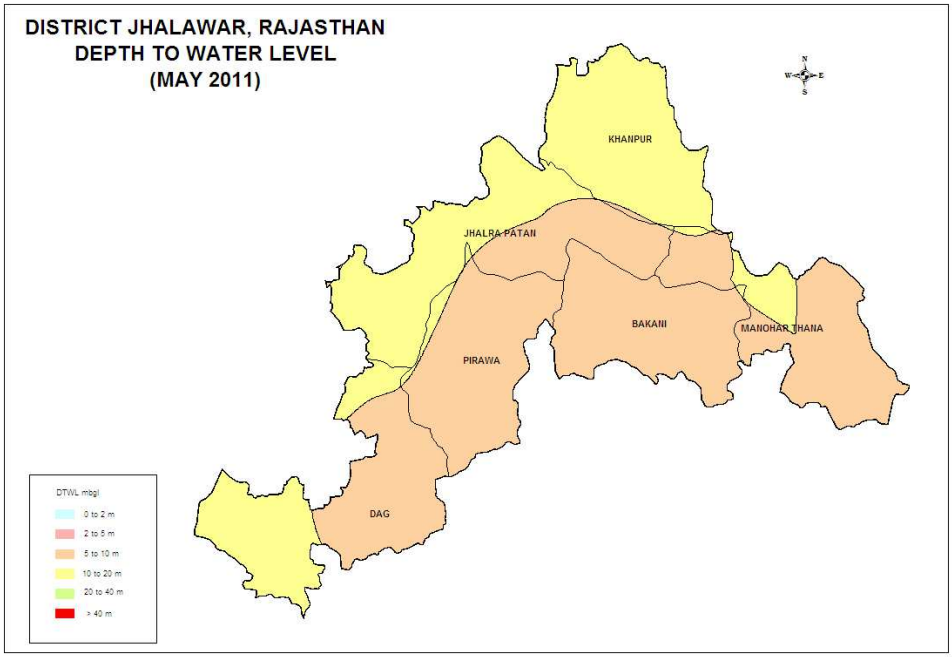

Figure 4: Depth to Water Level (Pre Monsoon - May 2011)

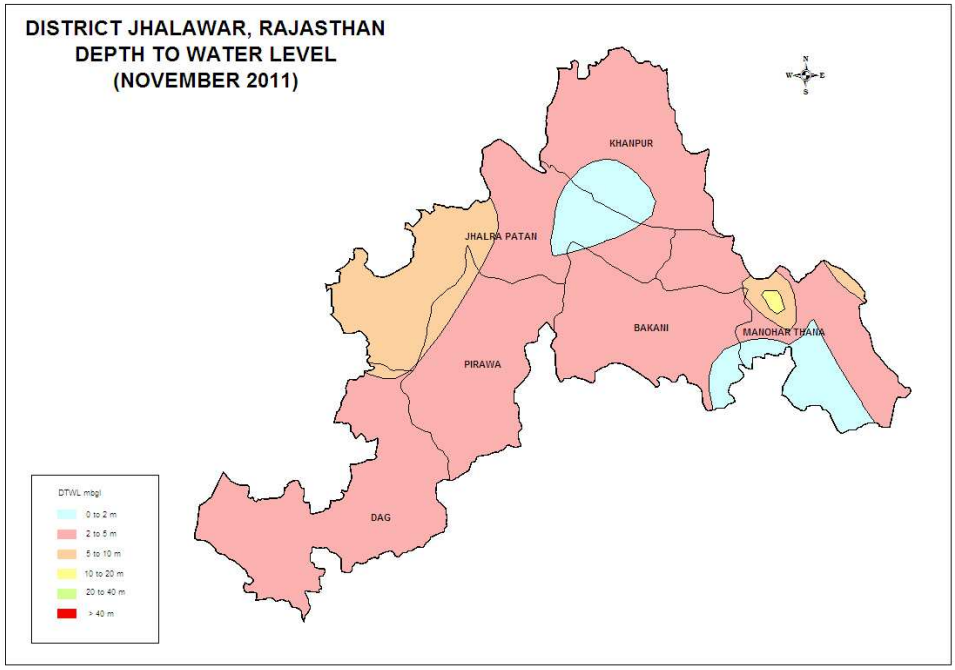

Figure 5: Depth to Water Level (Post Monsoon - November, 2011)

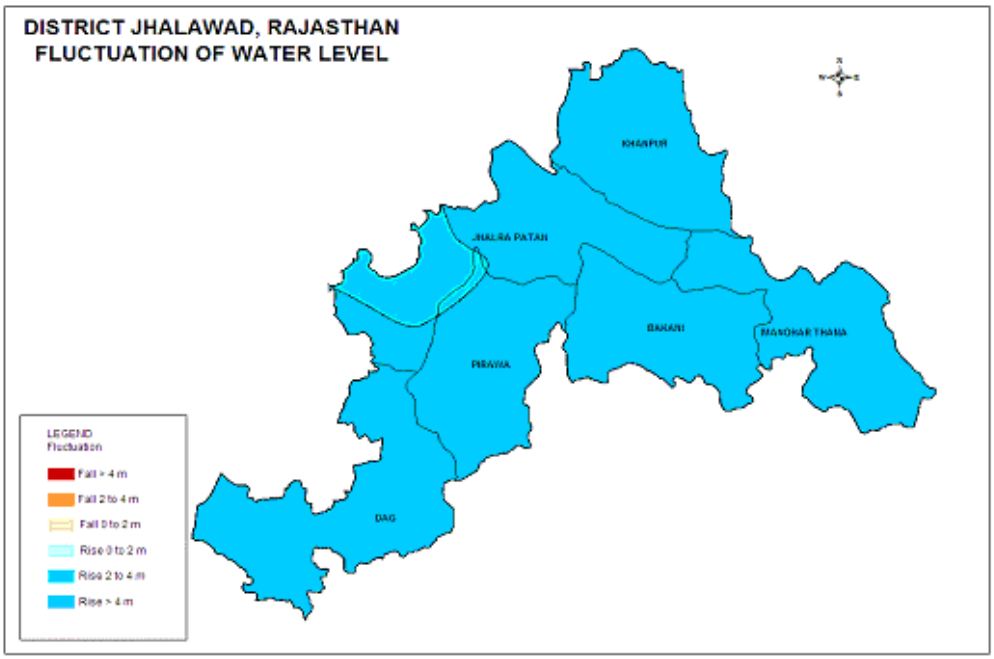

Figure 6: Fluctuation of Water Level (May – Nov 2011)

Analysis of long term water level data of Pre-monsoon (May, 2002 to May, 2011) indicates rising trend of upto 25 cm/ year in ground water levels in major part of the district except parts of Jhalrapatan, Khanpur, Pirawa, Manohar Thana and Bakani blocks, where declining trend of upto 25 cm/ year in water levels has been recorded (Figure 7).

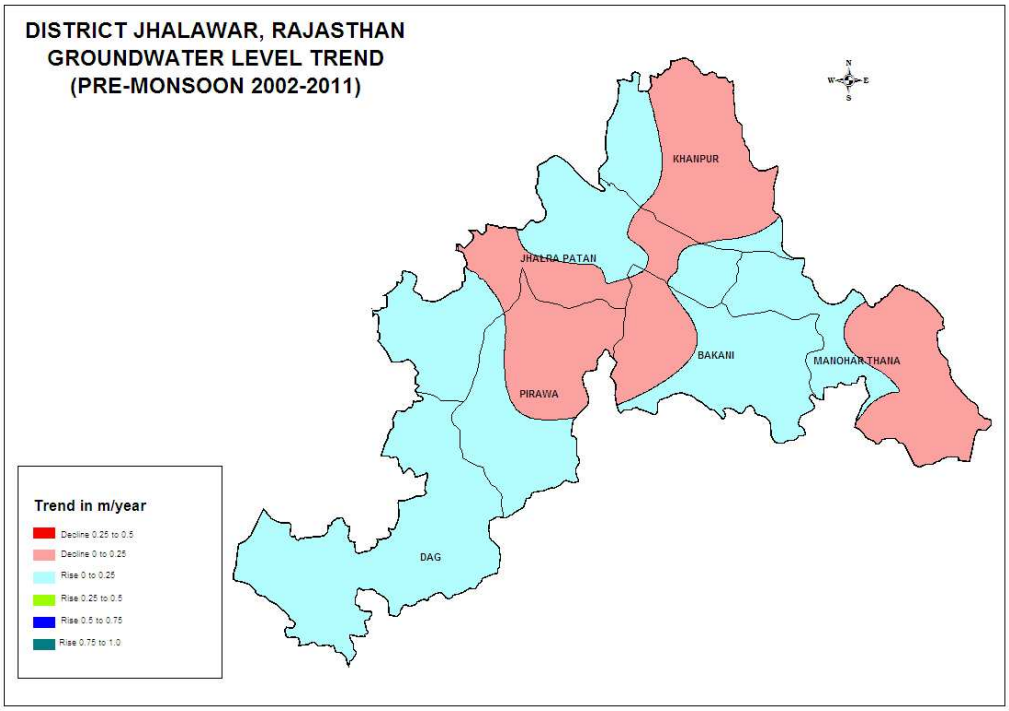

Figure 7: Decadal water level trend (May 2002 – May 2011)

4.0 Groundwater Quality

4.1 Water Quality in Shallow Aquifer

In most parts of the district, the electrical conductivity values are less than 1500 µS/cm at 25°C (Figure 8). In western part of Jhalrapatan block, electrical conductivity values more than 2250 µS/cm have been reported. At some places like Kundli Khera and Garnawad, shallow water is brackish with EC values more than 3000 µS/cm. The highest value of 5455 µS/cm has been recorded from Jhalawar Road.

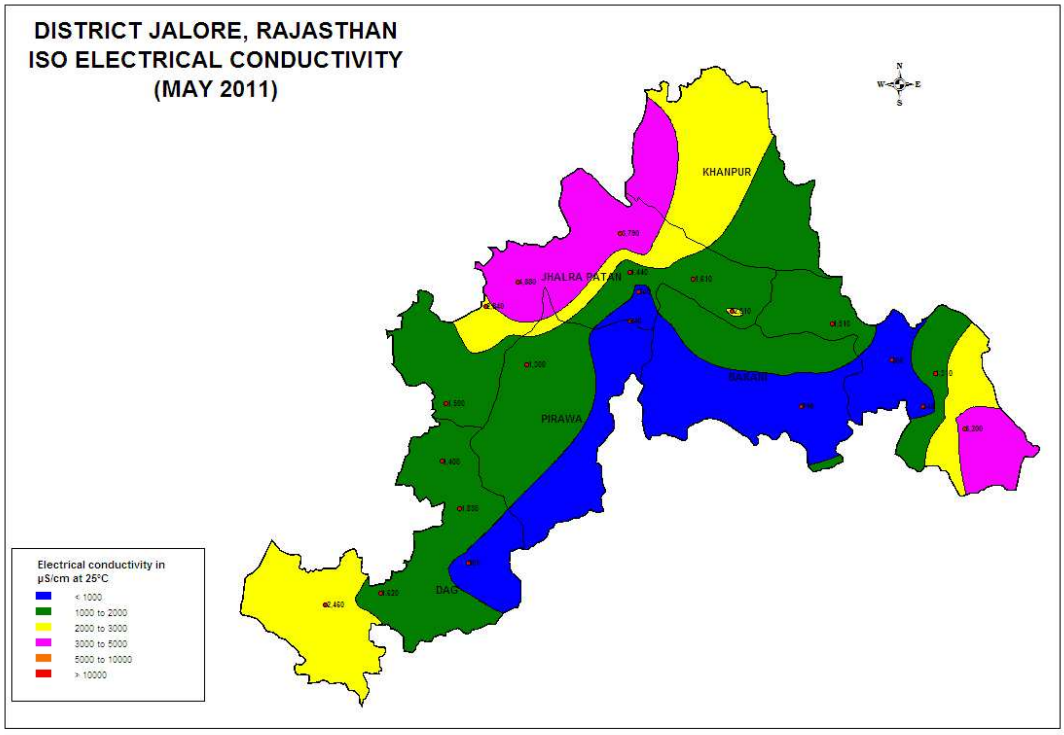

Figure 8: Iso Electrical Conductivity (May 2011)

Fluoride concentration in ground water in the district is less than permissible value of 1.5mg/lit (Figure 9). In Golana of Khanpur Block fluoride value of 2.5mg/lit has been reported.

Spot values of Nitrate concentration in excess of permissible limit of 45 mg/ lit have been reported in majority of wells analysed. Distribution of nitrate concentration in ground water in the district is shown in Figure 10.

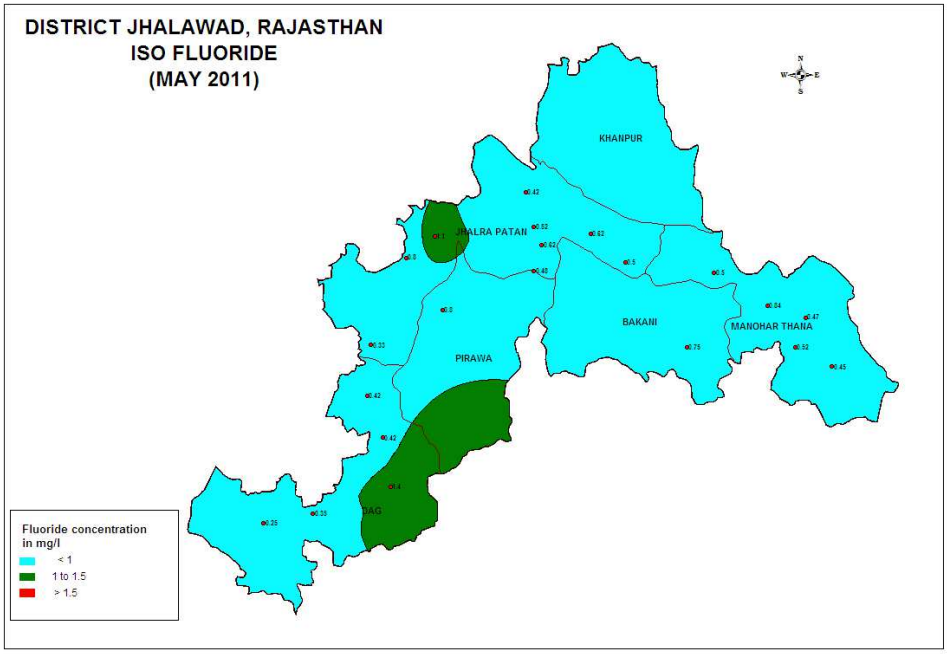

Figure 9: Iso Fluoride (May 2011)

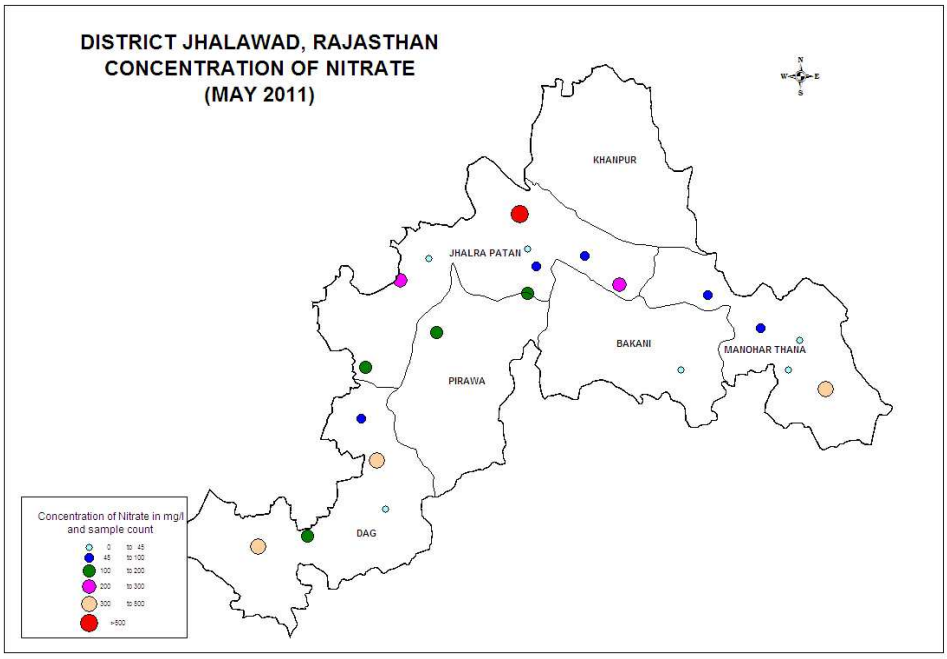

Figure 10: Nitrate Distribution (May 2011)

Iron concentration in ground water has been found to within desirable limit of 0.3 mg/litre in central, southern and eastern parts of the district and is within the permissible limit of 1 mg/litre in major part of the district (Figure 11). Excess iron concentration has been reported from isolated pockets in Jhalrapatan, Bakani and Manohar Thana blocks.

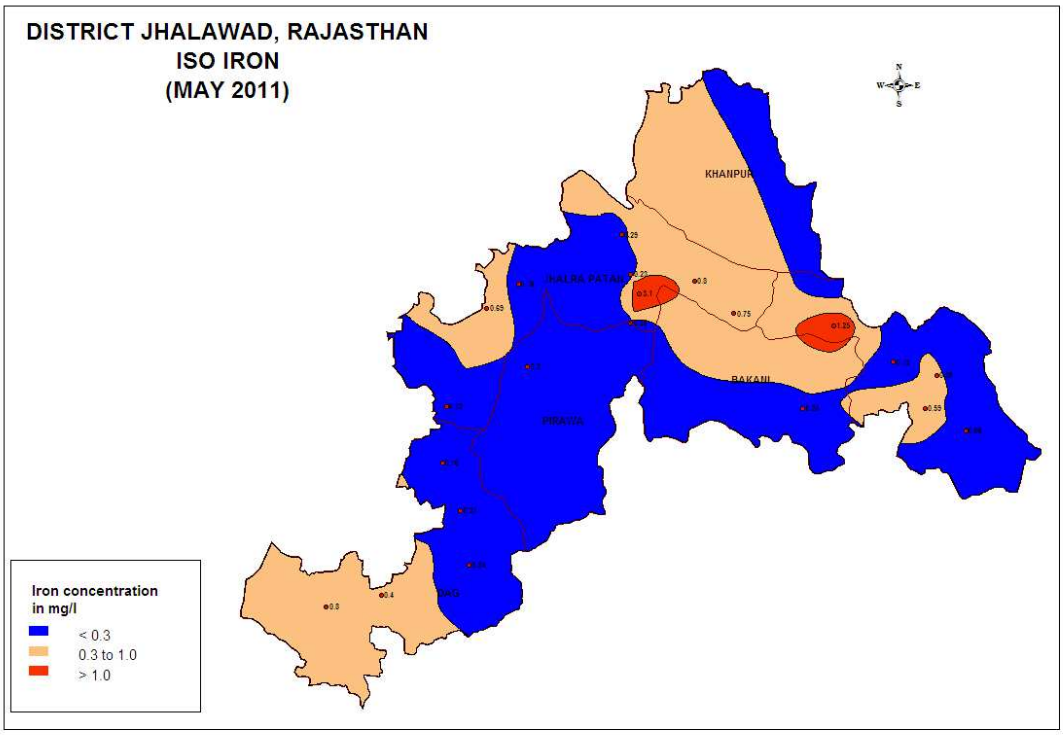

Figure 11: Iso Iron (May, 2011)

4.2 Water quality in Deeper Aquifer

Salinity is not a serious problem except at Sunel in Pirawa block and Jhalrapatan where EC values of more than 4600 µS/cm have been reported from tube wells.

At many places including Pirawa, Sadla, Raipur, Sunel, Magispur, Kagriya, Dongargaon, Ratali, Salawad and Sarda, fluoride concentration of more than 1.5 mg/lit has been reported.

5.0 Ground Water Resources

Ground water resources have been estimated jointly by the Central Ground Water Board and State Ground Water Department as per the norms recommended by GEC 97. While assessing the ground water resources, hilly areas have not been considered. Total annually replenishable ground water resource of the district has been estimated as 448.6199 mcm. Net annual groundwater availability is estimated to be 397.9099 mcm. Draft for all uses is 478.3731 mcm and overall stage of ground water development is 120.22%. Summarized block wise estimates of dynamic groundwater resources are given in Table 3. Out of six blocks, five blocks viz. Bakani, Dag, Jhalrapatan, Manohar Thana and Pirawa are Over-exploited and one block viz. Khanpur is Critical.

Table 3: Block wise replenishable ground water resources in Jhalawar district (as on 2009)

Sl. No.	Block	Annual replenishable resource (mcm)	Net Annual Ground Water Availability (mcm)	Annual Ground Water Draft for Irrigation (mcm)	Annual Ground Water Draft for Domestic and Industrial use (mcm)	Gross Ground Water Draft for All uses (mcm)	Stage of Ground Water Development (%)	Category
1	Bakani	63.2220	54.0548	72.3991	2.2449	74.6440	138.09	Over-exploited
2	Dag	66.5216	60.0357	66.5759	2.7244	69.3002	115.42	Over-exploited
3	Jhalrapatan	82.4842	74.4420	89.5059	3.3103	92.8162	124.68	Over-exploited
4	Khanpur	83.5058	71.3974	66.3895	2.3976	68.7872	96.34	Critical
5	Manohar Thana	78.8654	71.1760	82.5122	2.3662	84.8784	119.25	Over-exploited
6	Pirawa	74.0209	66.8039	85.3453	2.6018	87.9471	131.65	Over-exploited
DISTRICT TOTAL		**448.6199**	**397.9099**	**462.7279**	**15.6451**	**478.3731**	**120.22**	Over-exploited

6.0 Status of Ground Water Development

Basalts, Sandstone, and shales form the aquifer in different parts of the district. Alluvium area is restricted to riverbeds. Ground water occurs under unconfined to semi-confined condition. Depth and diameter of the dug well depends on formation and geomorphology. However, general depth of dug well ranges from 15 to 30m. Details of dug wells in different formations are given in Table 4.

Table 4: Average yield and depth of dugwells in various formations

Formation	Block	Avg. Yield m^3/day	Depth in m
Basalt	Bakani	30-50	20-25
	Dag	30-50	30-40
	Jhalrapatan	30-50	25-40
	Manohar Thana	30-50	30-40
	Pirawa	30-50	30-40
Sandstone	Jhalrapatan	70-100	25-40
	Khanpur	70-100	30-40

7.0 Ground Water Management Strategy

7.1 Ground Water Development

Stage of ground water development in the district is 120.22%. The scope for ground water development is already exhausted in 5 blocks viz. Bakani, Dag, Jhalrapatan, Manohar Thana and Pirawa, where ground water development has already exceeded 100% and thus these blocks have been categorized as “Over-exploited”. Khanpur block falls under “Critical” category where ground water development is approaching 100. There is no scope for further development in the district for irrigation or industrial use.

7.2 Ground Water Management

Due to over development of ground water, further exploitation of this precious resource needs to be checked. Artificial recharge is not feasible in the district as the country rock is composed exclusively of hard rocks. The water level is shallow and

transmissivity 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 100%, for sustainable utilization of water resources conjunctive use of surface and ground water is inevitable. Water harvesting through construction of bunds, anicuts, and rooftop harvesting structures in Vindhyan formation is possible as the water level during rains is deep. In basalts, which form the major aquifer, water level becomes very shallow during rains and hence void space is not available in the aquifer during the time when there is surplus availability of water. Therefore, the area suitable for recharge is very limited and site selection needs professional assistance.

8.0 Ground Water related Issues & Problems

Almost entire district is facing problem of ground water scarcity during summers. Many areas face problem of depleted water table. Major issues in the district are as follows:

Groundwater Depletion

Out of six blocks, five are over-exploited and one is critical, which is leading to stress on available ground water resources. Comparison of water level data of the past decade shows that water levels have registered decline in water level in some parts. The long term depleting nature of water level causes reduction in storage, which leads to water scarcity.

Water Quality Deterioration

Excess concentrations of Fluoride, Nitrate and Iron in ground water have been reported from some places in the district.

9.0 Recommendations

1. Ground water draft is very high in all the blocks. Stage of ground water development in the district has reached 120.22% due to indiscriminate use. It needs to be controlled by preventing further development.
2. Water scarcity is a perpetual phenomenon in Jhalawar. Permanent solution to drinking water problem should be devised using Surface water, as aquifer is not potential and sustainability remains questionable.
3. Mines can be additional potential source of water supply in October to December and partly from January to June.
4. Revival of traditional ground water storage system i.e. *Baori*, open wells, *Tanka* etc. for rain water conservation for use in day to day life will reduce ground water draft.
5. Awareness programme and training on rain water harvesting will be beneficial to check decline in water level and justified use.
6. Taking advantage of uneven topography of the area, small water harvesting structures like earthen dams at suitable sites upstream of irrigation commands may be constructed to store rain water. This will increase recharge to ground water which will ultimately result in increase of yield of wells.

7. 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.
8. 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.
9. High water requirement crops may be discouraged. Proper agriculture extension services should be provided to the farmers so that they can go for alternate low water requirement economical crops.