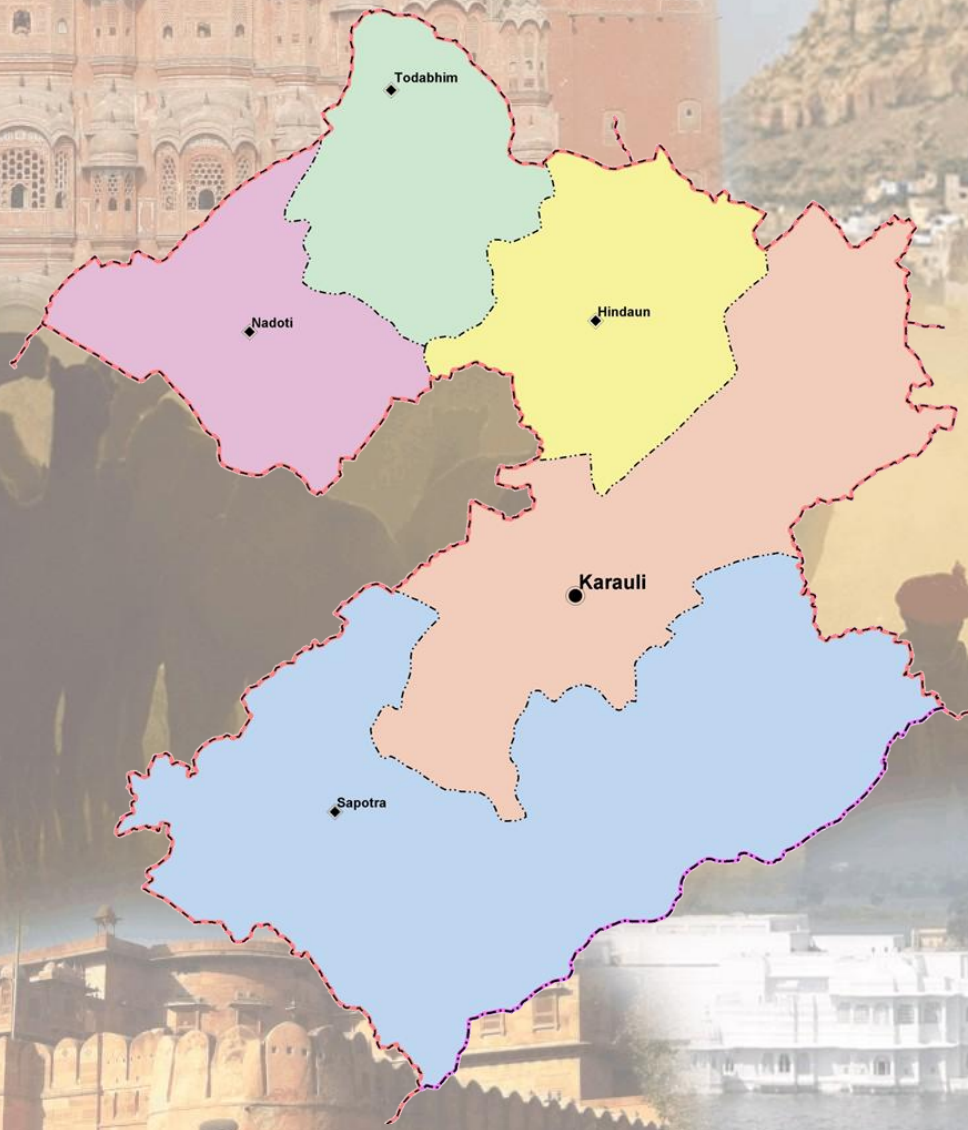
Ground Water Department,
Rajasthan

Hydrogeological Atlas of Rajasthan

Karauli District

European Union
State Partnership Programme

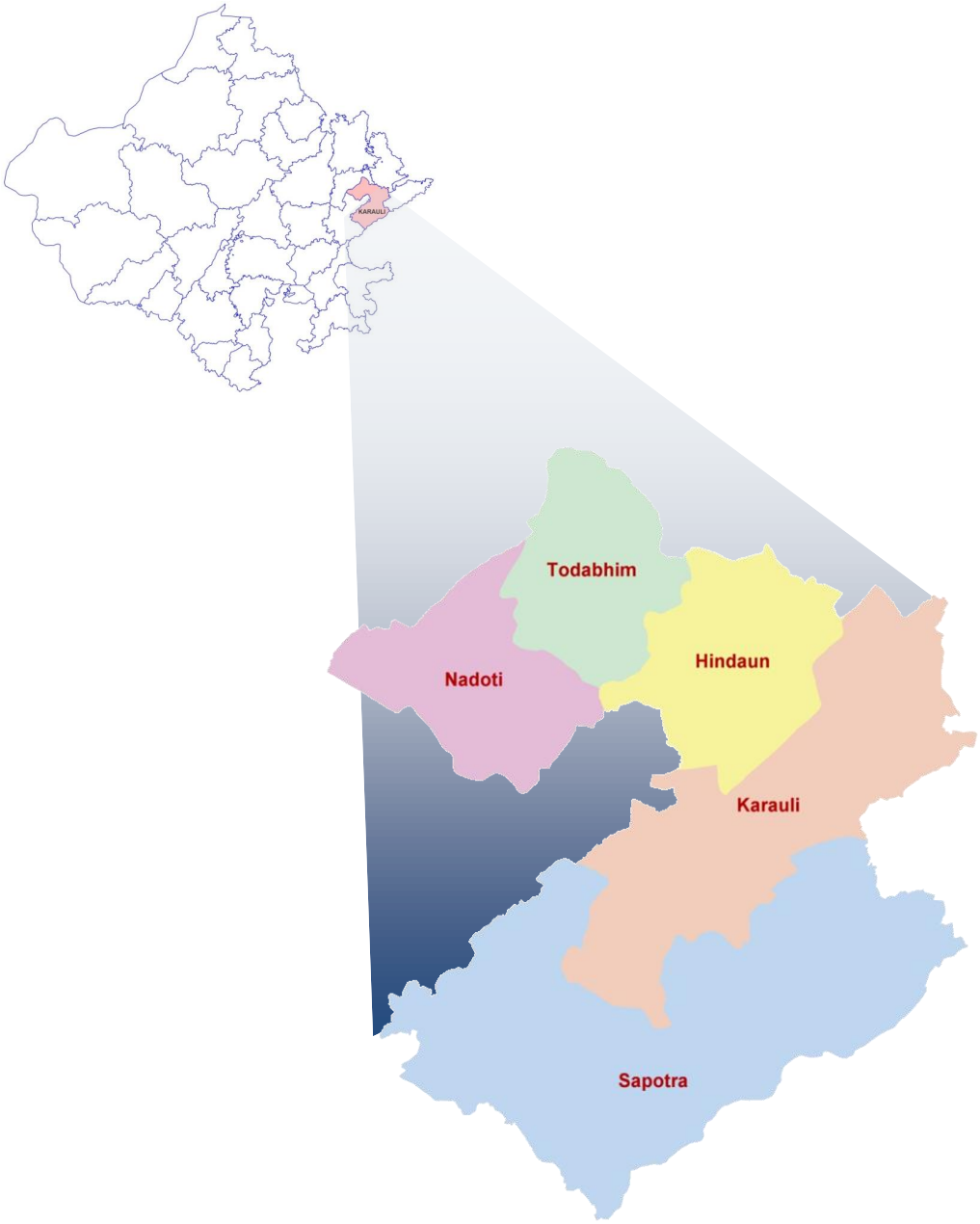


2013

ROLTA
Rolta India Limited

Hydrogeological Atlas of Rajasthan

Karauli District



Contents:

2013

ADMINISTRATIVE SETUP

DISTRICT – KARAULI

Location:

Karauli district is located in the eastern part of Rajasthan. It is bounded in the north by Dausa and Bharatpur districts, in the east by Dhaulpur district, south by state of Madhya Pradesh and Sawai Madhopur district in the west. It stretches between 26° 01' 27.02" to 27° 00' 11.61" north latitude and 76° 28' 34.98'' to 77° 24' 12.00'' east longitude covering an area of 4,985 sqkms. This district is part of four river basins namely 'Gambhir River Basin', 'Banas River Basin', 'Chambal River Basin' and 'Parbati River Basin'.

Administrative Set-up:

Karauli district is administratively divided into five blocks. The following table summarizes the basic statistics of the district at block level.Sapotra block is the largest in area occupying about 1955 sq kms whereas the smallest block is Todabhim spread over about 544 sq kms while population wise, Hindaun block has the highest population and Nadoti has lowest population.

S. No.	Block Name	Population (Based on 2001 census)	Area (sq km)	% of District Area	Total Number of Towns and Villages
1	Hindaun	3,47,264	649.5	13.0	128
2	Karauli	2,88,860	1,227.8	24.6	204
3	Nadoti	1,26,089	608.7	12.2	95
4	Sapotra	2,32,513	1,954.9	39.3	224
5	Todabhim	2,14,939	544.1	10.9	150
Total		**12,09,665**	**4,985.0**	**100.0**	**801**

Karauli district has 801 towns and villages, of which five block headquarters as well.

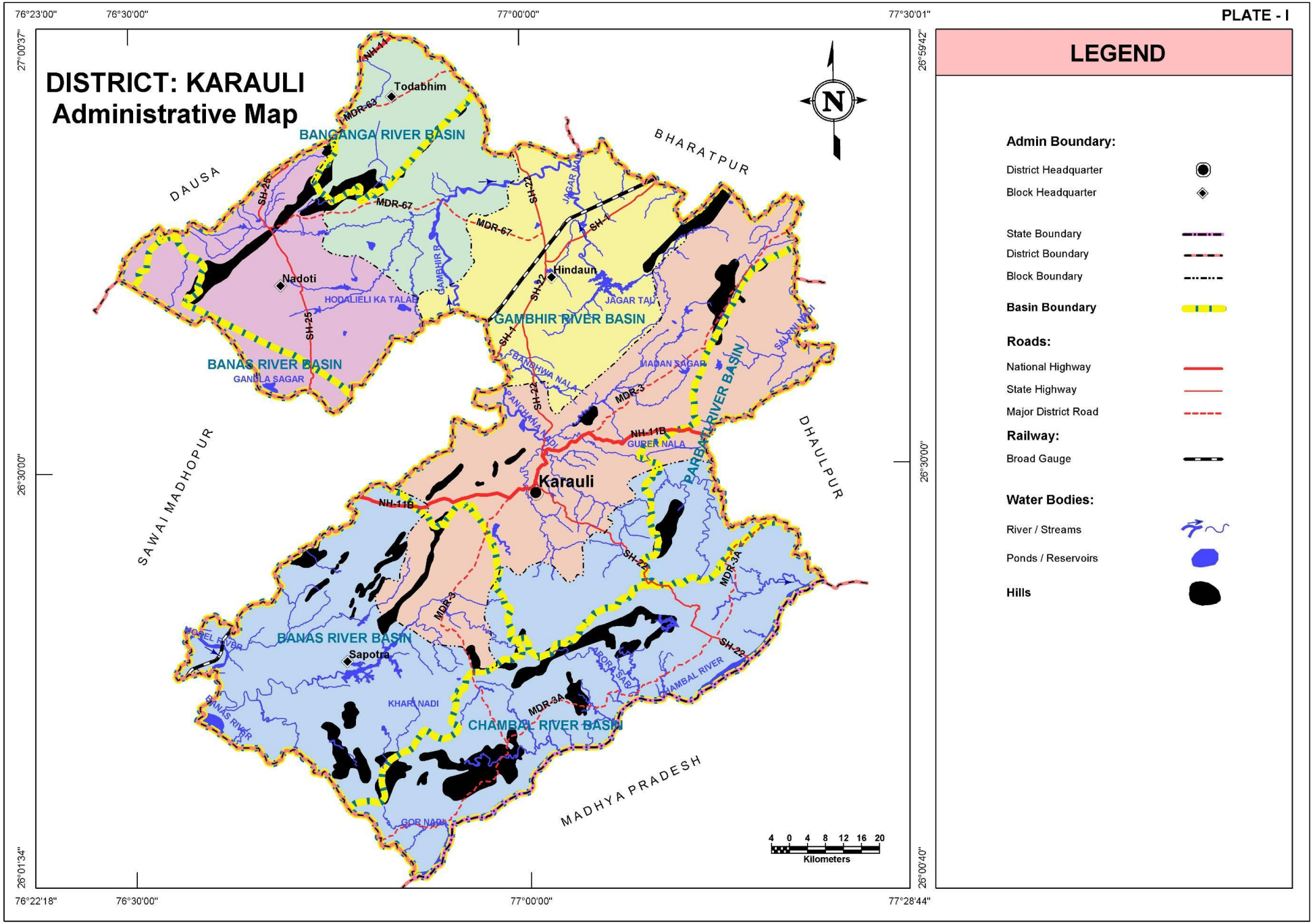
Climate:

The climate of the district is characterized by subtropical, dry with distinct winter, summer and monsoon. Highest temperature during May-June has been recorded as 49 °C and lowest temperature in January recorded as 5 °C. Most of the rainfall is received during the monsoon season, which extends from July to September. Average rainfall of the district is 577.11 mm.

Ground Water Department, Rajasthan

European Union
State Partnership Programme

PLATE - I



LEGEND

Admin Boundary:

- District Headquarter
- Block Headquarter
- State Boundary
- District Boundary
- Block Boundary
- **Basin Boundary**

Roads:

- National Highway
- State Highway
- Major District Road

Railway:

- Broad Gauge

Water Bodies:

- River / Streams
- Ponds / Reservoirs
- **Hills**

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TOPOGRAPHY

DISTRICT – KARAULI

The area is characterized by flat to undulating topography with small isolated hills in NW, NE, SW and eastern part of the district. Vindhyanchal and Aravalli hill ranges comes under the district area which covers almost half part of the district. The major rivers of the district are Gambhir in north, Morel and Banas in southwest and Chambal in southeast which developed very good drainage system along with their tributaries like Gor, Khar, Ranchana, Salrni and Jagar. The general topographic elevation in the district ranges between 250 m to 300 m above mean sea level in most of the blocks. Minimum elevation in the district is 131.0 m above mean sea level in Sapotra block in the southern part of the district and maximum of 522.5 m above mean sea level In Nadoti block in northwestern part of the district.

Table: Block wise minimum and maximum elevation

S. No.	Block Name	Min. Elevation (m amsl)	Max. Elevation (m amsl)
1	Hindaun	200.2	378.8
2	Karauli	221.1	413.4
3	Nadoti	225.5	522.5
4	Sapotra	131.0	470.4
5	Todabhim	205.4	441.4

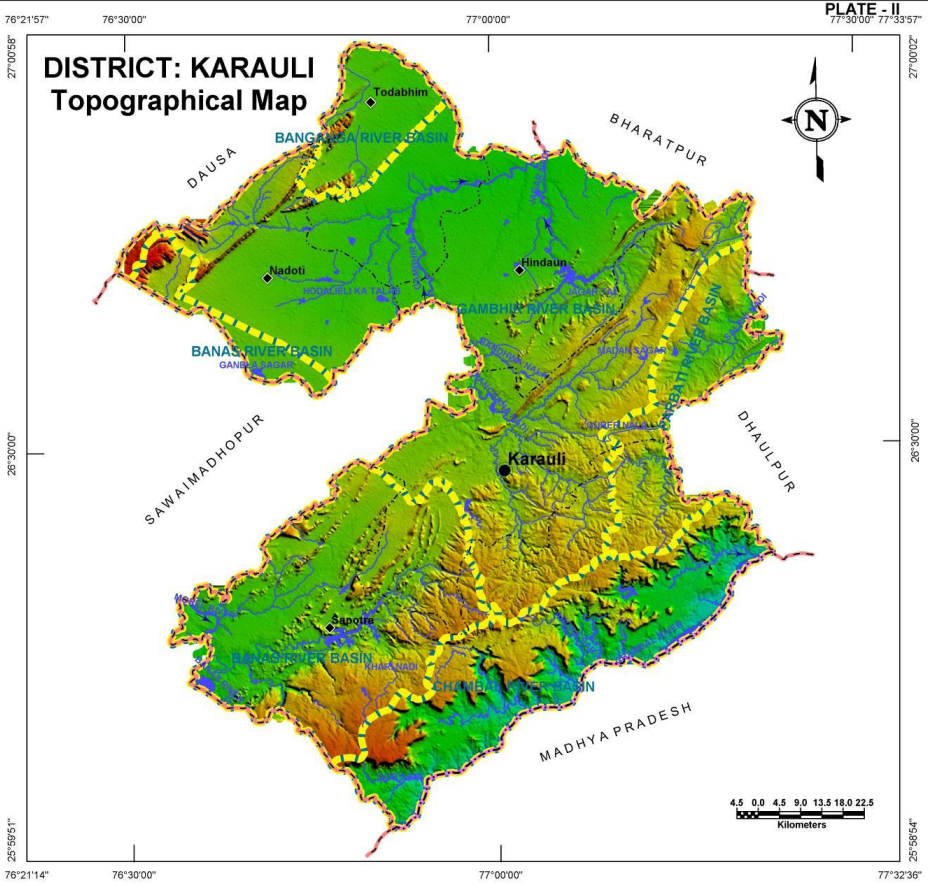
RAINFALL

The general distribution of rainfall across the district can be visualized from isohyets presented in the Plate – III where most of the district seems to have received rainfall in the range of 600-700 mm in year 2010. The total annual average rainfall is 646.8 mm based on the data of available blocks. Sapotra block received highest rainfall of 913.0mm whereas lowest was in Nadoti block (560.8mm). Maximum average annual rainfall recorded in Sapotra block about 705.2mm.

Table: Block wise annual rainfall statistics (derived from year 2010 meteorological station data)

Block Name	Minimum Annual Rainfall (mm)	Maximum Annual Rainfall (mm)	Average Annual Rainfall (mm)
Hindaun	609.1	668.5	634.9
Karauli	628.0	730.4	657.8
Nadoti	560.8	758.8	628.0
Sapotra	645.1	913.0	705.2
Todabhim	578.1	633.3	608.0

PLATE - II



LEGEND

Admin Boundary:
- District Headquarter
- Block Headquarter
- State Boundary
- District Boundary
- Block Boundary

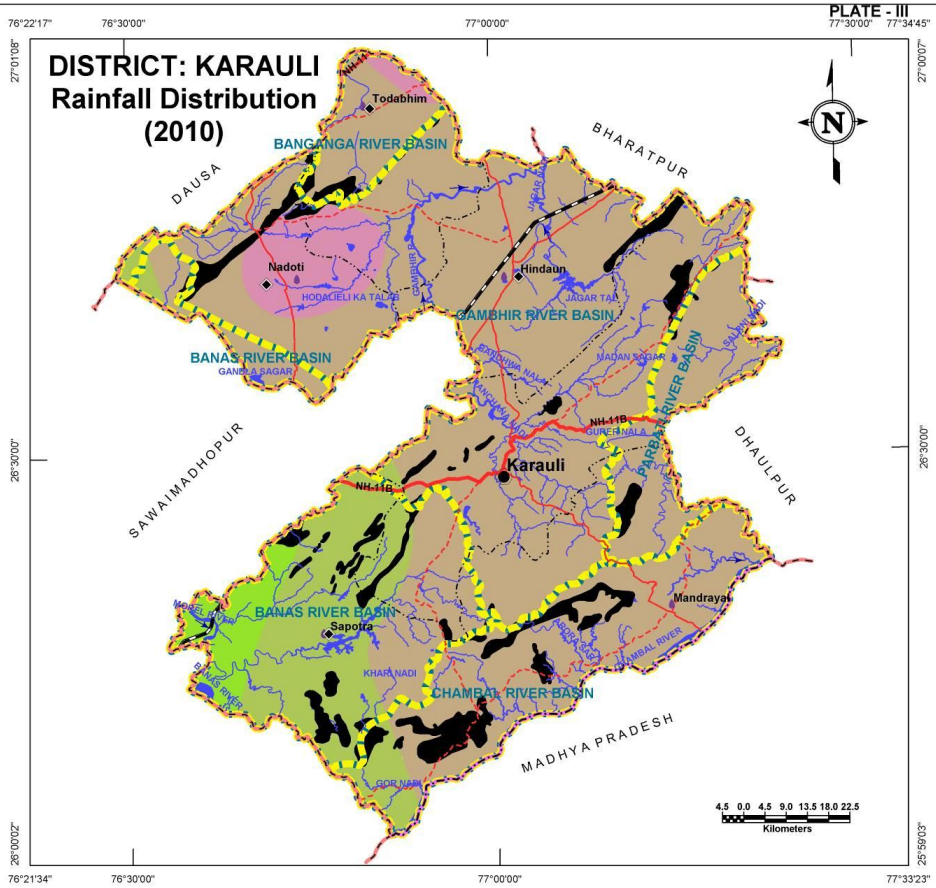
Basin Boundary

Water Bodies:
- River / Streams
- Ponds / Reservoirs

Elevation (m amsl):
523, 500, 450, 400, 350, 300, 250, 200, 150, 131

Source : SRTM DEM

PLATE - III



LEGEND

Admin Boundary:
- District Headquarter
- Block Headquarter
- Raingauge Stations
- State Boundary
- District Boundary
- Block Boundary

Basin Boundary

Roads:
- National Highway
- State Highway
- Major District Road

Railway:
- Broad Gauge

Water Bodies:
- River / Streams
- Ponds / Reservoirs

Hills

Isohyets (mm):
- 500-600
- 600-700
- 700-800
- 800-900
- 900-1000

GEOLOGY

DISTRICT – KARAULI

Geologically, the district lies under Vindhyan, Delhi and Bhilwara Super Groups. The eastern part of the district is separated from the western part by Great Boundary Fault. The latter consists of the rock formation of Bhander Group i.e. Sandstone, Shale and Limestone. The Delhi Super Group occupies the northwest part of the district which consist Quartzite, Schist of Ajabgarh and Alwar Group. A small isolated patch of Ranthambhor Group also occupies the center area of the district, which consists of Quartzite, Schist and Gneiss.

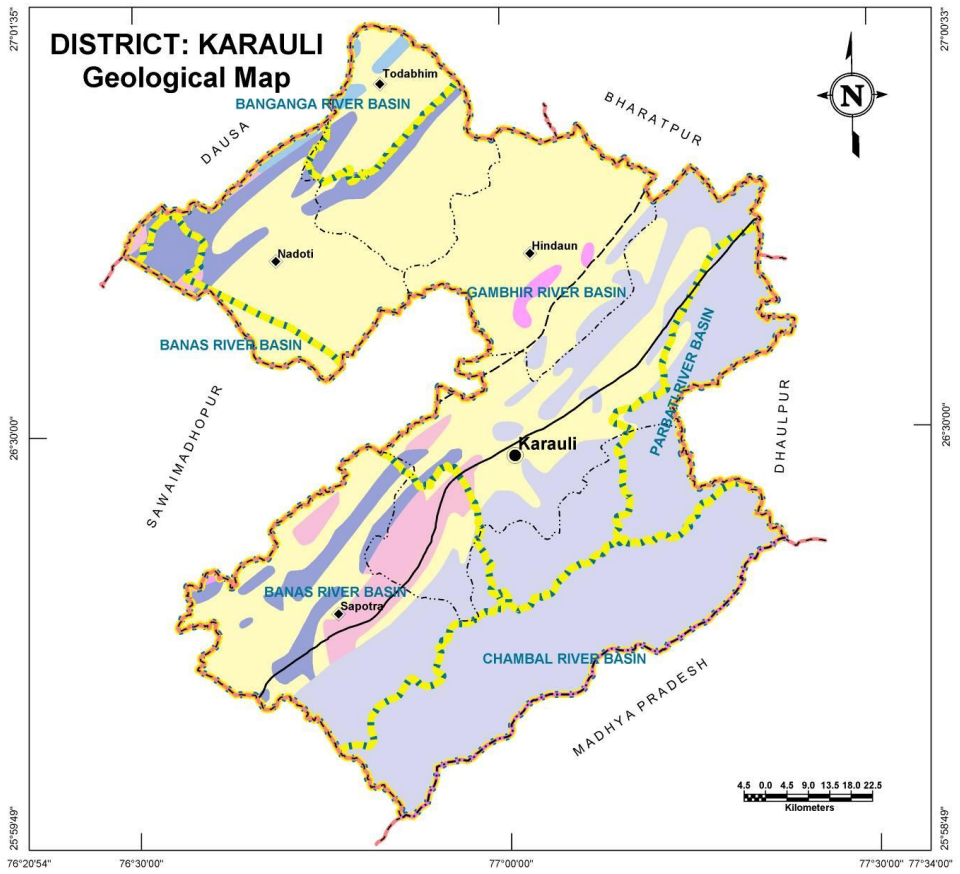
Super Group	Group	Formation
	Recent to Sub-Recent	Alluvium
--X--------X--------X--------X---Unconformity---X--------X--------X-------X--		
Vindhyan	Bhander	Sandstones, Limestone and Shale
	Rewa	
	Kaimur	
Delhi	Ajabgarh	Quartzite and Schist
	Alwar	
--X--------X--------X--------X---Unconformity---X--------X--------X-------X--		
Bhilwara	Ranthambhore	Quartzite, Schist and Gneiss

GEOMORPHOLOGY

Table: Geomorphologic units, their description and distribution

Origin	Landform Unit	Description
Denudational	Buried Pediment	Pediment covers essentially with relatively thicker alluvial, colluvial or weathered materials.
	Intermontane Valley	Depression between mountains, generally broad & linear, filled with colluvial deposits.
Fluvial	Alluvial Plain	Mainly undulating landscape formed due to fluvial activity, comprising of gravels, sand, silt and clay. Terrain mainly undulating, produced by extensive deposition of alluvium.
	Alluvial Plain (Sandy)	Flat to gentle undulating plain formed due to fluvial activity, mainly consists of gravels, sand, silt and clay with unconsolidated material of varying lithology, predominantly sand along river.
	Valley Fill	Formed by fluvial activity, usually at lower topographic locations, comprising of boulders, cobbles, pebbles, gravels, sand, silt and clay. The unit has consolidated sediment deposits.
	Ravine	Small, narrow, deep, depression, smaller than gorges, larger than gulley, usually carved by running water.
Structural	Plateau	Formed over varying lithology with extensive, flat, landscapes, bordered by escarpment on all sides. Essentially formed horizontally layered rocky marked by extensive flat top and steep slopes. It may be criss crossed by lineament.
Hills	Denudational, Structural Hill, Linear Ridge	Steep sided, relict hills undergone denudation, comprising of varying lithology with joints, fractures and lineaments. Linear to arcuate hills showing definite trend-lines with varying lithology associated with folding, faulting etc. Long narrow low-lying ridge usually barren, having high run off may form over varying lithology with controlled strike.

PLATE - IV



LEGEND

Admin Boundary:

- District Headquarter
- Block Headquarter
- State Boundary
- District Boundary
- Block Boundary

Basin Boundary

Structural Features:

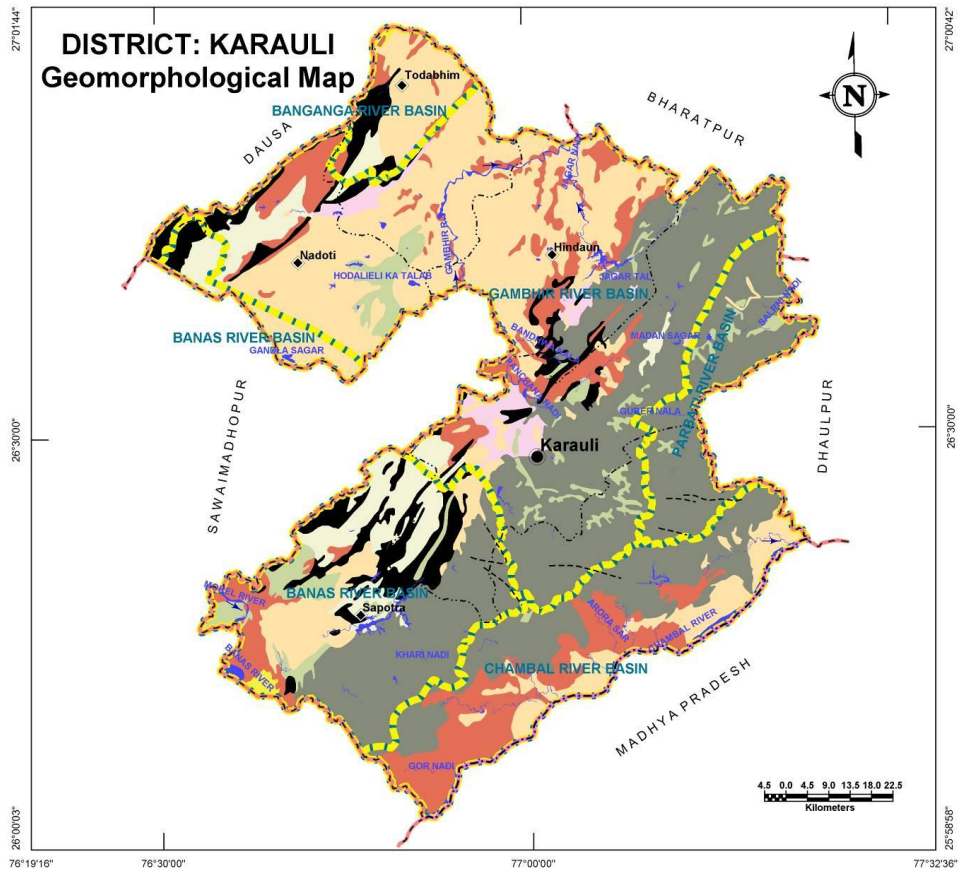
- Fault
- Great Boundary Fault

Geology:

- Alluvium and Wind blown sand
- Ajabgarh Group
- Alwar Group
- Ranthambhor Group
- Mangalwar Complex
- Bhander Group
- Rewa Group
- Kaimur Group
- Sand Group

Source: District Resource Map of Rajasthan - GSI

PLATE - V



LEGEND

Admin Boundary:

- District Headquarter
- Block Headquarter
- State Boundary
- District Boundary
- Block Boundary

Basin Boundary

Water Bodies

- River/Ponds/Reservoirs

Structural Features:

- Fault/Fractures/Lineament

Hills:

- Structural/Denudational/Linear Ridge

Landform Units:

Fluvial Origin:

- Alluvial Plain
- Alluvial Plain (Sandy)
- Valley Fill
- Ravine

Denudational Origin:

- Burried Pediment
- Intermontane Valley

Structural Origin:

- Plateau

Source: Ground Water Atlas of Rajasthan - SRSAC & GWD, Rajasthan

AQUIFERS

DISTRICT – KARAULI

Aquifer distribution map is presented in Plate – VI, which demonstrates widespread formation of aquifers within Alluvium and Sandstones. The alluvial aquifers (Older Alluvium) occupy approximately half of the district and occur as continuous patch in the western part of the district. The sandstone aquifers hold water both in primary and secondary openings and constitute good aquifers in the southeastern half of the district contributing to about 43% of district's aquifers. Quartzites aquifers form just 3% of the area and occur in the northwestern part of the district.

Table: aquifer potential zones their area and their description

Aquifer in Potential Zone	Area (sq km)	% age of district	Description of the unit/Occurrence
Older Alluvium	2,377.9	47.7	This litho unit comprises of mixture of heterogeneous fine to medium grained sand, silt and kankar.
Sandstone	2,132.7	42.8	Fine to medium grained, red colour and compact and at places.
Quartzite	161.2	3.2	Medium to coarse grained and varies from feldspathic grit to sericitic quartzite.
Hills	313.2	6.3	
Total	**4,985.0**	**100.0**	

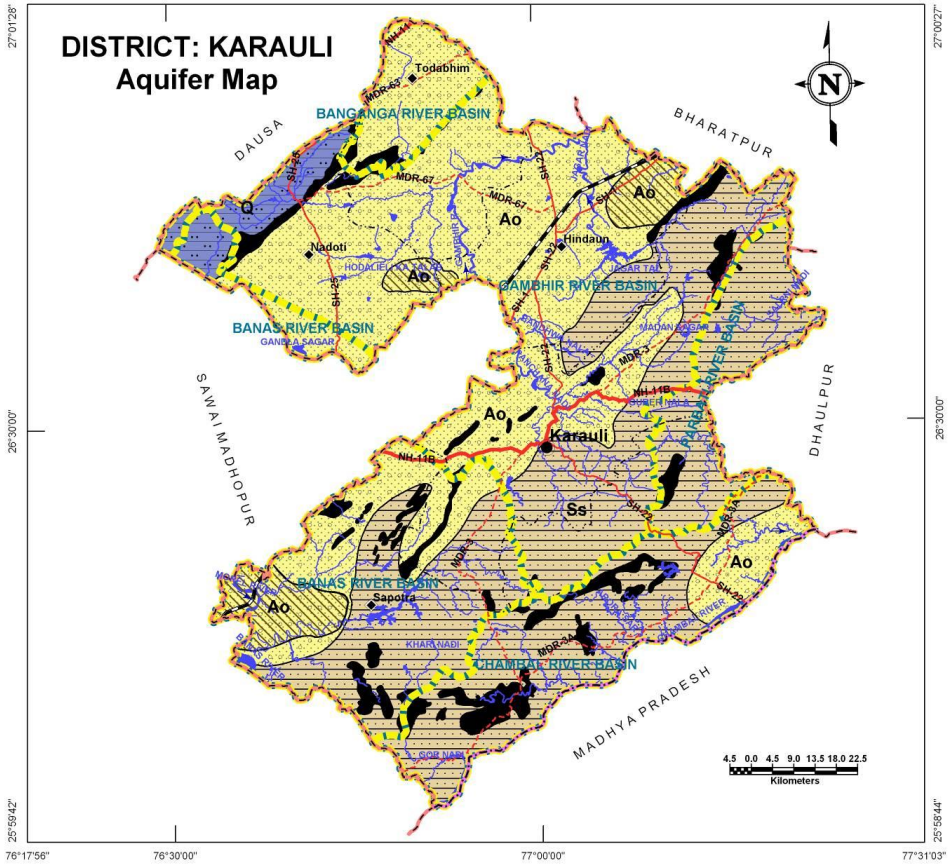
STAGE OF GROUND WATER DEVELOPMENT

In this district too, the ground water is under stress as revealed by ground water resource assessment studies. The stage of ground water development is very high as two blocks fall under 'Critical' category implying close to 100% development of resource. Ground water in two other blocks (Sapotra and Hindaun) is more stressed as they fall into 'Over Exploited category where exploitation exceeds the available dynamic ground water resource. Todabhim block has been 'Notified' for no more development of ground water resource.

Categorization on the basis of stage of development of ground water	Block Name
Critical	Nadoti, Karauli
Over Exploited	Sapotra, Hindaun
Notified	Todabhim

Basis for categorization: Ground water development <=100% - Critical and >100% - Over-Exploited. In Notified blocks development of GW is not permitted any more.

PLATE - VI



LEGEND

Admin Boundary:
- District Headquarter
- Block Headquarter
- State Boundary
- District Boundary
- Block Boundary
- **Basin Boundary**

Roads:
- National Highway
- State Highway
- Major District Road

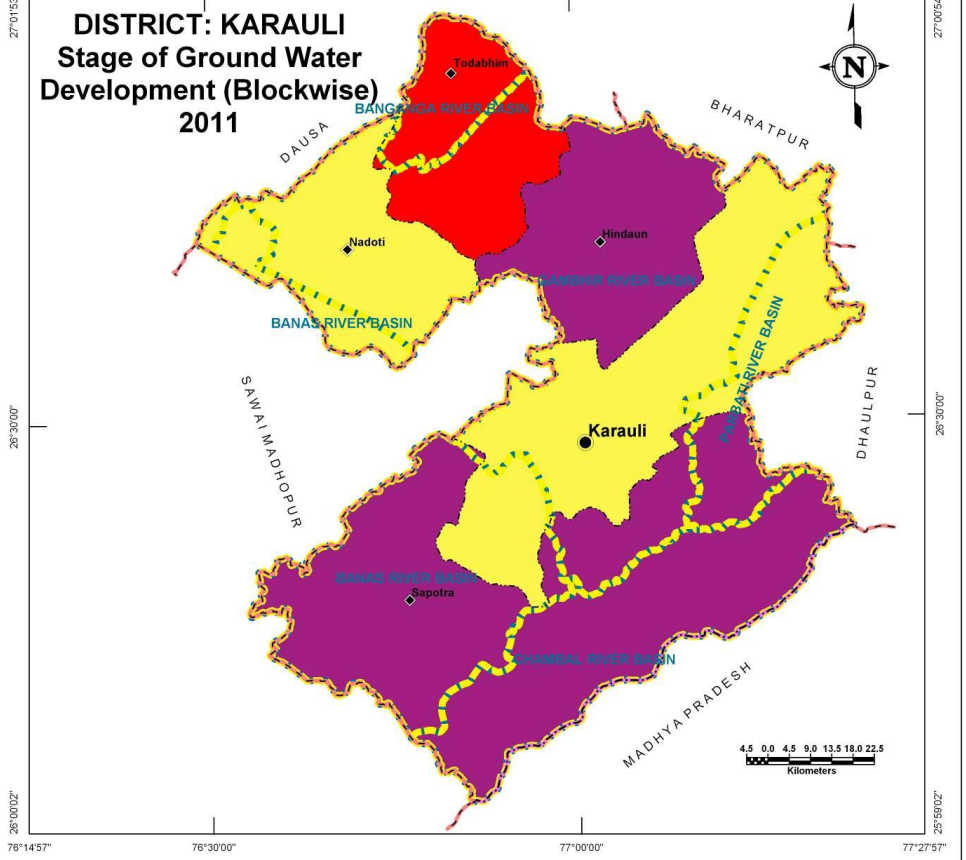
Railway:
- Broad Gauge

Water Bodies:
- River / Streams
- Ponds / Reservoirs
- **Hills**
- **Saline Area**
- **Command Area**

Aquifer:
- Older Alluvium
- Sandstone
- Quartzite

Source: Ground Water Potential Zone Map - GWD, Rajasthan

PLATE - VII



LEGEND

Admin Boundary:
- District Headquarter
- Block Headquarter
- State Boundary
- District Boundary
- Block Boundary
- **Basin Boundary**

Stage of Ground Water Development:
- Critical
- Over-Exploited
- Notified

Source: Ground Water Department, Rajasthan

LOCATION OF EXPLORATORY AND GROUND WATER MONITORING WELLS DISTRICT – KARAULI

Karauli district has a well distributed network of exploratory wells (51) and ground water monitoring stations (77) in the district owned by RGWD (22 and 54 respectively) and CGWB (29 and 23 respectively). The exploratory wells have formed the basis for delineation of subsurface aquifer distribution scenario in three dimensions. Benchmarking and optimization studies suggest that both the ground water level and quality monitoring network needs to be strengthened by adding 21 and 102 additional wells in different blocks.

Table: Block wise count of wells (existing and recommended)

Block Name	Exploratory Wells			Ground Water Monitoring Stations			Recommended additional wells for optimization of monitoring network	
	CGWB	RGWD	Total	CGWB	RGWD	Total	Water Level	Water Quality
Hindaun	6	5	**11**	4	12	**16**	1	21
Karauli	8	5	**13**	7	9	**16**	7	19
Nadoti	3	4	**7**	4	10	**14**	0	17
Sapotra	6	5	**11**	5	10	**15**	13	23
Todabhim	6	3	**9**	3	13	**16**	0	22
Total	**29**	**22**	**51**	**23**	**54**	**77**	**21**	**102**

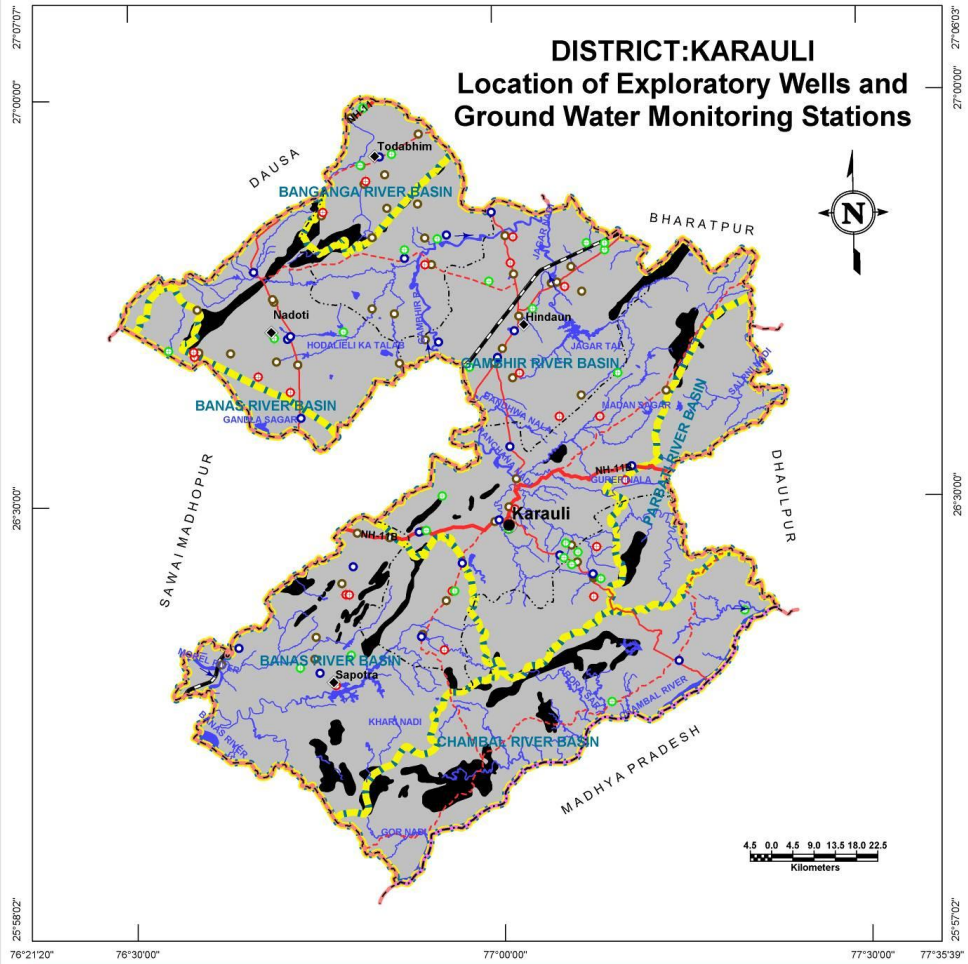
DEPTH TO WATER LEVEL (PRE MONSOON – 2010)

10m interval has been adopted to depict the depth to ground water levels in Karauli district as shown in Plate – IX. Variation in depth to water level varies from less than 10m below ground level to more than 70mbgl. In northwestern part of the district i.e., in Hindaun – Todabhim region, deeper water levels of 40m - 60m in general, and often reaching >70m bgl. Eastwards, the water level is moderately deep around (20-40m bgl) and the water level is quite shallow occurring 10m-20m bgl occasionally even less than 10m bgl in isolated patches especially in Nadoti region.

Depth to water level (m bgl)	Block wise area coverage (sq km) *					Total Area (sq km)
	Hindaun	Karauli	Nadoti	Sapotra	Todabhim	
< 10	7.4	23.7	45.0	1.7	0.1	**77.9**
10-20	324.2	862.6	292.0	743.0	210.0	**2,431.8**
20-30	150.6	264.7	158.3	1,024.5	189.5	**1,787.6**
30-40	112.1	14.8	45.8	8.4	56.9	**238.0**
40-50	30.2	0.5	26.4	-	33.2	**90.3**
50-60	13.3	-	4.5	-	13.4	**31.2**
60-70	5.3	-	-	-	8.7	**14.0**
< 70	0.1	-	-	-	0.9	**1.0**
Total	**643.2**	**1,166.3**	**572.0**	**1,777.6**	**512.7**	**4,671.8**

* The area covered in the derived maps is less than the total district area since the hills have been excluded from interpolation/contouring.

PLATE - VIII



LEGEND

Admin Boundary:
- District Headquarter
- Block Headquarter
- State Boundary
- District Boundary
- Block Boundary
- **Basin Boundary**

Roads:
- National Highway
- State Highway
- Major District Road

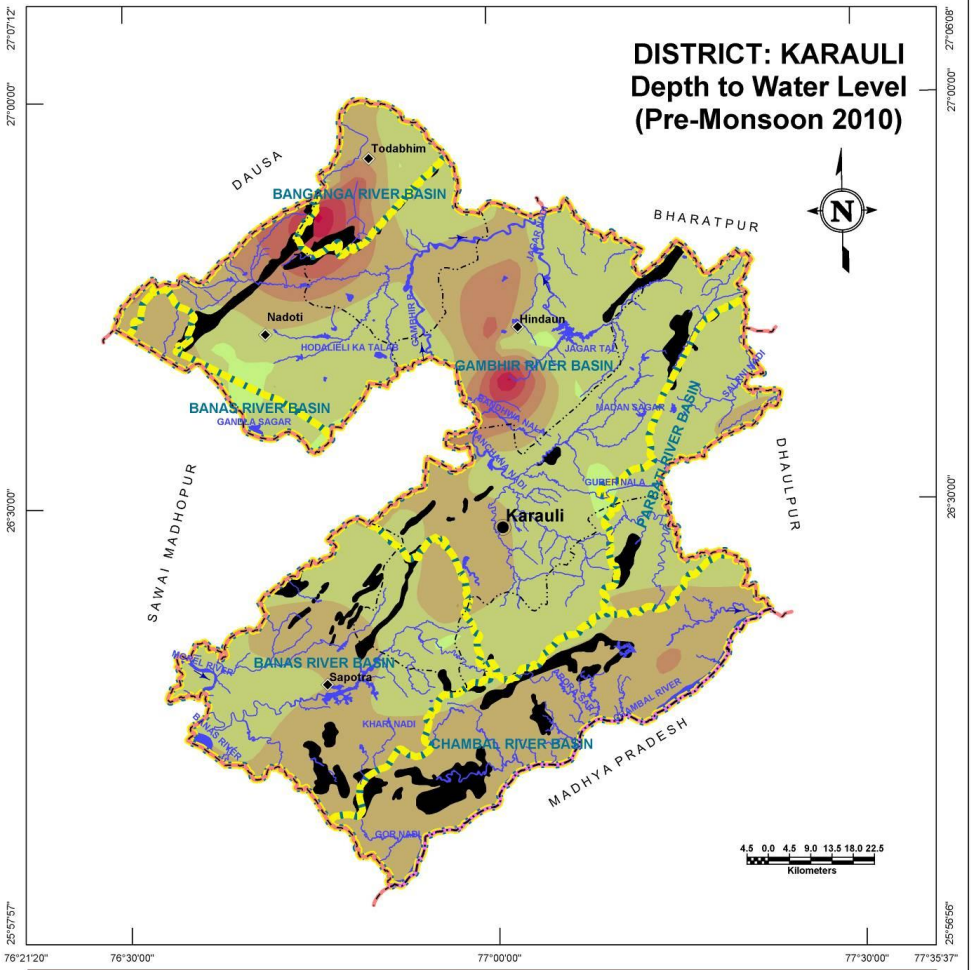
Railway:
- Broad Gauge

Water Bodies:
- River / Streams
- Ponds / Reservoirs
- **Hills**

Exploratory Wells:
- CGWB
- RGWD

Ground Water Monitoring Stations:
- CGWB
- RGWD

PLATE - IX



LEGEND

Admin Boundary:
- District Headquarter
- Block Headquarter
- State Boundary
- District Boundary
- Block Boundary
- **Basin Boundary**

Water Bodies:
- River / Streams
- Ponds / Reservoirs
- **Hills**

Depth to Water Level (m bgl):
- < 10
- 10 - 20
- 20 - 30
- 30 - 40
- 40 - 50
- 50 - 60
- 60 - 70
- > 70

WATER TABLE ELEVATION (PRE MONSOON – 2010) DISTRICT – KARAULI

Plate – XI presents the water table elevation map in Karauli district. Arrows are also indicated in the map, which show the flow direction of ground water. The central part of the district (northeast of Karauli) and the western most part of the district show high water levels and ground water flows from these areas towards north, southeast and southwestern directions following the topographic slope and river flow directions as well decided differently in each basin part of the district. The elevation ranges are varying in the district, the water table elevation highest reaching up to >320m amsl to a minimum elevation of <180m amsl in the Sapotra block in southeastern part of the district.

Table: Block wise area covered in each water table elevation range

Water table elevation range (m amsl)	Block wise area coverage (sq km)					Total Area (sq km)
	Hindaun	Karauli	Nadoti	Sapotra	Todabhim	
< 180	-	-	-	4.3	-	**4.3**
180 - 200	18.8	-	-	149.9	1.0	**169.7**
200 - 220	311.6	13.0	13.2	575.6	337.9	**1,251.3**
220 - 240	147.2	105.3	186.1	524.3	173.8	**1,136.7**
240 - 260	62.2	267.8	278.0	280.0	-	**888.0**
260 - 280	55.9	424.2	62.8	159.4	-	**702.3**
280 - 300	36.0	177.9	31.9	83.7	-	**329.5**
300 - 320	11.5	155.2	-	0.4	-	**167.1**
> 320	-	22.9	-	-	-	**22.9**
Total	**643.2**	**1,166.3**	**572.0**	**1,777.6**	**512.7**	**4,671.8**

WATER LEVEL FLUCTUATION (PRE TO POST MONSOON 2010)

Ground water level fluctuation map (Plate – XI) reveals a fall of more than 6 m in one area to rise in other areas by more than 18m. The negative fluctuation areas (indicated by pink and red regions) are the areas where overexploitation is taking place and even after monsoon recharge water level has not risen and has actually gone down with respect to pre-monsoon levels. Such ground water depletion areas are located in the central part of the district. Rest of the district has shown a nominal (0-4m) to significant rise in ground water level in the post monsoon season with respect to pre monsoon region. Maximum rise of more than 18m is noticed in the southern part of Karauli.

Table: Block wise area covered in each water fluctuation zone

Block Name	Block wise area coverage (sq km) per water level fluctuation range (m)														Total Area (sq km)
	< -6	-6 to -4	-4 to -2	-2 to 0	0 to 2	2 to 4	4 to 6	6 to 8	8 to 10	10 to 12	12 to 14	14 to 16	16 to 18	> 18	
Hindaun	-	-	-	78.8	478.0	86.4	-	-	-	-	-	-	-	-	**643.2**
Karauli	2.8	28.0	67.3	142.2	384.0	231.1	134.1	72.9	41.0	27.5	18.3	9.9	6.5	0.7	**1,166.3**
Nadoti	-	-	-	-	77.5	207.4	111.2	70.9	51.9	33.0	15.7	4.4	-	-	**572.0**
Sapotra	-	-	4.3	17.1	489.0	882.1	270.7	60.5	27.1	14.0	7.5	4.9	0.4	-	**1,777.6**
Todabhim	-	-	-	-	273.9	159.0	46.0	27.8	6.0	-	-	-	-	-	**512.7**
Total	**2.8**	**28.0**	**71.6**	**238.1**	**1,702.4**	**1,566.0**	**562.0**	**232.1**	**126.0**	**74.5**	**41.5**	**19.2**	**6.9**	**0.7**	**4,671.8**

PLATE - X

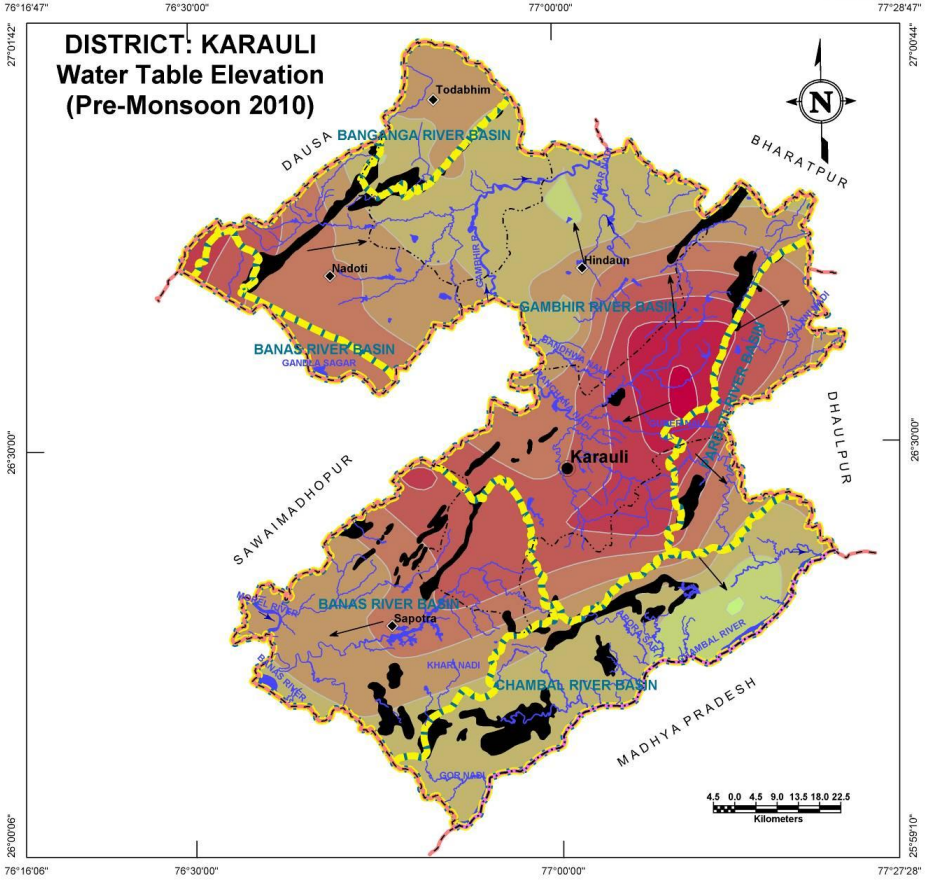
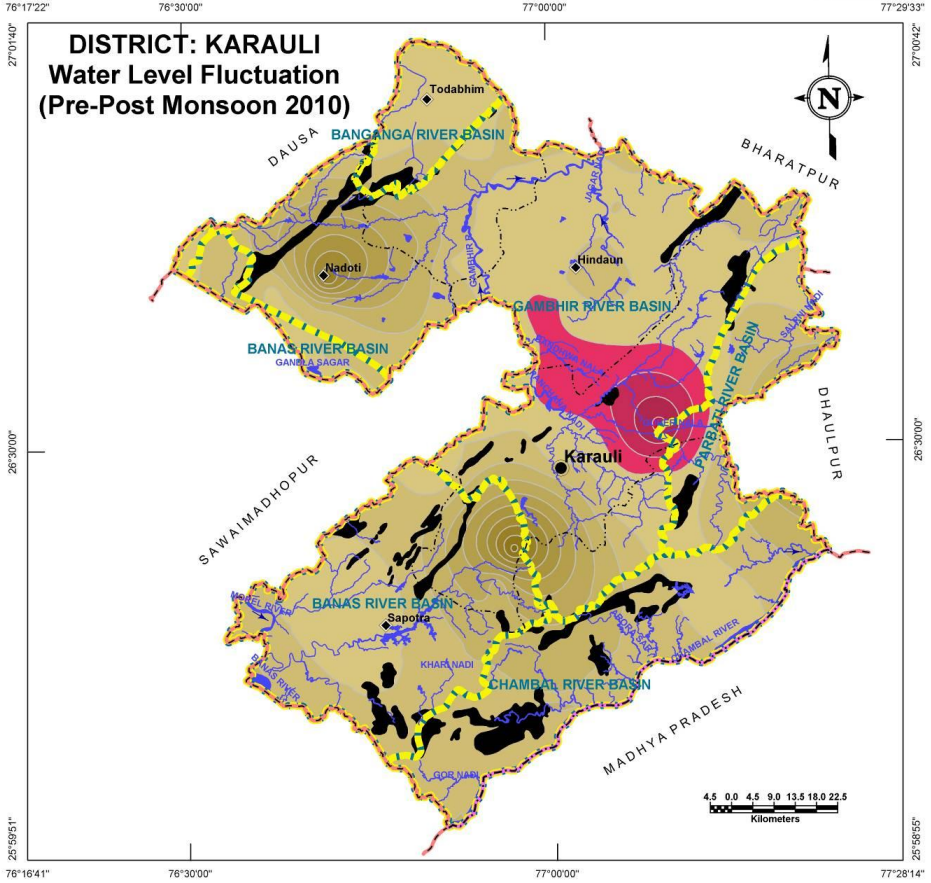


PLATE - XI



LEGEND

Admin Boundary:

- District Headquarter
- Block Headquarter
- State Boundary
- District Boundary
- Block Boundary
- **Basin Boundary**

Water Bodies:

- River / Streams
- Ponds / Reservoirs
- **Hills**
- **Water Table Elevation**

Water Table Elevation (m amsl):

- <180
- 180 - 200
- 200 - 220
- 220 - 240
- 240 - 260
- 260 - 280
- 280 - 300
- 300 - 320
- >320

LEGEND

Admin Boundary:

- District Headquarter
- Block Headquarter
- State Boundary
- District Boundary
- Block Boundary
- **Basin Boundary**

Water Bodies:

- River / Streams
- Ponds / Reservoirs
- **Hills**

Water Level Fluctuaion (m):

- < -6
- -6 to -4
- -4 to -2
- -2 to 0
- 0 to 2
- 2 to 4
- 4 to 6
- 6 to 8
- 8 to 10
- 10 to 12
- 12 to 14
- 14 to 16
- 16 to 18
- >18

GROUND WATER ELECTRICAL CONDUCTIVITY DISTRIBUTION — DISTRICT – KARAULI

The Electrical conductivity (at 25°C) distribution map is presented in Plate – XII. The areas with low EC values in ground water (<2000 µS/cm) are shown in yellow color and occupies almost 82% of the district area indicating that, by and large the ground water in the district is suitable for domestic purpose. The areas with moderately high EC values (2000 - 4000 µS/cm) are shown in green color and occupy 17% of the district area, largely in the northern and southeastern part of the district. Remaining small part of the district area approximately 1% has high EC values in ground water (>4000 µS/cm) is shown in red color, largely eastern part of Hindaun.

Table: Block wise area of Electrical conductivity distribution

Electrical Conductivity Ranges (µS/cm at 25°C) (Ave. of years 2005-09)	Block wise area coverage (sq km)										Total Area (sq km)
	Hindaun		Karauli		Nadoti		Sapotra		Todabhim		
	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	
< 2000	329.5	51.2	1,144.1	98.1	309.8	54.1	1,767.7	99.4	285.8	55.8	**3,836.9**
2000-4000	292.0	45.4	22.2	1.9	255.6	44.7	9.9	0.6	203.3	39.6	**783.0**
>4000	21.7	3.4	-	-	6.6	1.2	-	-	23.6	4.6	**51.9**
Total	**643.2**	**100.0**	**1,166.3**	**100.0**	**572.0**	**100.0**	**1,777.6**	**100.0**	**512.7**	**100.0**	**4,671.8**

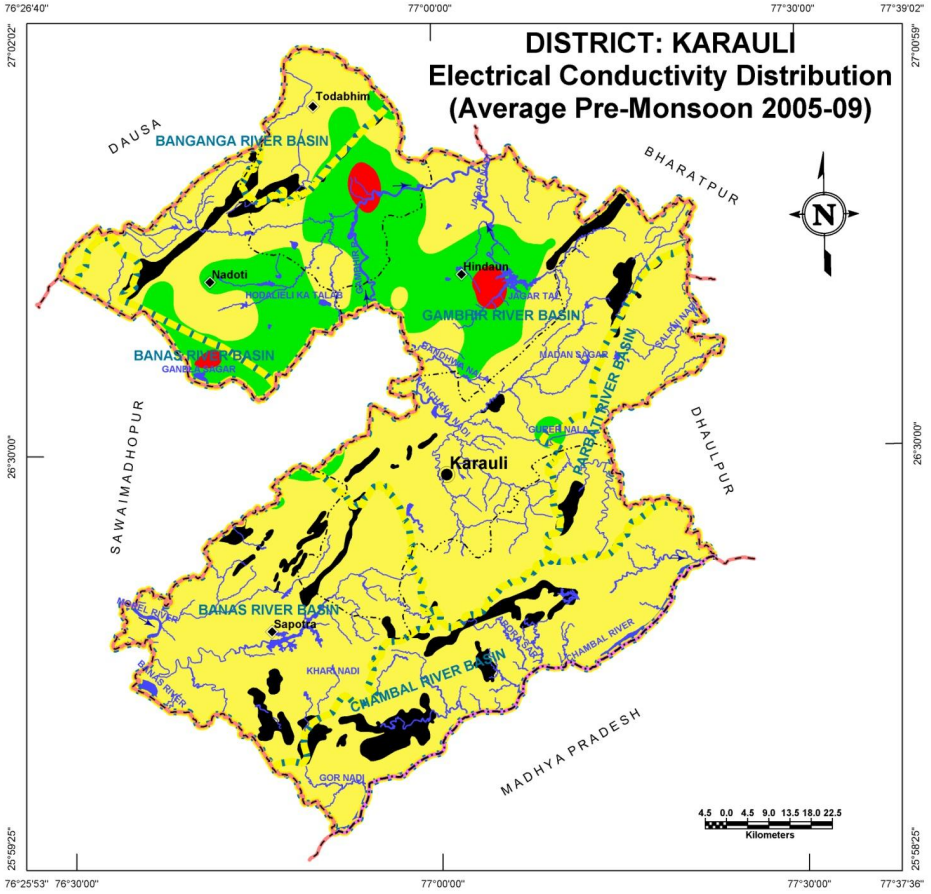
GROUND WATER CHLORIDE DISTRIBUTION

High chloride concentration in ground water also renders it unsuitable for domestic and other purposes. The yellow colored regions in Plate – XIII are such areas where chloride concentration is low (<250 mg/l) that occupy approximately 73% of the district area. The ground water in this region is suitable for domestic purposes. The areas with moderately high chloride concentration (250-1000mg/l) are shown in green color, which occupy approximately 27% of the district area, largely northern part of the district. No area in the district has shown very high (>1000 mg/l) Chloride concentration in ground water.

Table: Block wise area of Chloride distribution

Chloride Concentration Range (mg/l) (Ave. of years 2005-09)	Block wise area coverage (sq km)										Total Area (sq km)
	Hindaun		Karauli		Nadoti		Sapotra		Todabhim		
	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	
< 250	247.2	38.0	1,086.9	93.0	204.0	36.0	1,760.9	99.0	129.9	25.0	**3,428.9**
250-1000	396.0	62.0	79.4	7.0	368.0	64.0	16.7	1.0	382.8	75.0	**1,242.9**
> 1000	-	-	-	-	-	-	-	-	-	-	**-**
Total	**643.2**	**100.0**	**1,166.3**	**100.0**	**572.0**	**100.0**	**1,777.6**	**100.0**	**512.7**	**100.0**	**4,671.8**

PLATE - XII



LEGEND

Admin Boundary:

- District Headquarter
- Block Headquarter
- State Boundary
- District Boundary
- Block Boundary

Basin Boundary

Water Bodies:

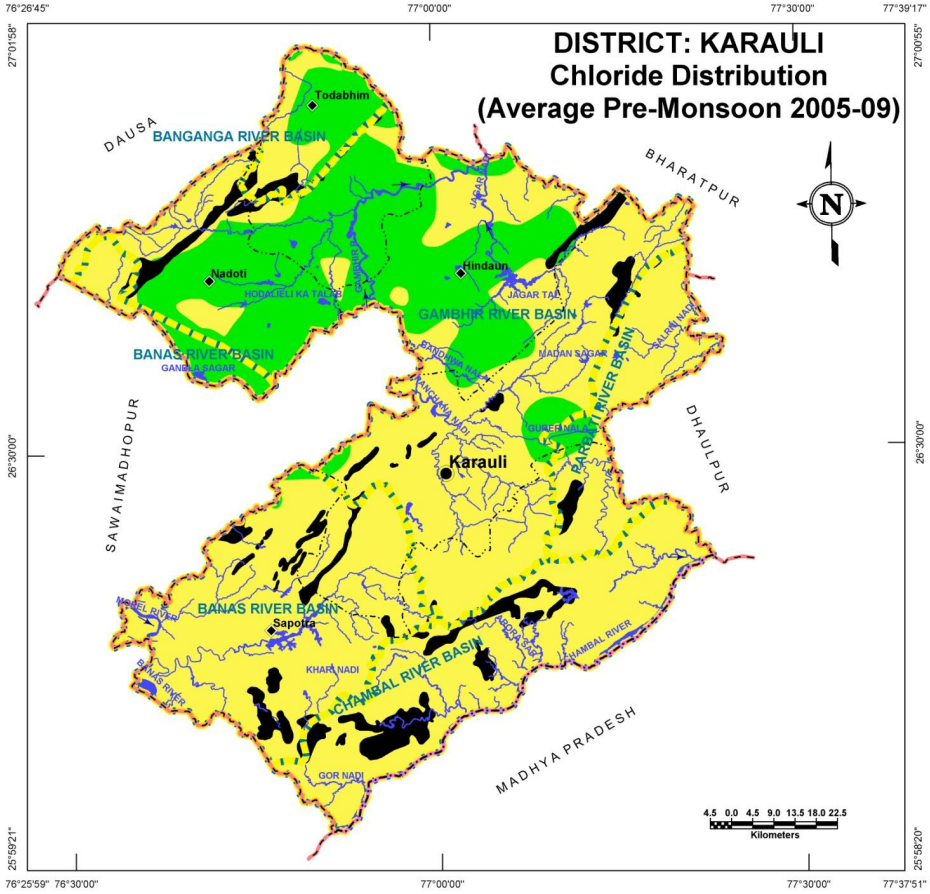
- River / Streams
- Ponds / Reservoirs

Hills

Electrical Conductivity (µS/cm at 25°C):

- < 2000
- 2000-4000
- >4000

PLATE - XIII



LEGEND

Admin Boundary:

- District Headquarter
- Block Headquarter
- State Boundary
- District Boundary
- Block Boundary

Basin Boundary

Water Bodies:

- River / Streams
- Ponds / Reservoirs

Hills

Chloride Concentration (mg/l):

- < 250
- 250 - 1000

GROUND WATER FLUORIDE DISTRIBUTION

DISTRICT – KARAULI

The Fluoride concentration map is presented in Plate – XIV. The areas with low concentration (i.e.,>1.5 mg/l) are shown in yellow color which occupy almost 91% of the district area which is suitable for domestic purpose. The areas with moderately high concentration (1.5-3.0 mg/l) are shown in green color that occupies approximately 8% of the district area, largely in the northern part of the district. A very small patch in the northern part of the district falls in high fluoride concentration (>3.0 mg/l) area and occupies approximately 1% area which is not suitable for domestic purpose.

Table: Block wise area of Fluoride distribution

Fluoride concentration Range(mg/l) (Ave. of years 2005-09)	Block wise area coverage (sq km)										Total Area (sq km)
	Hindaun		Karauli		Nadoti		Sapotra		Todabhim		
	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	
< 1.5	465.3	72.3	1,058.8	90.8	500.0	87.4	1,777.5	100.0	457.2	89.2	**4,258.8**
1.5-3.0	151.5	23.6	107.5	9.2	72.0	12.6	0.1	-	55.5	10.8	**386.6**
> 3.0	26.4	4.1	-	-	-	-	-	-	-	-	**26.4**
Total	**643.2**	**100.0**	**1,166.3**	**100.0**	**572.0**	**100.0**	**1,777.6**	**100.0**	**512.7**	**100.0**	**4,671.8**

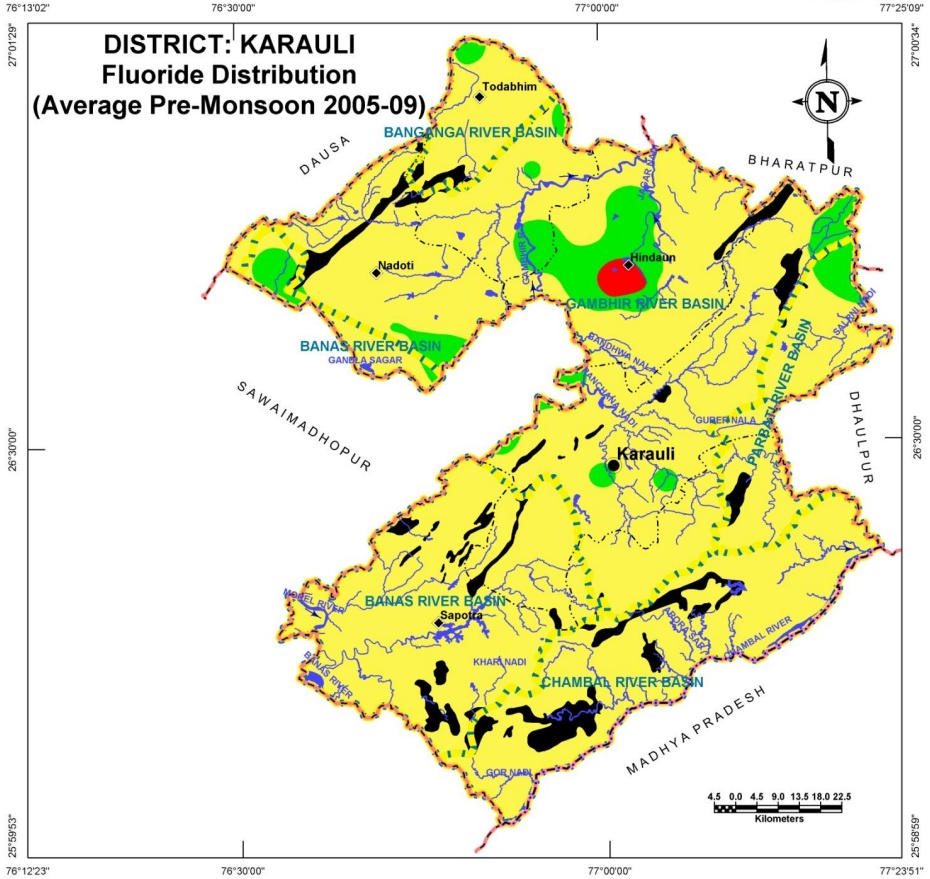
GROUND WATER NITRATE DISTRIBUTION

High nitrate concentration in ground water renders it unsuitable for agriculture purposes. Plate – XV shows distribution of Nitrate in ground water. Moderately high nitrate concentration (50-100 mg/l) is shown in green color and occupies approximately 57% of the district area. The areas with low nitrate concentration (<50 mg/l) are shown in yellow color and occupy approximately 29% of the district area, largely eastern part of the district where ground water is suitable for agriculture. Remaining part of the district area is covered with high nitrate concentration (>100 mg/l) which is shown in red colored patches largely seen in western part of Hindaun block.

Table: Block wise area of Nitrate distribution

Nitrate concentration Range (mg/l) (Ave. of years 2005-09)	Block wise area coverage (sq km)										Total Area (sq km)
	Hindaun		Karauli		Nadoti		Sapotra		Todabhim		
	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	
< 50	40.5	6.2	504.9	43.3	118.0	20.6	646.6	36.4	61.0	11.9	**1,371.0**
50-100	371.4	57.8	651.0	55.8	248.7	43.5	1,069.9	60.2	342.2	66.7	**2,683.2**
>100	231.3	36.0	10.4	0.9	205.3	35.9	61.1	3.4	109.5	21.4	**617.6**
Total	**643.2**	**100.0**	**1,166.3**	**100.0**	**572.0**	**100.0**	**1,777.6**	**100.0**	**512.7**	**100.0**	**4,671.8**

PLATE - XIV



LEGEND

Admin Boundary:

- District Headquarter
- Block Headquarter
- State Boundary
- District Boundary
- Block Boundary

Basin Boundary

Water Bodies:

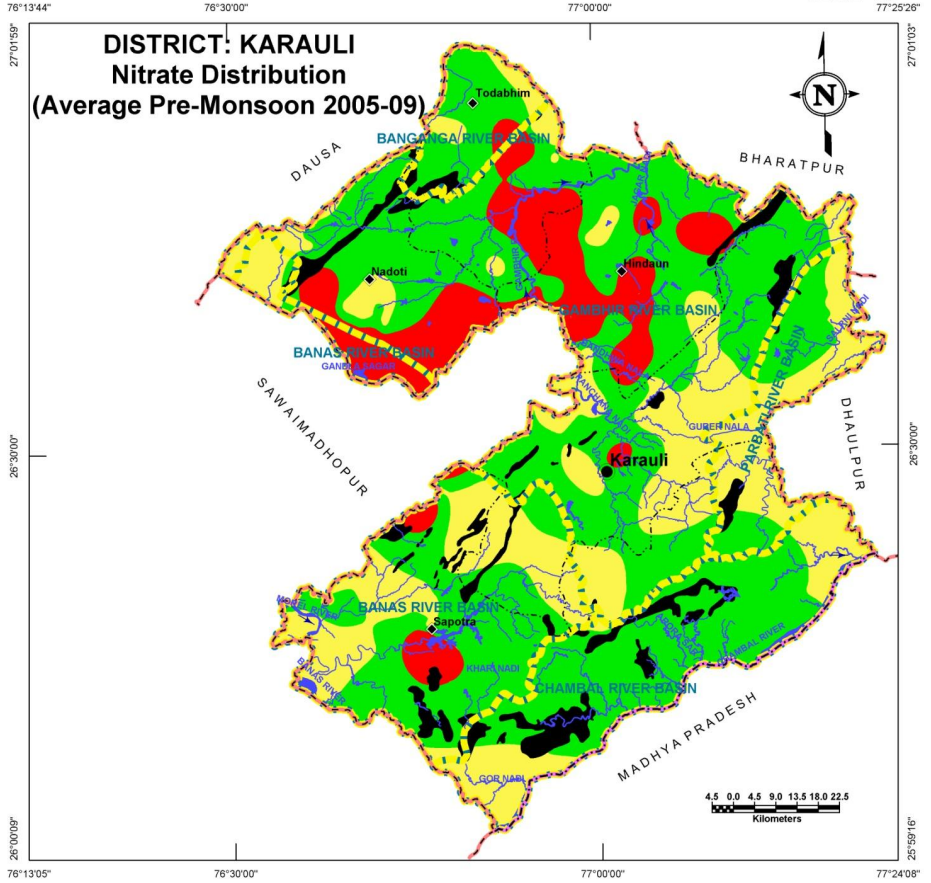
- River / Streams
- Ponds / Reservoirs

Hills

Fluoride Concentration (mg/l):

- < 1.5
- 1.5-3.0
- > 3.0

PLATE - XV



LEGEND

Admin Boundary:

- District Headquarter
- Block Headquarter
- State Boundary
- District Boundary
- Block Boundary

Basin Boundary

Water Bodies:

- River / Streams
- Ponds / Reservoirs

Hills

Nitrate Concentration (mg/l):

- < 50
- 50-100
- >100

DEPTH TO BEDROCK

DISTRICT – KARAULI

Plate – XVI depicts the bedrock depth from ground level in Karauli district. The beginning of massive bedrock has been considered for defining top of bedrock surface. It varies from less than 20 below ground level to more than 80m bgl. The major rocks types constituting the bedrock are sandstone and quartzites. These rocks are overlain by alluvial deposits of sand, clay, silt and admixture of these in different proportions and thicknesses. The map of depth to bed rock in meters below ground level reveals that the bedrock surface is quite undulating and varies from very shallow near hardrock exposures to more than 80m below ground level. Western part of the district i.e., in Nadoti, Sapotra, southern side of Sapotra and central parts of Hindam and Karauli blocks, the bedrock depth is less (of the order of <20 to 40 m bgl) and occasionally reaches to depth of 60m bgl. In the northeastern part of the district in blocks viz. Todabhim, Hindam, Karauli and Sapotra the bedrock depth often reaches 80m bglor more. Deepest bedrock has been encountered in eastern fringe of Karauli block (more than 80 meter below ground level).

Depth to bedrock (mbgl)	Block wise area coverage (sq km)										Total Area (sq km)
	Hindaun		Karauli		Nadoti		Sapotra		Todabhim		
	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	
< 20	-	-	-	-	-	-	70.3	4.0	-	-	**70.3**
20-40	103.6	16.1	23.5	2.0	367.5	64.0	762.4	42.9	-	-	**1,257.0**
40-60	272.2	42.3	655.4	56.0	204.5	36.0	930.4	52.3	287.8	56.0	**2,350.3**
60-80	267.4	41.6	428.9	37.0	-	-	14.5	0.8	224.9	44.0	**935.7**
> 80	-	-	58.5	5.0	-	-	-	-	-	-	**58.5**
Total	**643.2**	**100.0**	**1,166.3**	**100.0**	**572.0**	**100.0**	**1,777.6**	**100.0**	**512.7**	**100.0**	**4,671.8**

UNCONFINED AQUIFER

Alluvial areas

Aquifer in alluvial material is formed in western part of the district largely around Banas and Gambhir Rivers with thickness varying from less than 10 meter, reaching upto 50 meter. Entire Todaabhim block has unconfined aquifer formed in alluvial material with thickness from 10 to 40 meter and maximum area of Hindaun also covered with alluvial aquifer. In southwestern part of Karauli block, aquifer thickness is more reaching upto 50m.

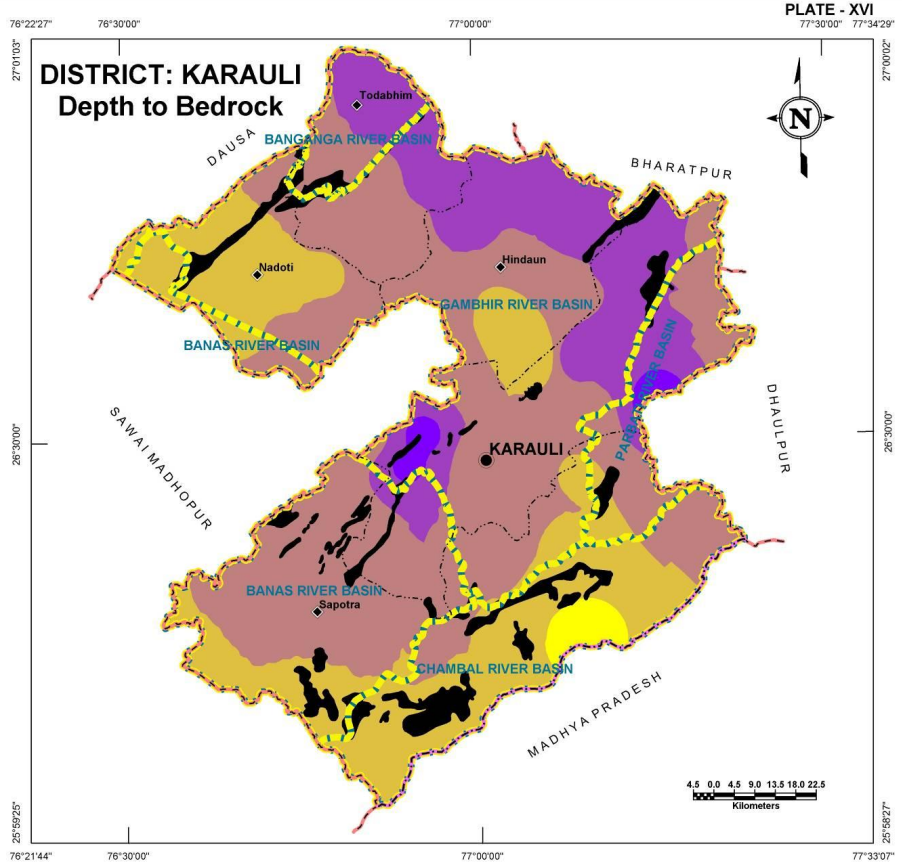
Unconfined aquifer Thickness (m)	Block wise area coverage (sq km)					Total Area (sq km)
	Hindaun	Karauli	Nadoti	Sapotra	Todabhim	
< 10	480.7	176.3	140	320.8	404.2	**1,522.0**
10-20	41.4	120.9	172.1	71.6	57.7	**463.7**
20-30	24.7	66.2	98.6	73.5	48.4	**311.4**
30-40	-	57.6	-	9.9	2.2	**69.7**
> 40	-	8.7	-	-	-	**8.7**
Total	**546.8**	**429.7**	**410.7**	**475.8**	**512.5**	**2,375.5**

Hard rock areas

Weathered, fractured and jointed rock formations form the phreatic aquifer in the areas where hard rocks are exposed or occur at shallow depths. Such zone ranges in thickness from less than 10 meter to 100 meter in the district. Maximum thickness of unconfined condition in hardrock is reported in the eastern side of the district (>100m), whereas the general thickness in the district is upto 40m.

Unconfined aquifer Thickness (m)	Block wise area coverage(sq km)					Total Area (sq km)
	Hindaun	Karauli	Nadoti	Sapotra	Todabhim	
<10	48.2	113.4	161.3	80.1	0.2	**403.2**
10-20	-	168.7	-	966.7	-	**1,135.4**
20-30	2.9	107.0	-	105.5	-	**215.4**
30-40	45.3	112.0	-	53.4	-	**210.7**
40-50	-	79.6	-	62.6	-	**142.2**
50-60	-	70.3	-	28.6	-	**98.9**
60-70	-	46.6	-	4.9	-	**51.5**
70-80	-	27.2	-	0	-	**27.2**
80-90	-	11.5	-	-	-	**11.5**
> 90	-	0.3	-	-	-	**0.3**
Total	**96.4**	**736.6**	**161.3**	**1301.8**	**0.2**	**2,296.3**

PLATE - XVI



LEGEND

Admin Boundary:

- District Headquarter
- Block Headquarter
- State Boundary
- District Boundary
- Block Boundary

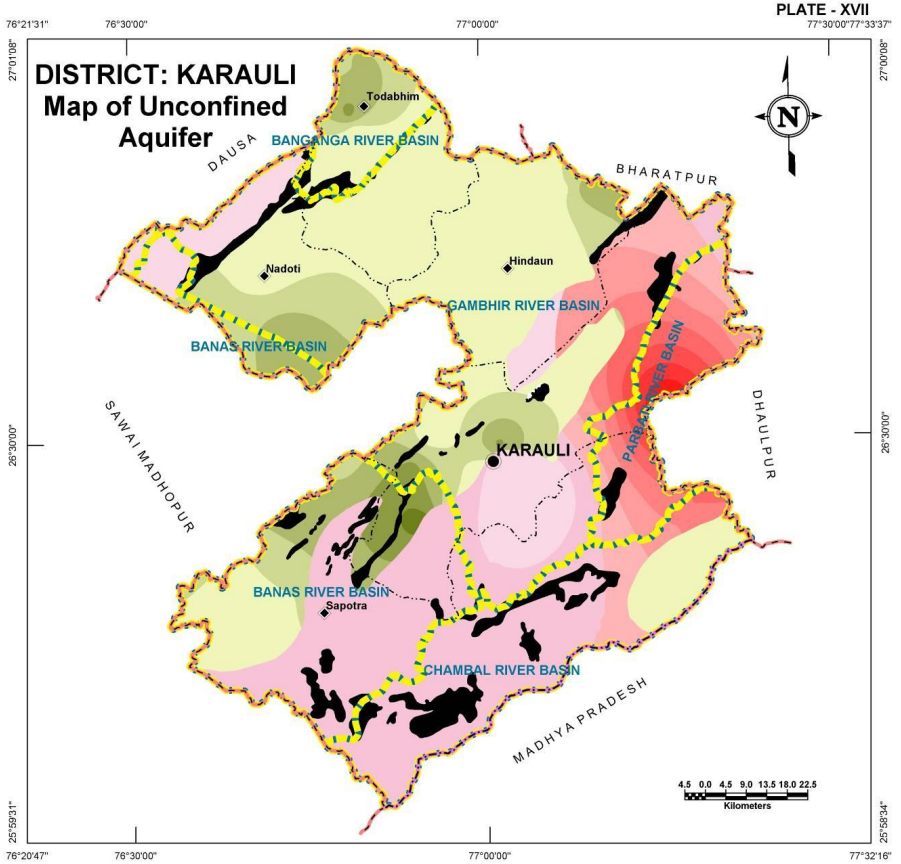
Basin Boundary

Hills

Depth to Bedrock(m bgl):

- < 20
- 20-40
- 40-60
- 60-80
- >80

PLATE - XVII



LEGEND

Admin Boundary:

- District Headquarter
- Block Headquarter
- State Boundary
- District Boundary
- Block Boundary

Basin Boundary

Hills

Aquifer Thickness (m):

Alluvial Area:	Weathered & Fractured Zone in Hardrock Area:	
< 10	<10	50-60
10-20	10-20	60-70
20-30	20-30	70-80
30-40	30-40	80-90
>40	40-50	>90

Glossary of terms

S. No.	Technical Terms	Definition
1	AQUIFER	A saturated geological formation which has good permeability to supply sufficient quantity of water to a Tube well, well or spring.
2	ARID CLIMATE	Climate characterized by high evaporation and low precipitation.
3	ARTIFICIAL RECHARGE	Addition of water to a ground water reservoir by man-made activity
4	CLIMATE	The sum total of all atmospheric or meteorological influences principally temperature, moisture, wind, pressure and evaporation of a region.
5	CONFINED AQUIFER	A water bearing strata having confined impermeable overburden. In this aquifer, water level represents the piezometric head.
6	CONTAMINATION	Introduction of undesirable substance, normally not found in water, which renders the water unfit for its intended use.
7	DRAWDOWN	The drawdown is the depth by which water level is lowered.
8	FRESH WATER	Water suitable for drinking purpose.
9	GROUND WATER	Water found below the land surface.
10	GROUND WATER BASIN	A hydro-geologic unit containing one large aquifer or several connected and interrelated aquifers.
11	GROUND WATER RECHARGE	The natural infiltration of surface water into the ground.
12	HARD WATER	The water which does not produce sufficient foam with soap.
13	HYDRAULIC CONDUCTIVITY	A constant that serves as a measure of permeability of porous medium.
14	HYDROGEOLOGY	The science related with the ground water.
15	HUMID CLIMATE	The area having high moisture content.
16	ISOHYET	A line of equal amount of rainfall.
17	METEOROLOGY	Science of the atmosphere.
18	PERCOLATION	It is flow through a porous substance.
19	PERMEABILITY	The property or capacity of a soil or rock for transmitting water.
20	pH	Value of hydrogen-ion concentration in water. Used as an indicator of acidity (pH < 7) or alkalinity (pH > 7).
21	PIEZOMETRIC HEAD	Elevation to which water will rise in a piezometers.
22	RECHARGE	It is a natural or artificial process by which water is added from outside to the aquifer.
23	SAFE YIELD	Amount of water which can be extracted from ground water without producing undesirable effect.
24	SALINITY	Concentration of dissolved salts.
25	SEMI-ARID	An area is considered semiarid having annual rainfall between 10-20 inches.
26	SEMI-CONFINED AQUIFER	Aquifer overlain and/or underlain by a relatively thin semi-pervious layer.
27	SPECIFIC YIELD	Quantity of water which is released by a formation after it's complete saturation.
28	TOTAL DISSOLVED SOLIDS	Total weight of dissolved mineral constituents in water per unit volume (or weight) of water in the sample.

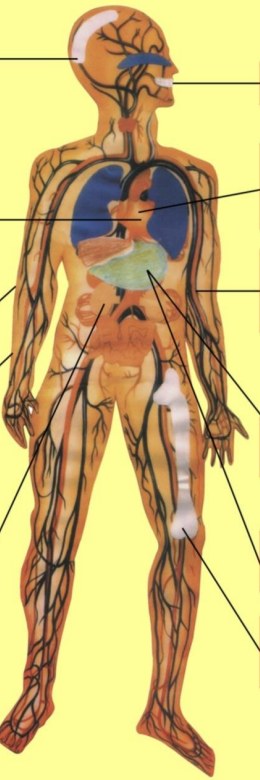
(Contd…)

S. No.	Technical Terms	Definition
29	TRANSMISSIBILITY	It is defined as the rate of flow through an aquifer of unit width and total saturation depth under unit hydraulic gradient. It is equal to product of full saturation depth of aquifer and its coefficient of permeability.
30	UNCONFINED AQUIFER	A water bearing formation having permeable overburden. The water table forms the upper boundary of the aquifer.
31	UNSATURATED ZONE	The zone below the land surface in which pore space contains both water and air.
32	WATER CONSERVATION	Optimal use and proper storage of water.
33	WATER RESOURCES	Availability of surface and ground water.
34	WATER RESOURCES MANAGEMENT	Planned development, distribution and use of water resources.
35	WATER TABLE	Water table is the upper surface of the zone of saturation at atmospheric pressure.
36	ZONE OF SATURATION	The ground in which all pores are completely filled with water.
37	ELECTRICAL CONDUCTIVITY	Flow of free ions in the water at 25C mu/cm.
38	CROSS SECTION	A Vertical Projection showing sub-surface formations encountered in a specific plane.
39	3-D PICTURE	A structure showing all three dimensions i.e. length, width and depth.
40	GWD	Ground Water Department
41	CGWB	Central Ground Water Board
42	CGWA	Central Ground Water Authority
43	SWRPD	State Water Resources Planning Department
44	EU-SPP	European Union State Partnership Programme
45	TOPOGRAPHY	Details of drainage lines and physical features of land surface on a map.
46	GEOLOGY	The science related with the Earth.
47	GEOMORPHOLOGY	The description and interpretation of land forms.
48	PRE MONSOON SURVEY	Monitoring of Ground Water level from the selected DKW/Piezometer before Monsoon (carried out between 15th May to 15th June)
49	POST-MONSOON SURVEY	Monitoring of Ground Water level from the selected DKW/Piezometer after Monsoon (carried out between 15th October to 15th November)
50	PIEZOMETER	A non-pumping small diameter bore hole used for monitoring of static water level.
51	GROUND WATER FLUCTUATION	Change in static water level below ground level.
52	WATER TABLE	The static water leval found in unconfined aquifer.
53	DEPTH OF BED ROCK	Hard & compact rock encountered below land Surface.
54	G.W. MONITORING STATION	Dug wells selected on grid basis for monitoring of state water level.
55	EOLIAN DEPOSITS	Wind-blown sand deposits

Ground Water Department,
Rajasthan

European Union
State Partnership Programme

भूजल में घुले मुख्य तत्वों की अधिकता का मानव शरीर पर दुष्प्रभाव



- बोरोन-स्नायु तन्त्र पर प्रभाव
- क्लोराइड-सोडियम के साथ मिलकर उच्च रक्त चाप
- कैल्शियम-जोड़ों में कड़ापन
- आर्सेनिक-त्वचा रोग, कैंसर
- लेड-बच्चों के शारीरिक व मानसिक विकास में बाधा वयस्कों में गुर्दे के रोग
- फ्लोराइड - दंत क्षरण
- सोडियम-हृदय, गुर्दा व रक्त परिसंचरण रोगों से ग्रसित लोगों को हानिकारक
- नाइट्रेट-नवजात शिशुओं में ब्लू बेबी बीमारी (मेथमोग्लोबिनिमिया)
- सल्फेट-अधिकता में मैग्नेशियम के साथ मिलकर दस्तावर
- आयरन-आयरन जीवाणु से आमाशय संबंधी रोग
- फ्लोराइड-जोड़ों में अकड़न, हड्डियों में मुड़ाव

केन्द्रीय भूमि जल बोर्ड,
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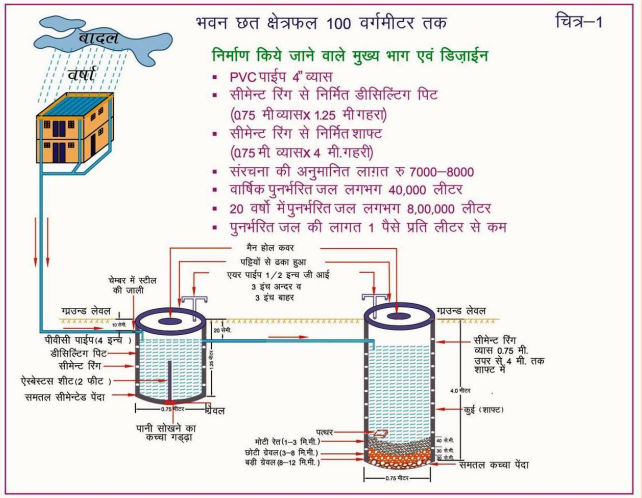
भूजल अमूल्य है इसे प्रदूषित न करें।

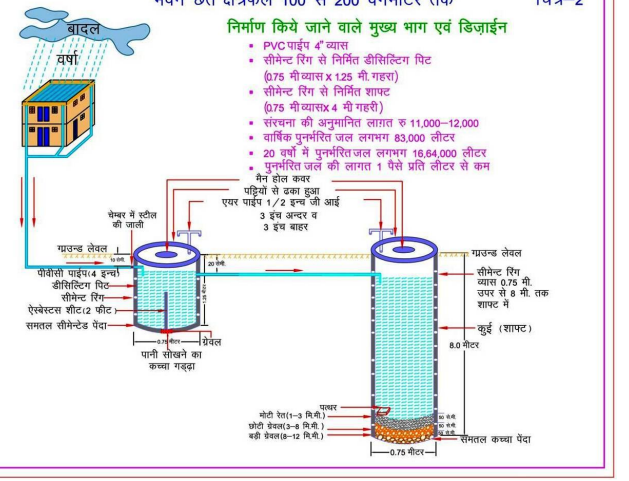
चित्र–1
भवन छत क्षेत्रफल 100 वर्गमीटर तक
निर्माण किये जाने वाले मुख्य भाग एवं डिज़ाईन

- PVC पाईप 4" व्यास
- सीमेन्ट रिंग से निर्मित डीसिल्टिंग पिट (0.75 मी व्यास x 1.25 मी गहरा)
- सीमेन्ट रिंग से निर्मित शाफ्ट (0.75 मी व्यास x 4 मी गहरी)
- संरचना की अनुमानित लागत रु 7000–8000
- वार्षिक पुनर्भरित जल लगभग 40,000 लीटर
- 20 वर्षों में पुनर्भरित जल लगभग 8,00,000 लीटर
- पुनर्भरित जल की लागत 1 पैसे प्रति लीटर से कम



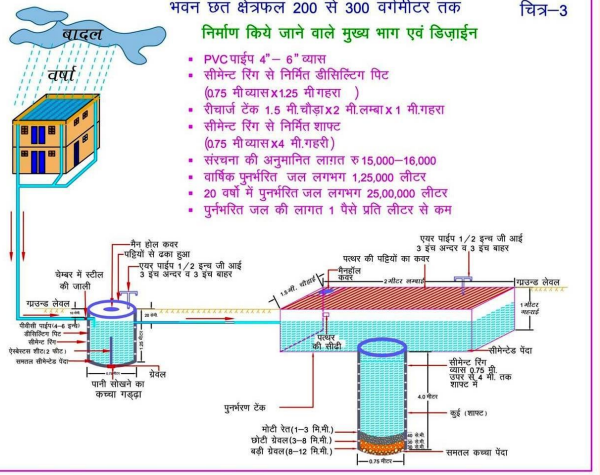
चित्र–2
भवन छत क्षेत्रफल 100 से 200 वर्गमीटर तक
निर्माण किये जाने वाले मुख्य भाग एवं डिज़ाईन

- PVC पाईप 4" व्यास
- सीमेन्ट रिंग से निर्मित डीसिल्टिंग पिट (0.75 मी व्यास x 1.25 मी. गहरा)
- सीमेन्ट रिंग से निर्मित शाफ्ट (0.75 मी व्यास x 4 मी गहरी)
- संरचना की अनुमानित लागत रु 11,000–12,000
- वार्षिक पुनर्भरित जल लगभग 83,000 लीटर
- 20 वर्षों में पुनर्भरित जल लगभग 16,64,000 लीटर
- पुनर्भरित जल की लागत 1 पैसे प्रति लीटर से कम



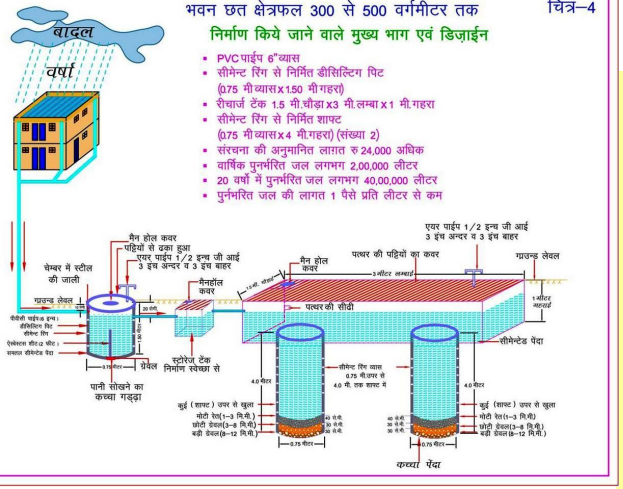
चित्र–3
भवन छत क्षेत्रफल 200 से 300 वर्गमीटर तक
निर्माण किये जाने वाले मुख्य भाग एवं डिज़ाईन

- PVC पाईप 4" – 6" व्यास
- सीमेन्ट रिंग से निर्मित डीसिल्टिंग पिट (0.75 मी व्यास x 1.25 मी गहरा)
- रीचार्ज टैंक 1.5 मी.चौड़ा x 2 मी.लम्बा x 1 मी.गहरा
- सीमेन्ट रिंग से निर्मित शाफ्ट (0.75 मी व्यास x 4 मी.गहरी)
- संरचना की अनुमानित लागत रु 15,000–16,000
- वार्षिक पुनर्भरित जल लगभग 1,25,000 लीटर
- 20 वर्षों में पुनर्भरित जल लगभग 25,00,000 लीटर
- पुनर्भरित जल की लागत 1 पैसे प्रति लीटर से कम



चित्र–4
भवन छत क्षेत्रफल 300 से 500 वर्गमीटर तक
निर्माण किये जाने वाले मुख्य भाग एवं डिज़ाईन

- PVC पाईप 6" व्यास
- सीमेन्ट रिंग से निर्मित डीसिल्टिंग पिट (0.75 मी व्यास x 1.50 मी गहरा)
- रीचार्ज टैंक 1.5 मी.चौड़ा x 3 मी.लम्बा x 1 मी.गहरा
- सीमेन्ट रिंग से निर्मित शाफ्ट (0.75 मी व्यास x 4 मी.गहरा) (संख्या 2)
- संरचना की अनुमानित लागत रु 24,000 अधिक
- वार्षिक पुनर्भरित जल लगभग 2,00,000 लीटर
- 20 वर्षों में पुनर्भरित जल लगभग 40,00,000 लीटर
- पुनर्भरित जल की लागत 1 पैसे प्रति लीटर से कम



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Myths and Facts about Ground Water

S No	Myths	Facts
1	What is Ground Water • an underground lake • a net work of underground rivers • a bowl filled with water	Water which occurs below the land in geological formations/rocks is Ground water
2	Ground Water occurs everywhere beneath the Land Surface	Not really, it depends on the nature of rock formation
3	There is a relationship between ground water and surface water	Not all the places. Near streams/rivers there is relation
4	Groundwater is not renewable resource	It is renewable source and every year it is being recharged through rain/applied irrigation etc
5	Ground water is unlimited and deeper you drill more discharge	It is limited to annual recharge from rain/applied irrigation. The discharge may not increase if you go deeper
6	Ground Water moves rapidly	The movement of ground water is very slow
7	Ground water pumped from wells is thousands of years old	Generally the ground water being tapped through wells is a few years old
8	If water taste good—it is safe to drink	It may have other chemicals e.g. fluoride, nitrates etc which are harmful
9	Water from free flowing tube wells is very pure	This water can also be contaminated so test before use
10	If I recharge my TW/DW/HP it will not benefit me	It will also benefit you and also adjoing wells
11	There is no static ground water resources in Rajasthan	Rajasthan is also having Static GW resources, and being tapped in most of areas as GW annual withdrawal is more than annual recharge
12	I cannot meet annual cooking and drinking water requirement by rain water harvesting	The water requirement for drinking and cooking is only 8 lit/day. You can harvest this water for family of 5 persons from roof top or paved area of 75 Sq m to meet annual requirement
13	You can increase ground water recharge	This can be done by harvesting the rain water and storing in sub surface reservoir (GW) by constructing the recharge structures
14	You cannot use abandoned TW/HP/DW for ground water recharge	These should be used as recharge structures as harvested rain water is directly put into GW reservoir
15	Putting waste near HP/TW will not cause any problem	Such actions will pollute wells and water

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