GOVERNMENT OF INDIA

MINISTRY OF WATER RESOURCES

CENTRAL GROUND WATER BOARD

GROUND WATER INFORMATION
DUNGARPUR DISTRICT
RAJASTHAN

WESTERN REGION
JAIPUR
2013

DUNGARPUR DISTRICT AT A GLANCE

1. GENERAL INFORMATION

Geographical Area	:	3855.93 sq km
Administrative Divisions	:	5 Panchayat Samitis
Villages	:	972
Population (2011)	:	1388552
Average Annual Rainfall (2001-2011)	:	650mm

2. GEOMORPHOLOGY

Major Physiographic unit	:	**Alluvial plains, Hillocks, Pediments**
Major Drainage	:	**Som & Mahi**

3. LAND USE (2010-11)

Forest Area	:	622.04
Net Area Sown	:	1316.17
Total cropped area	:	1866.70

4. SOIL TYPE : **Red loam & hilly soil**

5. PRINCIPAL CROPS (2010-11) (Area in ha)

Rice	:	13727
Maize	:	89065
Wheat	:	37334
Pulses	:	28200

6. IRRIGATION BY DIFFERENT SOURCES (2010-11) (Area in ha)

Tubewells	:	1952
Other wells	:	22295
Tanks	:	2212
Canal	:	7404
Other sources	:	3183
Net Irrigated Area	:	37046
Gross irrigated Area	:	38737

7. GROUND WATER MONITORING WELLS (As on 31/03/2012)

Dugwells	:	18
Piezometers	:	6

8. GEOLOGY

Quaternary to Recent	:	Alluvium
Aravalli Super Group	:	Metasediments
Bhilwara Super Group	:	Gneiss, schist, marble and migmatite.

9. HYDROGEOLOGY

Water Bearing Formation	:	Weathered, fractured hard rock and localized alluvial patches near river course.
Premonsoon Depth to Water Level (May-2011)	:	1.7 to 55.32 m bgl.
Postmonsoon Depth to Water Level (Nov.-2011)	:	0.46 to 11.38 m bgl.

10. GROUND WATER EXPLORATION (As on 31.3.2012)

Wells Drilled	:	36 (in hard rock)
Depth Range	:	43 – 154 m
Discharge	:	Meagre to 336 m^3/day
Transmissivity	:	2 to 129 m^2/day

11. GROUND WATER QUALITY

EC (µS/cm at 25°C), F, Fe and NO_3 (mg/l)	:	EC – 466 to 2800, F – 0.12 – 5.35, Fe – 0.005 to 1.065, NO_3 – 1 to 71

12. DYNAMIC GROUND WATER RESOURCES- (As on 31/03/2009 in MCM)

Annually replenishable ground water resource	:	126.68
Net Annual Ground Water Availability	:	114.83

	Annual Ground Water Draft (Irrigation+Domestic)	:	89.06
	Stage of Ground Water Development	:	77.56%

13. AWARENESS AND TRAINING ACTIVITY

A	Mass Awareness Programme	:	NIL
B	Water Management Training Programme	:	NIL. However, World Water Day was celebrated at Dungarpur on 22 March, 2007.

14. GROUND WATER CONTROL & REGULATION

Over-Exploited Taluka	:	None
Semi-Critical Taluka	:	3
Notified Taluka	:	None

15. MAJOR GROUND WATER PROBLEMS AND ISSUES

Declining ground water level trends have been observed in some parts of the district. Four blocks in the district fall under semicritical category. Fluoride contamination in ground water has been observed in some parts of the district.

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1.0 Introduction

Dungarpur district, covering geographical area of 3855.93 sq km, forms southern part of the state of Rajasthan. The district is bounded in the north by Udaipur district, in the east by Banswara district, in the southwest it has common border with the state of Gujarat (Figure 1). State extending between north latitudes 23°20' & 24°01' and east longitudes 73°22' & 74°23' is administered by 4 tehsils and 5 blocks. The district covers about 1.13% of total area of the State. According to 2011 census, total population of Dungarpur district was 1388552 with the composition of 1299809 rural and 88743 urban population and decennial growth rate of 25.36% during the period 2001-2011.

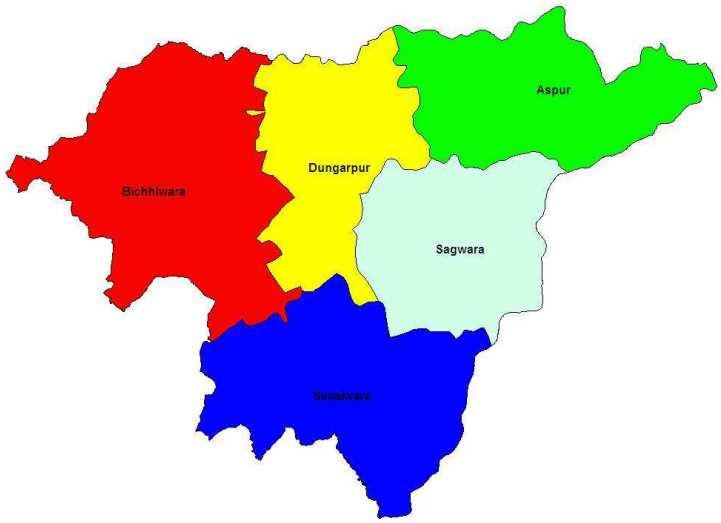

Figure 1: Administrative map

Systematic Hydrogeological Survey has been carried out during the Year 1961-68 in Vatrak River Basin by Ground Water Wing of Geological Survey of India. Central Ground Water Board carried out Systematic Hydrogeological Survey of the district during 1974-76. which further has been reappraised periodically during various Annual Action Plans. Groundwater regime is also monitored through 24 hydrograph stations (18 dug wells 6 piezometers) four times a year for water levels and once a year for water quality. The district area has been explored to delineate aquifer systems, assess their potentiality and quality parameters by constructing 29 EW and 7 OW. Salient features of ground water exploration in the district are furnished in Table 1.

Table 1: Salient Features of Ground Water Exploration

Type of well	No.	Depth drilled (m)	SWL (m)	T (m^2/day)	Discharge (lpm)	EC (µS/cm) at 25°C
EW	29	70.85 - 154	0.24 - 31.9	2 – 129	1 - 336	350 – 4250
OW	7	43 -151.11	0.78 - 8.17	5	150 - 660	535 - 1900

2.0 Climate and Rainfall

Major part of the district enjoys sub humid type of climate. However, semi arid type of climate is also experienced in a small area near northern boundary of the district. The summer season prevails from March to May, when peak temperatures are attained. Mean daily maximum temperature during May is 38.6°C and the mean daily minimum temperature is 24.9°C. Thereafter temperatures decrease with the onset of southwest monsoon. After the withdrawal of monsoon in September, the day temperature increases slightly and a secondary maximum is attained in October. However, night temperature continues to fall. From November onwards both the day and night temperatures decrease rapidly till January, which is the coldest month with mean daily maximum temperature of 24.2°C and mean daily minimum temperature of 7.8°C. The annual potential evapotranspiration of the district is of the order of 1380mm with highest potential evapotranspiration (204.4mm) during the month of May and lowest (55.2mm) during the month of December.

Normal annual rainfall of the district during the period 1951 -2000 has been 677.8mm. However, annual average rainfall during the period 2001 – 2011 has been slightly less at 650.35mm. The highest average annual rainfall (897.67mm) has been recorded at Venia and the lowest average annual rainfall has been recorded at 570.55mm at Kanba. Average annual rainfall data of the district for the period 2001 – 2011 is given in Table 2.

Table 2: Average annual rainfall data (2001-2011)

Station	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Average
Aspur	704.0	450.0	644.5	800.0	517.0	1494.0	889.0	500.0	738.0	568.0	1327.0	784.68
Chikhali	662.0	273.0	575.0	641.0	406.0	1401.0	943.0	558.0	702.0	571.0	658.0	671.82
Dewal	470.0	286.0	411.0	390.0	424.0	863.0	533.0	416.0	623.0	604.0	768.0	526.18
Dhambola	640.0	256.0	769.0	703.0	594.0	1633.0	982.0	421.0	831.0	614.0	1044.0	771.55
Dungarpur	791.0	369.0	708.0	675.0	572.0	1611.0	580.0	319.0	914.0	760.0	977.0	752.36
Galiakot	644.0	499.0	800.0	1096.0	617.0	1671.0	770.0	301.0	620.0	497.0	762.0	752.45
Ganeshpur	535.0	452.0	578.0	656.0	525.0	1320.0	559.0	387.0	623.0	489.0	881.0	636.82
Kanba	446.0	256.0	511.0	464.0	509.0	976.0	520.0	346.0	446.0	800.0	1002.0	570.55
Nithawa	608.0	511.0	722.0	800.0	648.0	1252.0	653.0	624.0	812.0	489.0	1204.0	756.64
Sabla	523.0	449.0	721.0	841.0	621.0	1434.0	913.0	561.0	868.0	623.0	1078.0	784.73
Sagwara	553.0	372.0	829.8	974.0	549.0	1588.0	1056.0	477.0	810.0	668.0	1015.0	808.35
Somkamla ambba	479.9	375.6	649.8	730.4	519.1	893.4	655.0	392.0	795.2	496.6	966.6	632.15
Veejan	593.0	390.0	795.0	688.0	388.0							570.80
Venja						1611.0	824.0	657.0	813.0	610.0	853.0	894.67

3.0 Geomorphology & Drainage

The district is characterised by uneven topograpgy with hills of Aravallis comprising of mainly quartzite and intrusive rocks alternating with low lying areas of phyllites, slates and schists. The district, though fairly open in the south is interspersed with stony hills covered with low jungle. In the north and east, the landscape is rugged and wild, but towards the southwestern border, the harsh features gradually become softer and finally merge in the topography of Gujarat region. The eastern part slopes towards the basin of Mahi river and consists of

plain area. Cultivated areas are mainly confined to valleys and low lying ground between the hills where the soil is alluvial in nature.

The rugged and wild aspect of the region is attributed to the off shoots of the Aravallis. The country is broken and hilly, but none of the hills attain a great height. The highest peak which is in the extreme northwest is about 572 m above mean sea level and the other highest point 2 km north of Sagwara is 497 m above mean sea level. The lowest point in the district is about 90 m above mean sea level near Solakari village in the bed of Mahi River.

3.1 Drainage

The district is drained mainly by the rivers Som and Mahi. The former forms the natural boundary between Dungarpur and Udaipur districts and separates Dungarpur district from Banswara district. The Mahi river originates from the Mahi Kanta hills in the western part of Madhya Pradesh and enters Banswara and Dungarpur districts before entering Gujarat near village Salakari. On an average, the river bed is about 100m to 130 m in width and mostly rocky. Its banks are steep in many parts though not very high. Its length in Dungarpur district is about 110 km. The Som river flows southeast from hills near Bichhabhera in Udaipur district, till it meets the border of Dungarpur district. It then turns first to the east and then to the south forming the northern boundary. After meeting the Jhakham, it enters the Dungarpur district and after traversing for a few km down it meets river Mahi at Baneshwar. The river traverses through the district for a distance of about 84 km.

Moran a seasonal river emerges in the central part of the district and flows in the southeastern direction to find its way into the Mahi. There are various streams like Jhakham, Majhham, Vatrak, Bhader, Gangli, Sapan and Very Ganga. All these dry up during summer. The seasonal nallahas are Nagdari, Phallu, Padar, Mahaya and Kadva Bagaria.

4.0 Soil, Land use and irrigation

There are pre-dominantly two types of soils in the district. Red loam soils are found in the southeastern parts of the district, adjoining Gujarat border. These are soils of hilly plains (flats) i.e. brought down from nearby hills and deposited in low lying areas. They are characterstically shallow to moderately deep, reddish in colour medium in texture, sandy loam to loam in nature, non calcareous, granular, well drained, free of salts and may have slight calcareous carbonates in lower layers.

Hilly soils are found along the hill ranges of Aravallis in the northern and western parts of the district. These soils are very shallow with gravelly material, very near to the surface. These are in general, light in texture and reddish brown to greyish brown in colour, non calcareous and freely drained. These extend in small patches on uneven terrain.

Out of total reported area of 385593 ha, forests cover an area of 62204 ha occupying 16% of the total area. Net sown area in the district is 131617 ha covering 34% of eh district area. Land use pattern of the district is given in Table 3.

Table 3: Land use pattern (2010-11)

S. No.	Particulars	Area in ha
1	Area not available for cultivation	92948
2	Forest	69978
3	Other uncultivated land excluding fallow land	56861
4	Fallow land	41963
5	Net area sown	131617
6	Total cropped area	186670
7	Area sown more than once	55053
	Total reporting area	385593

The principal source of irrigation in the district is ground water. Ground water is abstracted through tubewells, dug wells and dug cum bore wells. The details of the area irrigated by different sources are given in Table 4.

Table 4: Source wise area irrigated (2010-11)

Source	Net irrigated area (ha)	Gross irrigated area (ha)
Canal	7404	7421
Tank	2212	2312
Tubewells	1952	2047
Other wells	22295	23678
Other sources	3183	3279
Total	37046	38737

5.0 Geology

The district is underlain by mainly hard rock formations belonging to Bhilwara Supergroup and Aravalli Supergroup intruded by granite. Along the major river courses, localized patches of shallow alluvium occur overlying the compact basement. The geological succession in district is as follows:

Quaternary	Alluvium	Unconsolidated sand, silt, clay, pebble and gravel beds
~~Unconformity~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		
Post Aravallis	Intrusives	Granite, serpentinite
Aravall Supergroup	Lunavada group	Phyllite, meta siltstone, mica schist and quartzite
	Jharol group	Chlorite, phyllite, quartzite and mica schist
	Udaipur group	Phyllite, metagreywacke, gneiss, dolomite and limestone
	Debari group	Metavolcanics, quartzite, phyllite
~~Unconformity~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		
Bhilwara Supergroup	Mangalwar complex	Gneiss, schist, impure marble and migmatites

6.0 Ground Water Scenario

6.1 Hydrogeology

The principal source of ground water recharge is precipitation. Of the total rainfall

received, a major part is lost as runoff and evapotranspiration through soil and vegetation. Only a small portion of rainfall infiltrates down to join the ground water body.

In general, ground water occurs under unconfined conditions in gneisses, marble and migmatities of Bhilwara Supergroup; gneisses, schists, phyllites quartzites and dolomite of Aravalli Supergroup; granites of post- Aravallis and alluvium of Quaternary age. The hydrogeological map of the district is given in Figure 2. The occurrence and movement of ground water is mainly governed by the fractures, joints, bedding planes and other plains of structural weakness in consolidated rocks and grain size distribution and interconnection of pore spaces in alluvium.

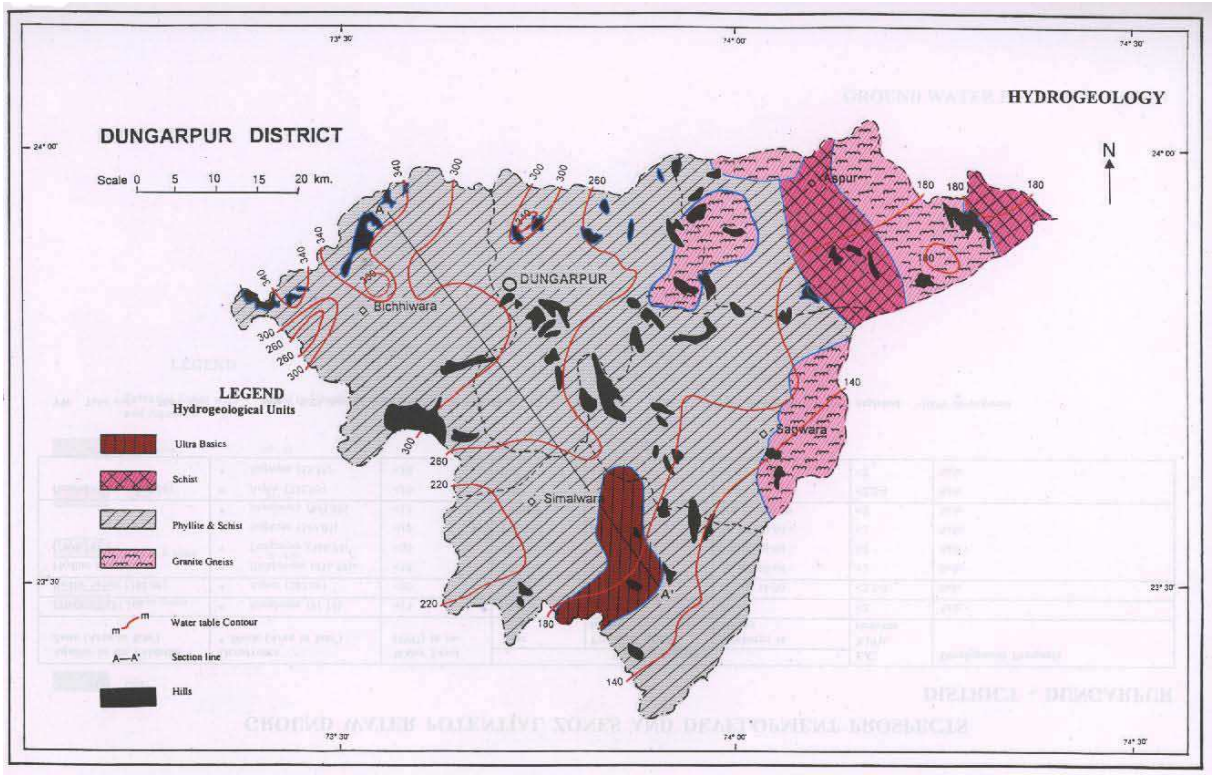

Figure 2: Hydrogeology

6.1.1 Gneisses

Weathered biotite and hornblende gneiss forms the bed rock in the northern and eastern parts of the district around villages Gehuwara, Punali, Hathali, Harnia, Pantli and Savgarh of Dungarpur tehsil and eastern parts of Sagwara tehsil upto river Mahi. In general, thickness of weathered zone extends from 4 to 6 m. Dug wells tapping this formation generally have meagre yield.

6.1.2 Schists, phyllites and slates

More than 75% of the district is occupied by these formations. Dug wells tapping these formations and located near the nallas and streams generally have moderately good yields due to seepage through the weathered planes, but the wells located in other areas have only moderate to meagre yield. Weathered zones of phyllites overlying the fractured zones also have moderate yield.

Thickness of weathered and fractured zone extends down to 5 to 10m. At places,

it is covered by 1 to 2m thick cover of clayey soils. Depth of the wells in these fomations ranges from less than 5 to 25 mbgl. Wells yielding more than 100 m^3/day are reported from villages Moveri, Jalap, Parlia, Dadoria, Sanchia, Nolsam, Nariawada, & Tanihora. Based on the yield tests conducted on 27 dug wells, the specific capacity of the aquifer was found to range from 0.0082 to 0.219m^3/min/m.

6.1.3 Intrusives

The crystalline rocks of the area have been intruded by granites, amphibolite, pegmatites, quartz and amphibolite veins in the northeastern part of the district, around the village Wanwasa Lodawal, Bilodia & Richa. Depth of wells in these formations ranges from 7.5 to 12 m. Yield of dugwells tapping intrusives ranges from 15 to 100 m^3/day. Wells tapping basic intrusives yield more as compared to wells tapping granites or other instrusives.

6.1.4 Alluivium

Alluvial deposits comprising of unconsolidated pebbles of slates, phyllites and quartzites; silty clay, sand, gravel and kankar occur usually along the major river courses. These deposits are not extensive and occur as localized patches of variable thickness in uneven depressions along the river courses overlying the compact basement at shallow depths. The thickness of alluvial cover does not exceed 6 to 7 metres. These deposits, though of limited occurrence have low to moderate permeability, depending upon clay content and the degree of consolidation. In general, depth of wells ranges from 1.85 to 8.09 m. Yield of wells tapping alluvium ranges from 35 to 230 m^3/per day. The wells yielding more than 70 m^3/day are reported around the village Miniwara, Nab, Nawa Tapara and Taudi Umri.

6.2 Water Level Scenario

Central Ground Water Board periodically monitors the National Hydrograph Network Stations (NHNS) stations in the Dungarpur district, four times a year i.e. in January, May (Premonsoon), August and November (Postmonsoon).

6.2.1 Depth to Water Level – Premonsoon (May-2011)

Depth to water level during pre-monsoon (May, 2011) varied from 1.7 to 55.32 mbgl recorded at Baroda (Aspur block) and at Jasala (Simalwara block) respectively. In general depth t water level varied from 5 to 20 mbgl. A perusal of map (Figure 3) reveals that large patch of water level of more than 40 mbgl exists in the southeastern part of the district in Simalwara block. Shallow water level less than 5 mbgl has been recorded in Dungarpur and Aspur blocks.

6.2.2 Depth to Water Level – Postmonsoon (Nov-2011)

During post monsoon period (November, 2011), the depth to water level varied from 0.46 mbgl at Baroda to 11.38 mbgl at Mittasar in Aspur block. Map of depth to water level for the period of November 2011 (Figure 4) shows that the water levels are mostly less than 10 mbgl in the entire district. Shallow water level less than 2 mbgl have been registered in patches scattered in the district.

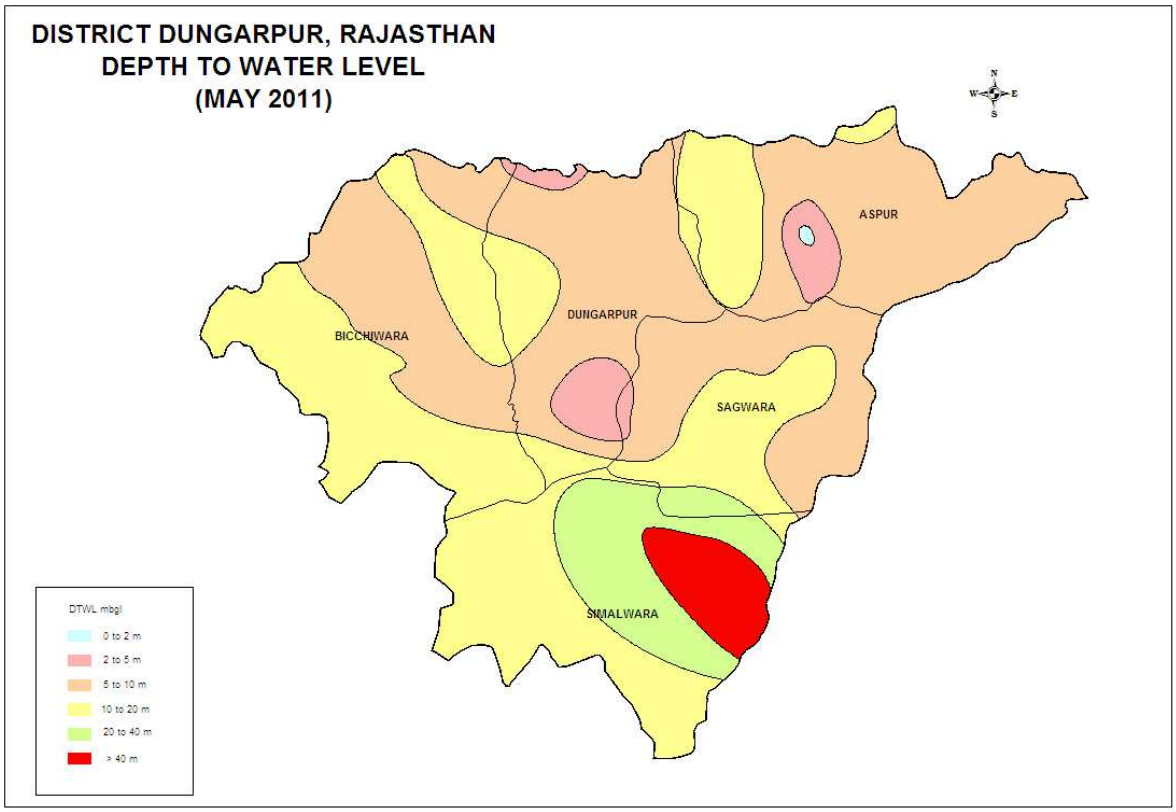

Figure 3: Depth to Water Level Map (May, 2011)

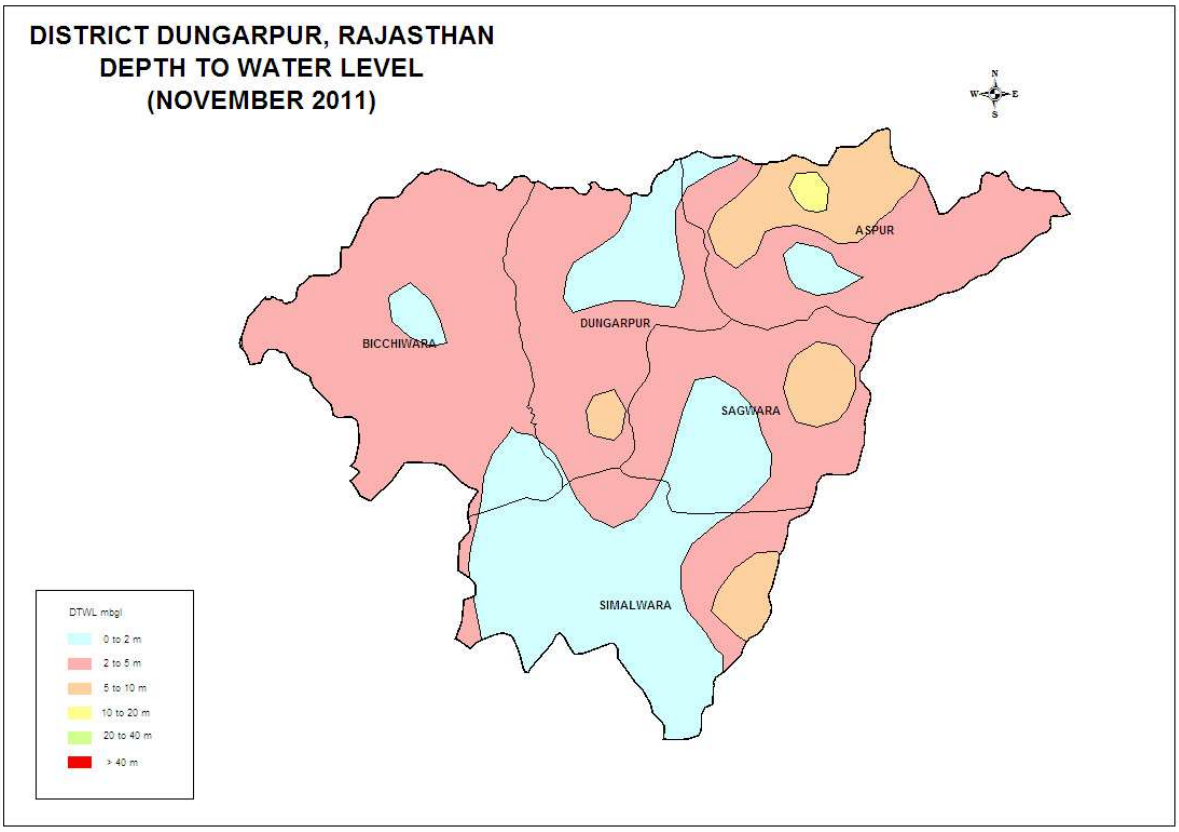

Figure 4: Depth to Water Level Map (November, 2011)

6.2.3 Seasonal Water Level Fluctuation (May-Nov. 2011)

Analysis of water level data of pre- and post-monsoon (May and November, 2011) indicates that about 88% of the monitoring stations in the district have registered rise in water levels with extent of rise varying from 1.24 to 46.93 m. Most of the wells have registered rise of more than 4 m (82%). Fall in ground water levels has been recorded from isolated pockets in Aspur and Dungarpur blocks. The extent of fall varies from 2.23 to 5.03 mbgl. Fall of more than 4 m has been observed in Aspur block (Figure 5).

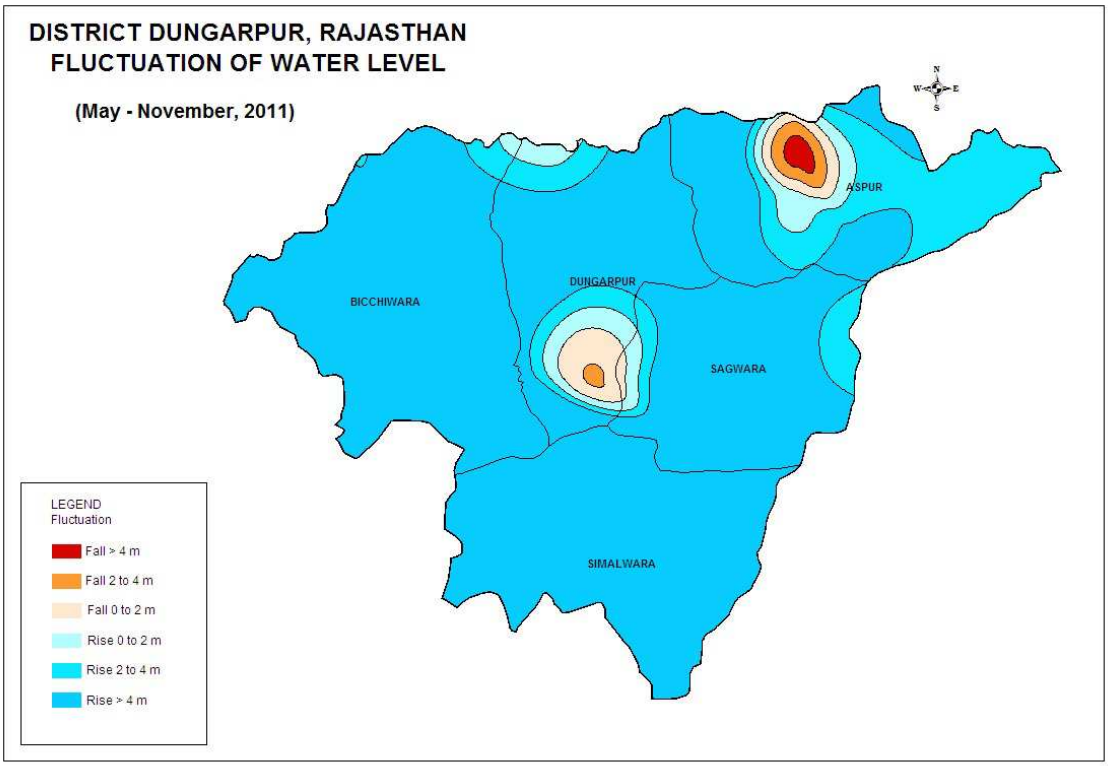

Figure 5: Seasonal ground water level fluctuation map (May – November, 2011)

6.2.4 Water Level Trend (2002-11)

The decadal premonsoon water level trend map for the period of May 2002 - May 2011 has been prepared and the same is presented in Figure 6. About two third of district experienced the rising trends of water level except a few isolated patches of falling trend in central and western part of the district. Rising trends in the range of 0.003 to 0.03 m/year and falling trend in the range of 0.005 to 0.068 m/year have been observed in the district.

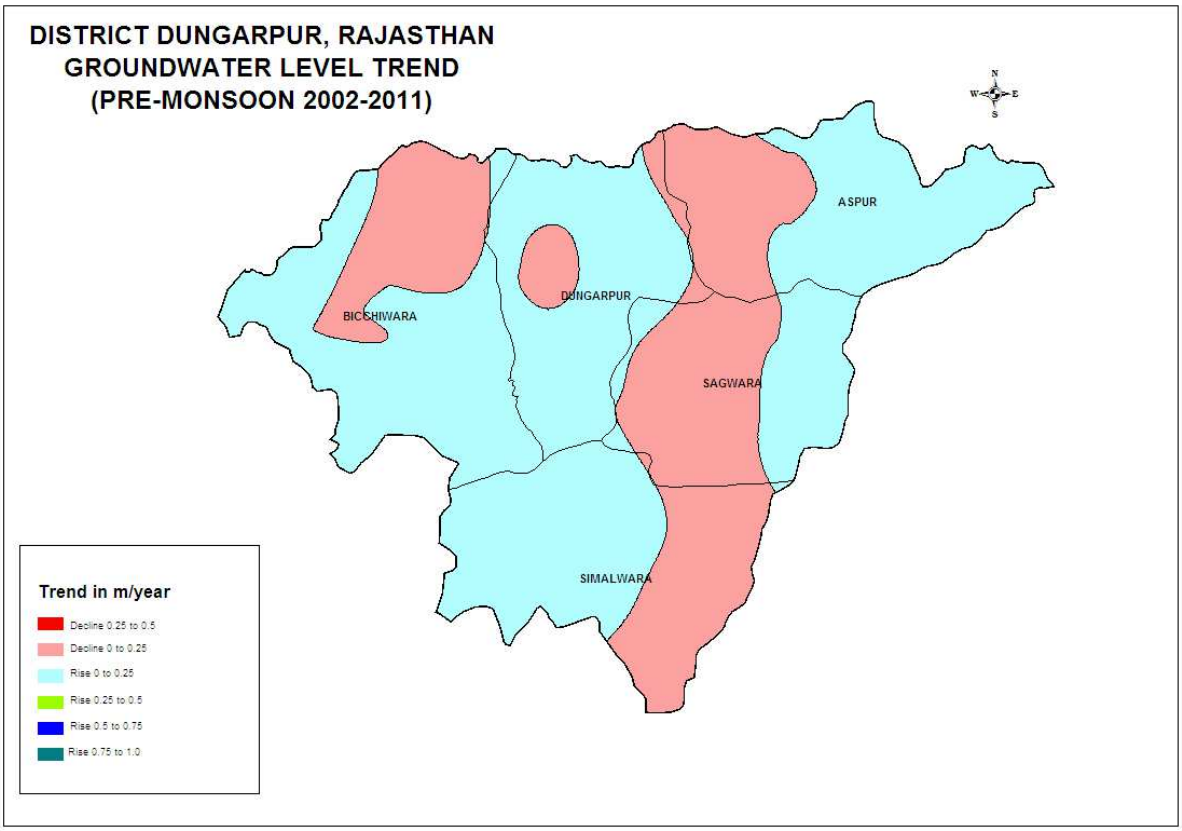

Figure 6: Water Level Trend Map (Premonsoon- 2002-2011)

6.3 Ground Water Quality

For the evaluation of hydrochemical status and distribution of various chemical constituents in ground water in the district, ground water samples are collected from the national network of observation wells during the month of May. The distribution of various important chemical constituents on ground water is discussed in the following paragraphs.

6.3.1 Electrical Conductivity (EC)

Electrical Conductance is the ability of a substance to conduct an electric current. Chemically pure water in liquid form has a very low conductance. The presence of dissociated ions in solution, however, renders the solution conductive. Therefore, EC of a solution gives an idea about the quantity of ions or dissolved solids present in it. Electrical conductivity in the district has been found to range from 466 to 2800 µS/cm at 25°C. Electrical conductivity more than 2000 µS/cm at 25°C has been observed mostly in the adjoining blocks of Sagwara, Aspur and Dungarpur (Figure 7).

6.3.2 Fluoride (F)

Concentration of fluoride in ground water in the district was found to vary from 0.12 to 5.35 mg/l. Occurrence of high fluoride in ground water in the district is a matter of great concern as 55.56% of the ground water samples collected for chemical analysis have shown fluoride value beyond maximum permissible limit of 1.5 mg/l (Figure 8). Around 33.33% and 11.11% of stations are within desirable and maximum permissible limit respectively. The area adjoining blocks of Aspur, Dungarpur and Sagwara are affected with fluoride contamination in

ground water.

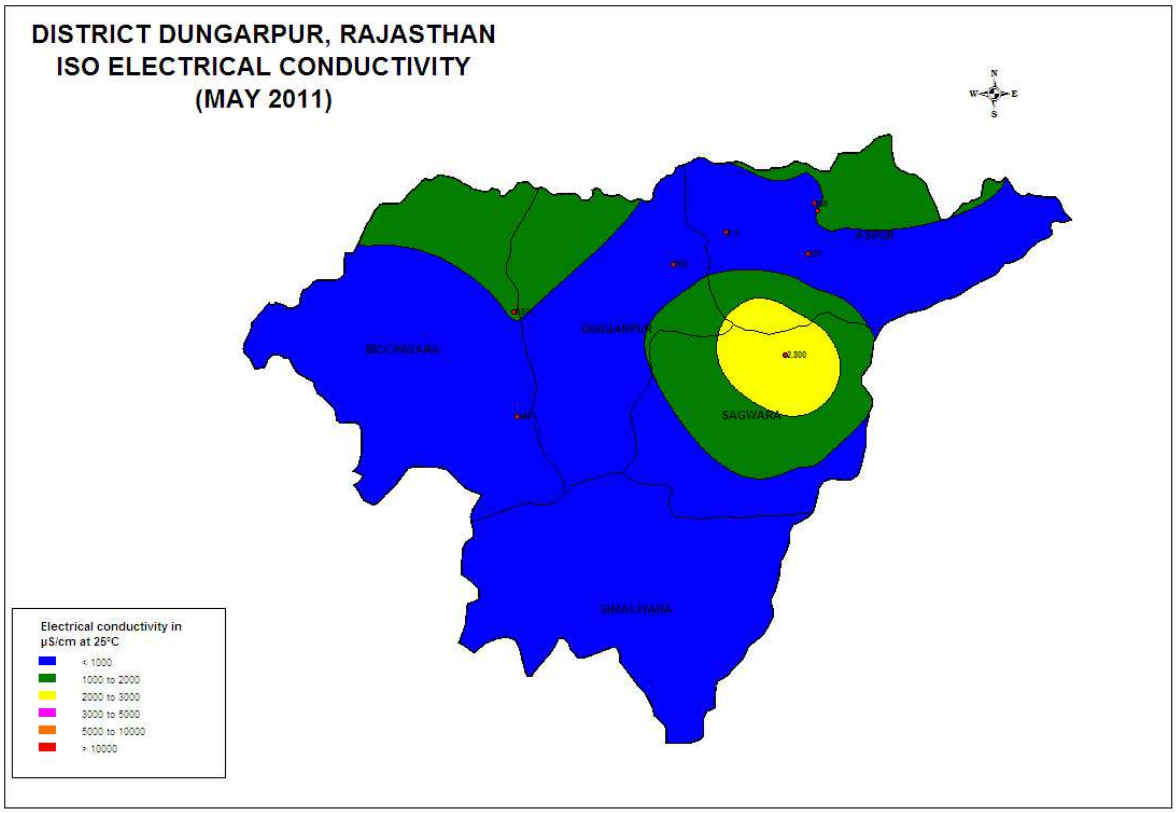

Figure 7: Iso Electrical Conductivity Map (May, 2011)

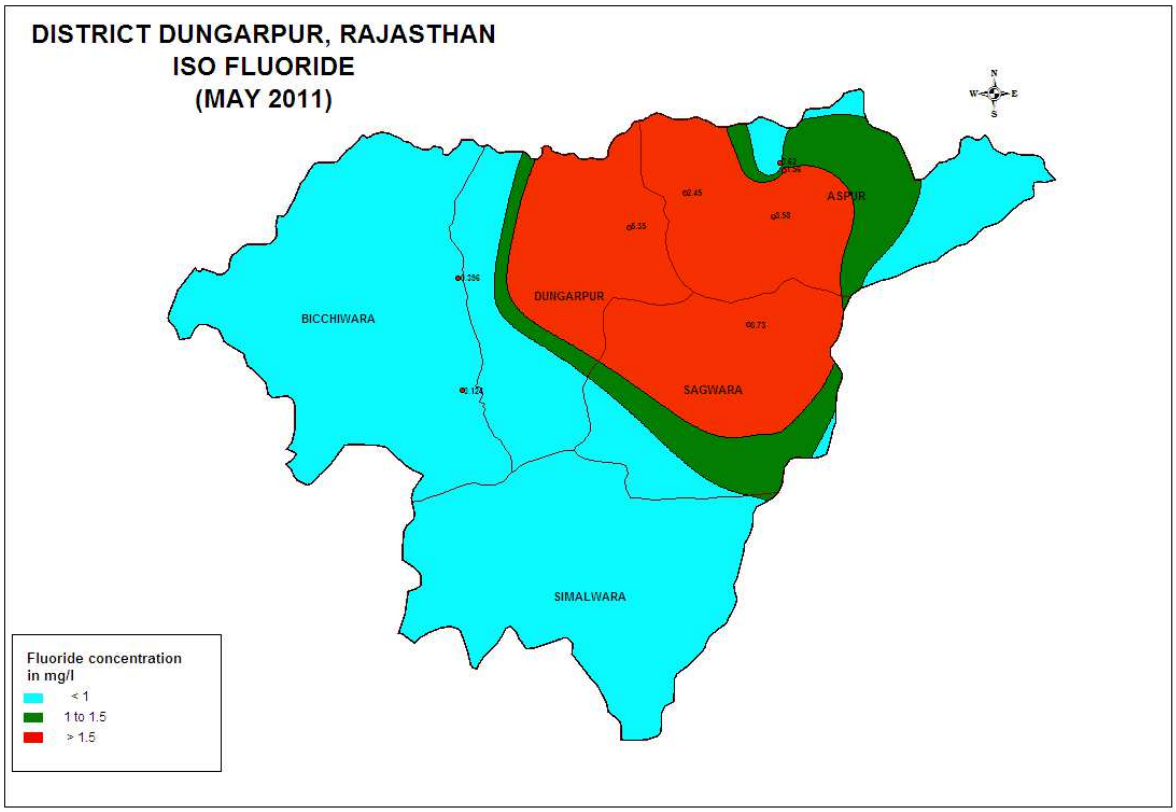

Figure 8: Iso Fluoride Map (May, 2011)

6.3.3 Iron (Fe)

Iron is an essential element in human nutrition. Excess of iron may cause bitter sweet astringent taste to water. Iron content in ground water has been found to vary from 0.005 to 1.065 mg/l. About 11.11% of samples analysed have iron value beyond the permissible limit of 1.0 mg/l. About 44.44% samples have iron content are within desirable limit of 0.3 mg/l and rest 44.44% have iron content between the desirable and maximum permissible limits (0.31 to 1.0 mg/l). Iron contamination has been observed in the adjoining blocks of Bicchiwara, Dungarpur and Simalwara (Figure 9).

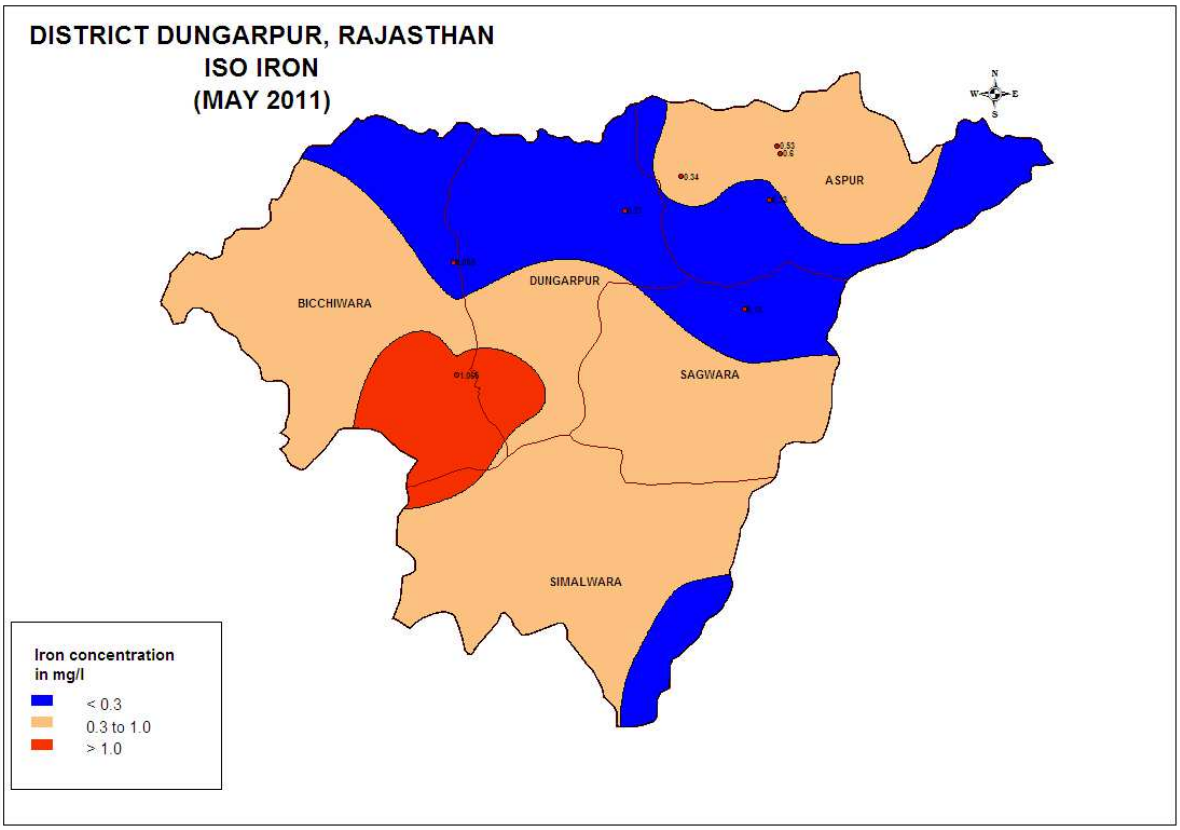

Figure 9: Iso Iron map (May, 2011)

6.3.4 Nitrate (NO_3)

Higher concentrations of nitrate are expected where fertilizers are used, in decayed animals and vegetable matter, in leaches from sludge and refuge disposal and in industrial discharges. Higher concentration of nitrate causes mathaemoglobinaemia disease in bottle fed infants (3 months old). Gastrointestinal disorders are also found. It may also have adverse effect on central nervous and cardio vascular system.

Dungarpur district does not have nitrate pollution problem. Nitrate concentration was found to range from 1 to 71 mg/l. Only one sample from Sagwara block was found to contain nitrate concentration more than the permissible limit 45 mg/l. Around 88.88% of stations have nitrate values within desirable limit & 11.11% of stations are within maximum permissible limit & no station have value beyond permissible limit in the district (Figure 10).

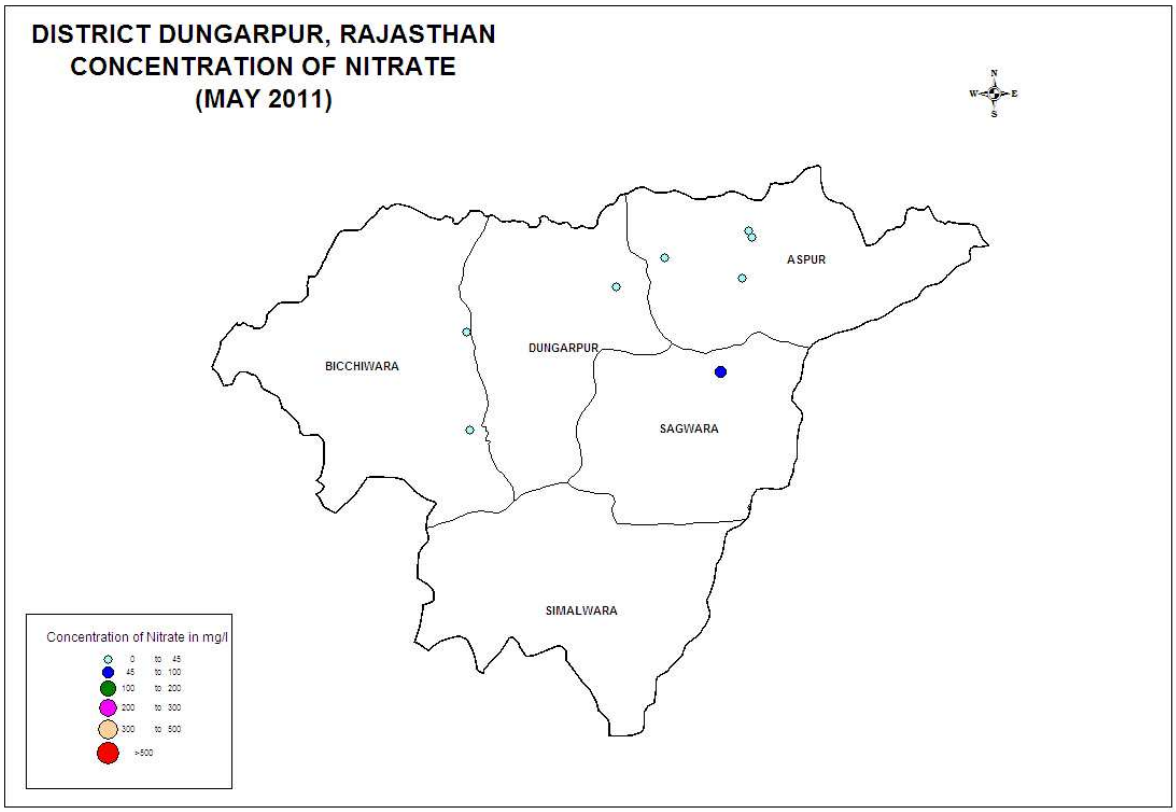

Figure 9: Nitrate distribution map (May, 2011)

7.0 Ground Water Resources

Central Ground Water Board and Rajasthan Ground Water Department (RGWD) have jointly estimated the ground water resources of Dungarpur district based on GEC-97 methodology. Ground water resources estimation was carried out for 2393 sq km area in non-command and 241 sq km in Command area (in Aspur block). The graphical representation of block wise ground water resources is shown in Figure 10 and block wise ground water resources are given in Table 5.

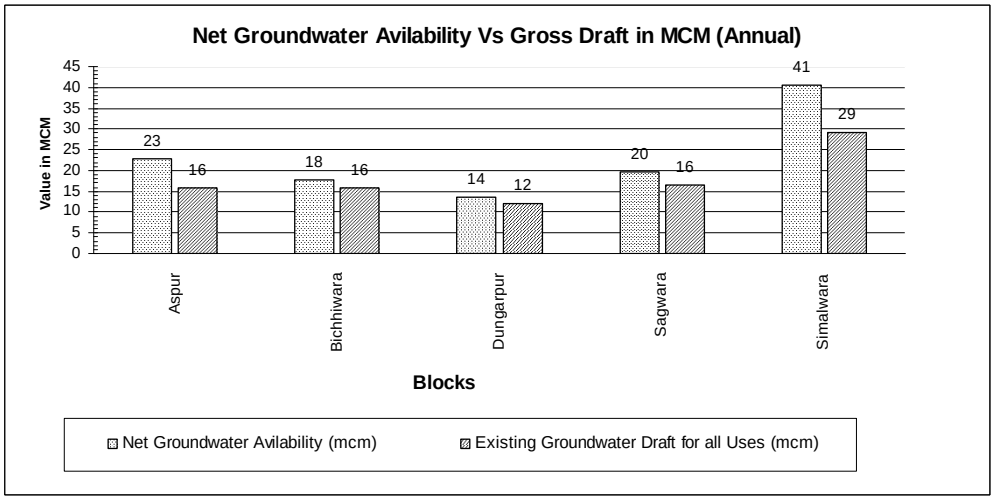

Figure 10 : Ground Water Resources (March 2009)

The total annually replenishable resource of the district has been assessed to be

126.68 MCM and net annual ground water availability has been estimated to be 114.83 mcm. Gross annual ground water draft for all uses has been estimated to be 89.06 MCM with stage of ground water development at 77.56 %.

Table 5: Block wise Ground Water Resources (March 2009)

Block	Total Annual Ground Water Recharge (MCM)	Net Annual Ground Water Availab-Ility (MCM)	Gross Ground Water Draft For Irrigation (MCM)	Gross Ground Water Draft For Dom.& Ind. Use (MCM)	Gross Ground Water Draft For All Uses (MCM)	Stage of G.W. Develo pment (%)	Category
Aspur	24.5463	22.9059	14.5410	1.2707	15.8117	69.03	Safe
Bichhiwara	19.8836	17.8953	14.3886	1.3628	15.7514	88.02	Semicritical
Dungarpur	15.1112	13.6001	10.4508	1.6692	12.1200	89.12	Semicritical
Sagwara	21.9932	19.7939	14.4228	1.9368	16.3596	82.65	Semicritcial
Simalwara	45.1498	40.6348	27.0645	1.9514	29.0159	71.41	Semicritical
Total	126.6841	114.8299	80.8677	8.1909	89.0586	77.56	

7.1 Status of Ground Water Development

The overall stage of ground water development in the district is 77.56%. It varies from 69.03% in Aspur block to 89.12% in Dungarpur. Out of five blocks, one block viz. Aspur block falls under safe category, which offers scope for further ground water development. The remaining four blocks viz. Bichhiwara, Dungarpur, Sagwara and Simalwara blocks are semi-critical, which have scope for ground water development in the future, but caution is to be exercised while developing the resource so as to avoid any deleterious effect on ground water regime.

8.0 Ground water related issues and problems

Over the past decade, ground water levels have registered declining trends in some parts of the district. Four blocks in the district fall under semicritical category, which require cautious approach in ground water development to protect ground water resources against depletion. Fluoride contamination in ground water is also a matter of concern.

9.0 Ground Water Management Strategy

Due to pressure of population and improvement in the standard of living, the demand of fresh water for both agriculture and domestic use has substantially increased. As surface flow is available only for a limited period, ground water withdrawal has sharply increased. Four out of five blocks fall under semicritical category. Special attention is to be paid for ground water management in such blocks to avoid further deterioration of ground water situation. Artificial recharge measures need to be implemented simultaneously in these blocks to sustainability of abstraction structures.

9.1 Ground Water Development

Aspur block in the district is safe and offers ample scope for ground water development. The remaining four blocks are semicritical and require cautious approach in ground water development. Dugwells 3 to 5 m in diameter and 15 to 20 m in depth are feasible in both in phyllites/ schists as well as granite gneiss

aquifers. Yield of 50000 to 60000 litres per day is expected from such wells. Where wells do not give sufficient yield, 20 to 30 m vertical boring (4" diameter) is recommended to be done at the bottom of the well. Deepening of dug wells can also be done by blasting as and when required. Low duty bore wells 6" in diameter and 60 to 70 m deep are feasible in schists and phyllites, which may yield 5000 to 10000 litres per hour.

The results of exploration have indicated that construction of medium capacity borewells tapping schists/ phyllites down to depth of 80 m are feasible in the northern part of Dungarpur block, southwestern part of Simalwara block and a small patch between Bhiluda and Galiakot in the southeastern part of Sagwara block.

9.2 Water Conservation and Artificial Recharge

After detailed scientific studies, massive programme needs to be taken up for artificial recharge to groundwater using suitable techniques like harvesting roof top rainwater (RTRWH), urban storm rainwater runoff, village storm water run off, dug well recharge in farms, constructing sub surface barriers across streams/rivers and nallas along with watershed development projects in hard rock terrains. Awareness creation along with financial incentives is the need of the hour for promoting construction of recharge structures. Techniques of ground water recharge should percolate down to common man through numerous Training Programmes

10.0 Recommendations

- Taking advantage of uneven topography, small check dams or earthen bunds, upstream of irrigation commands can be constructed to harvest rain water. This will increase the recharge to ground water body and yield of wells located in such areas.
- Modern agricultural management techniques need to be adopted for effective and proper utilization of the resource. This can be achieved by distribution of water maintaining minimum pumping hours and selecting the most suitable cost effective cropping pattern.
- In safe area, ground water development may be enhanced by encouraging construction of new ground water abstraction structures. Proper care should be taken while selecting the site for wells in crystalline formations. Deepening of existing structures can be resorted to in order to tap maximum thickness of weathered zone.
- Low to medium capacity tubewells can be constructed either along structurally weak planes or along bedding planes of the formations.
- Lift irrigation schemes may be taken up to utilize base flow in streams by constructing sump wells along the banks. However, periodic monitoring of baseflow would be required for planning its utilization.
- In the area near canal, farmers may be encouraged to use ground water in conjunction with canal water. The canal water thus saved can be utilized by the villages at the tail end where scarcity of water is observed.