



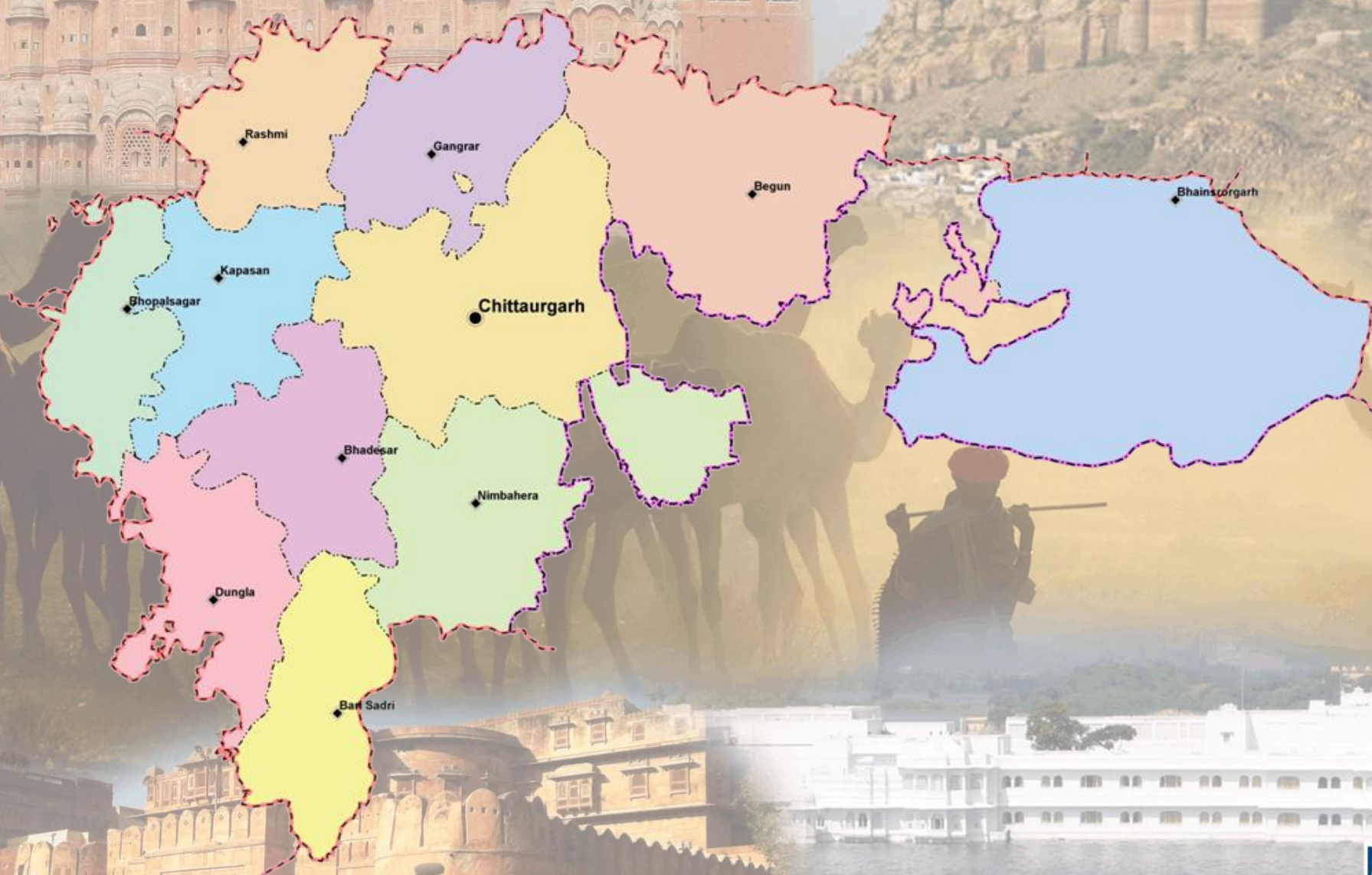
Ground Water Department,
Rajasthan

Hydrogeological Atlas of Rajasthan

Chittaurgarh District



European Union
State Partnership Programme



2013



ROLTA
Rolta India Limited

Hydrogeological Atlas of Rajasthan

Chittaurgarh District

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ADMINISTRATIVE SETUP

DISTRICT – CHITTAURGARH

Location:

Chittaurgarh district is located in the southern part of Rajasthan. It is bounded in the north by Bhilwara and Bundi districts, in the east by Kota district, Udaipur and Rajsam and districts in the west and in the south by Pratapgarh district along with state of Madhya Pradesh. It stretches between 24° 12' 57.33" to 25° 12' 55.27" North latitude and 74° 06' 10.35" to 75° 49' 08.38" East longitude covering area of 7,841.1 sq kms. Most part of the district is part of Banas River Basin and the eastern region is part of Chambal River Basin while, Mahi River Basin forms the extreme southern part.

Administrative Set-up:

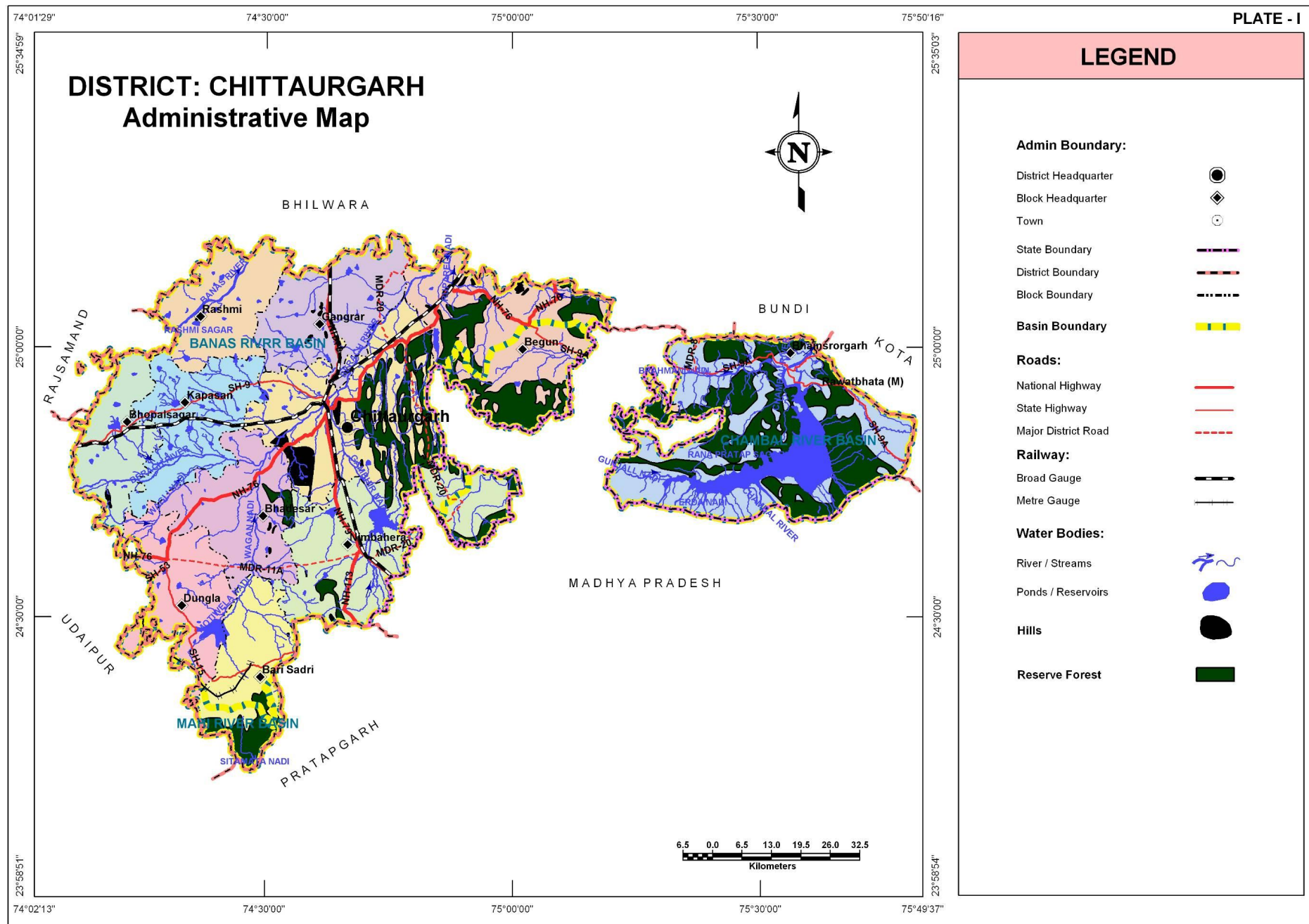
Chittaurgarh district is administratively divided into eleven Blocks. The following table summarizes the basic statistics of the district at block level.

S. No.	Block Name	Population (Based on 2001 census)	Area (sq km)	% of District Area	Total Number of Towns and Villages
1	Bari Sadri	1,03,845	482.3	6.2	154
2	Begun	1,21,346	982.9	12.5	255
3	Bhadesar	1,07,393	528.5	6.7	168
4	Bhainsrorgarh	1,15,069	1,572.3	20.1	213
5	Bhopalsagar	72,675	398.1	5.1	85
6	Chittaurgarh	2,64,179	974.5	12.4	230
7	Dungla	89,975	509.9	6.5	108
8	Gangrar	88,640	564.3	7.2	128
9	Kapasan	1,03,194	512.2	6.5	112
10	Nimbahera	1,88,718	868.5	11.1	171
11	Rashmi	75,326	447.6	5.7	89
Total		13,30,360	7,841.1	100.0	1,713

Chittaurgarh district has 1,713 towns and villages, of which eleven are block headquarters as well.

Climate:

Climate of the district is dry and hot except during monsoon season. Winter season is from November to February and is followed by summer from March to June. Highest temperature is in summer often crosses 45 °C whereas in January average day temperature comes down to 16 °C and nights becoming very cold reaching 3-5 °C. Average rainfall received in the district is 782.1mm.



TOPOGRAPHY

The western, southern and northern parts of the district are relatively plain areas. Hills are scattered in Bari Sadri and Bhadesar blocks in the eastern part of the district. Hill ranges towards east of Chittaurgarh town runs north-south with intervening valleys parallel to them. The general topographic elevation in the district is between 450 m to 500 m above mean sea level in western and southern parts and 350 m to 400 m above mean sea level in northern, northeastern and in central parts of the district. Elevation ranges from a minimum of 300m above mean sea level in Bari Sadri block in the southern part of the district to maximum of 616.3 m above mean sea level In Chittaurgarh in eastern part of the district.

Table: Block wise minimum and maximum elevation

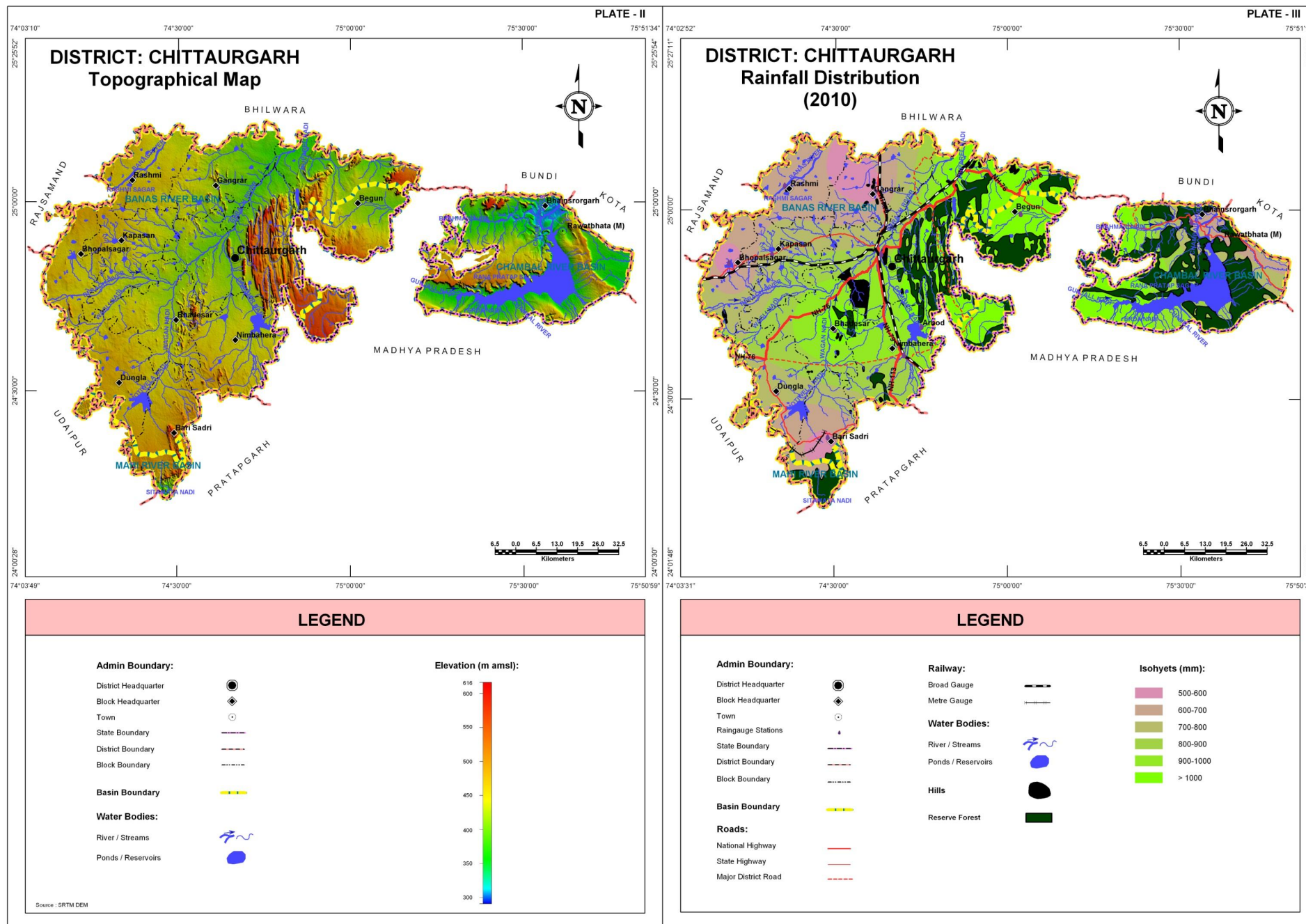
S. No.	Block Name	Min. Elevation (m amsl)	Max. Elevation (m amsl)
1	Bari Sadri	300.0	594.8
2	Begun	352.0	604.4
3	Bhadesar	401.0	562.8
4	Bhainsrorgarh	300.0	590.7
5	Bhopalsagar	436.4	602.0
6	Chittaurgarh	370.2	616.3
7	Dungla	429.6	508.2
8	Gangrar	368.8	557.7
9	Kapasan	414.1	489.2
10	Nimbahera	408.3	597.7
11	Rashmi	419.3	550.5

RAINFALL

The district received good rainfall in the year 2010. The general distribution of rainfall across district can be visualized from isohyets map presented in the Plate – III. In Northeast to central part, district received 900 to 1000 mm rainfall, whereas northwest and southern parts received less than 700 mm. The annual average rainfall was 848.0 mm based on the data of available blocks while highest average annual rainfall was 1,368.7 mm in Begun block. Minimum annual rainfall is lowest in Bhopalsagar block (525.1 mm). Begun block has received highest maximum annual rainfall of about 1,775.3 mm.

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)
Bari Sadri	570.8	862.5	658.8
Begun	877.4	1,775.3	1,368.7
Bhadesar	796.3	1,074.5	931.3
Bhainsrorgarh	658.5	1,282.3	879.0
Bhopalsagar	525.1	826.9	681.2
Chittaurgarh	689.7	1,242.4	961.9
Dungla	611.2	891.8	753.7
Gangrar	548.4	915.3	684.4
Kapasan	579.8	918.4	766.4
Nimbahera	740.8	1,343.4	998.5
Rashmi	581.4	719.9	643.9



GEOLOGY

DISTRICT – CHITTAURGARH

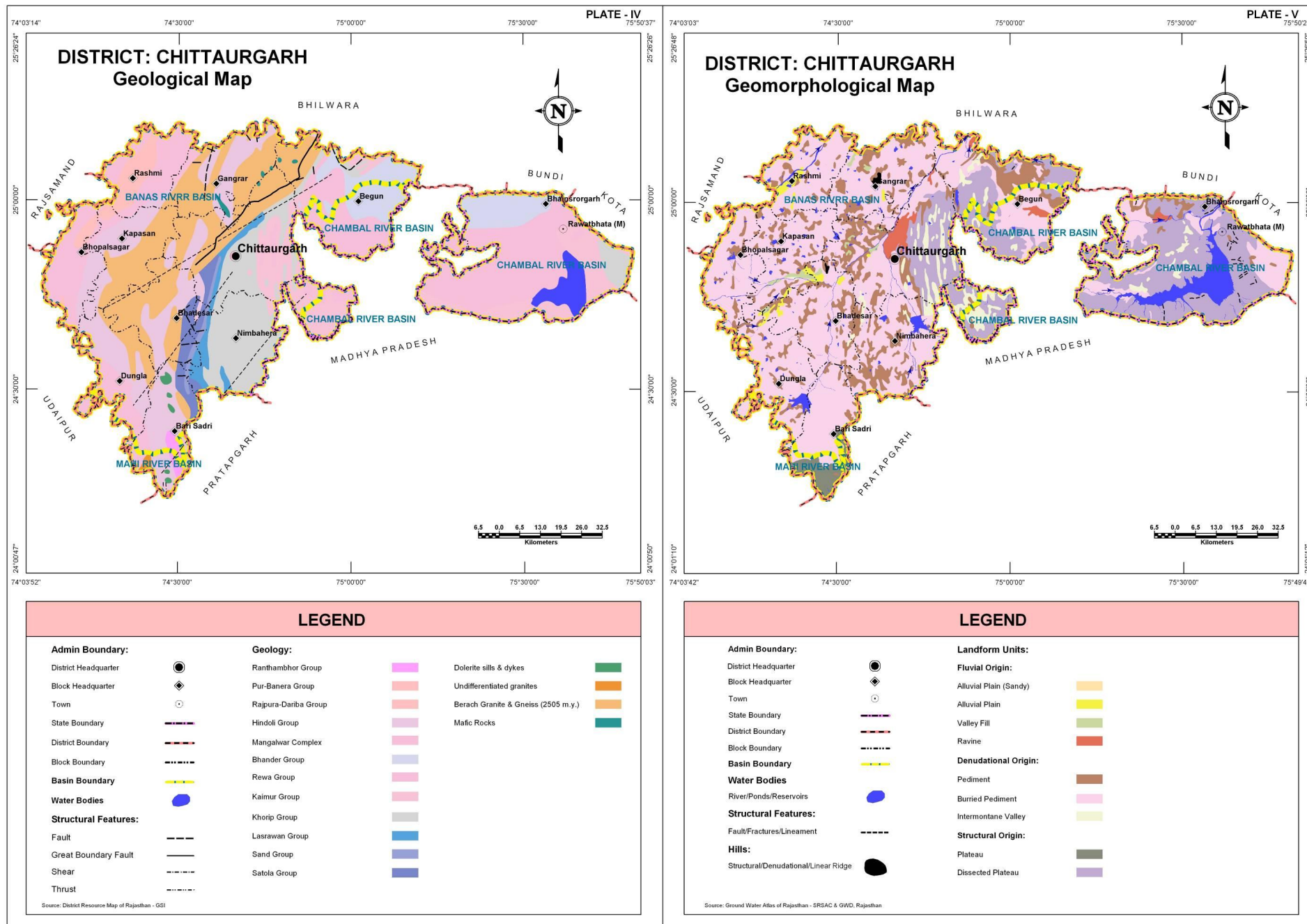
Geologically, the district comprises of Bhilwara and Vindhyan Super Group along. The NW and SW part of the district occupied by gneisses and schist of Mangalwar complex. In the NW of Rashmi these rocks are overlain by NE-SW trending rocks of Pur Banera Group. Further eastwards rocks of Hindoli Group are found, trending NE-SW in north and swing to NW-SE in the southern part of the district. These meta-sediments are intruded by the Berach granite which is found all along with Hindoli Group of rocks. The rocks belonging to Ranthambore Group are represented by quartzite slates and shales. Vindhyan rocks are found further east separated by great boundary fault in the NW of Chittaurgarh comprise conglomerates, shales, sandstone and limestone.

Super Group	Group	Formation
	Recent to Sub-recent	Alluvium-Sand silt and clay
	Deccan Traps	Basalt
Vindhyan	Bhander, Kaimur, Khorip, Lasarawan and Sand	Upper Vindhyan (Limestone, Shale, Sandstone) Lower Vindhyan (Limestone, Shale, Sandstone, Siltstone and Conglomerate)
Great Boundary Fault		
Bhilwara	Ranthambhor	Quartzite, Shale and Slate
	Pur- Banera Group	Calc-schist, Calc-gneiss, Dolomitic marble, Quartzite and Garnet-mica schist
		Dolerite Sills & dykes
	Hindoli Group	Shale, slate, Phyllite, Matagraywacke, Limestone, dolomite, marble, meta basic volcanics, quartzite and mica schist
	Mangalwar Complex	Migmatite gneiss, Felspathic mica schist, sillimanite, mica schist, silicified, quartzite, impure marble and paraamphibolite

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.
	Pediment	Broad gently sloping rock flooring, erosional surface of low relief between hill and plain, comprised of varied lithology, criss-crossed by fractures and faults.
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	Dissected Plateau	Plateau, criss-crossed by fractures forming deep valleys.
	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.



AQUIFERS

DISTRICT – CHITTAURGARH

In Chittaurgarh district, the aquifers are formed only within the weathered, fractured and jointed hardrocks. Alluvial aquifers are not present in this district. Spatial distribution wise BGC is the most predominant aquifer type with 24.5% of the district area, Schist and shale aquifers occupy almost similar spatial areas (18.8% and 18.6%) of the district. Sandstone and limestone also form good aquifer with almost 12% and 7.5 % of total district area. Sandstones also contain water in their primary openings that can yield water even if they are massive and compact.

Table: aquifer potential zones their area and their description

Aquifer in Potential Zone	Area (sq km)	% age of district	Description of the unit/Occurrence
Limestone	589.5	7.5	In general, it is fine to medium grained, grey, red yellowish, pink or buff in colour.
Sandstone	942.8	12.0	Fine to medium grained, red colour and compact and at places.
Shale	1,455.6	18.6	Grey, light green and purple in colour and mostly splintery in nature.
Schist	1,476.3	18.8	Medium to fine grained compact rock. The ltho units are soft, friable and have closely spaced cleavage.
BGC	1,923.0	24.5	Grey to dark coloured, medium to coarse grained rocks.
Non Potential Zone (Hills, RF)	1,453.9	18.6	-
Total	7,841.1	100.0	

STAGE OF GROUND WATER DEVELOPMENT

In the Chittaurgarh district all the 11 blocks, 9 blocks fall into 'over exploited' category since the aquifer development is complete and severe stress indicated on ground water resources since its exploitation has exceeded the recharge. As a result of this situation the ground water should not be extracted anymore and alternative means of fulfilling the needs be resorted too. Two of the blocks i.e., Chittaurgarh and Nimbahera have been 'Notified' where no more drilling is for ground water is permitted.

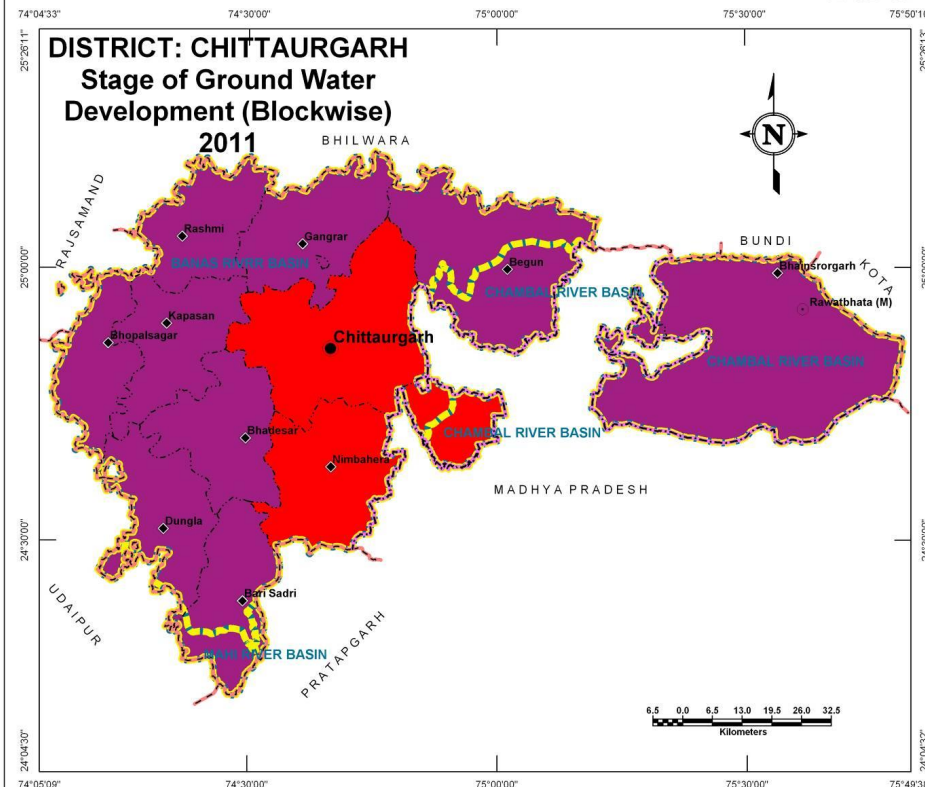
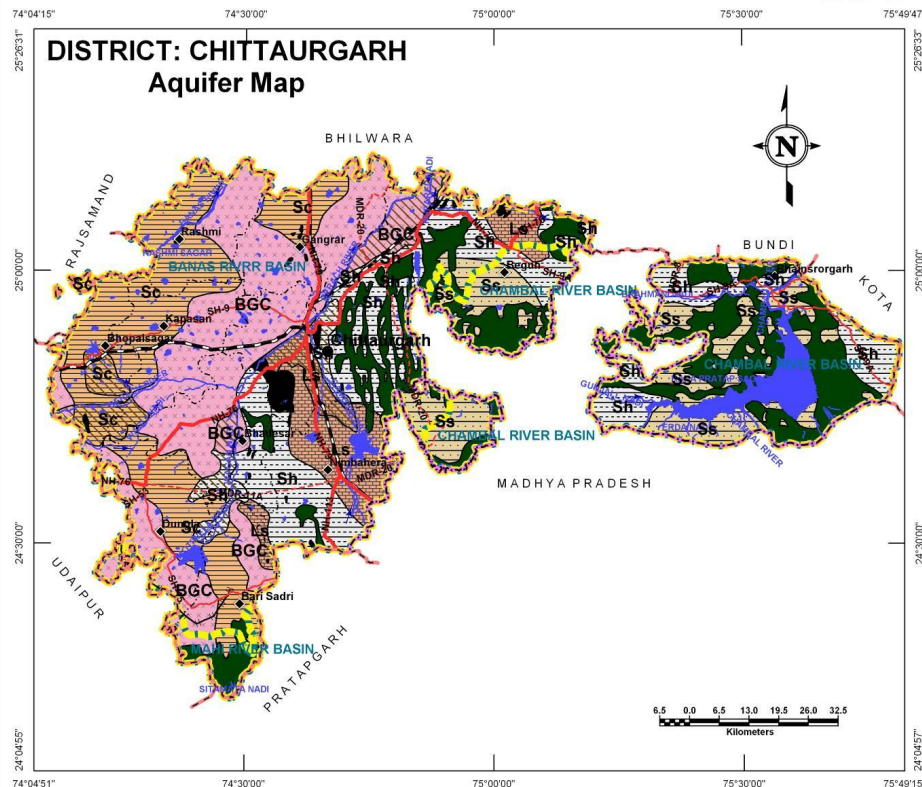
Categorization on the basis of stage of development of ground water	Block Name
Over Exploited	Dungla, Rashmi, Bhadesar, Bhainsrorgarh, Begun, Bari Sadri, Gangrar, Kapasan, Bhopalsagar
Notified	Nimbahera, Chittaurgarh

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



PLATE - VI

PLATE - VII



LEGEND

Admin Boundary:

District Headquarter

Block Headquarter

Town

State Boundary

District Boundary

Block Boundary

Basin Boundary

Roads:

National Highway

State Highway

Major District Road

Railway:

Broad Gauge

Metre Gauge

Water Bodies:

River / Streams

Ponds / Reservoirs

Hills

Reserve Forest

Command Area

Aquifer:

Limestone

Sandstone

Shale

Schist

BGC

Source: Ground Water Potential Zone Map - GWD, Rajasthan

LEGEND

Admin Boundary:

District Headquarter

Block Headquarter

Town

State Boundary

District Boundary

Block Boundary

Basin Boundary

Stage of Ground Water Development:

Over-Exploited

Notified

Source: Ground Water Department, Rajasthan

LOCATION OF EXPLORATORY AND GROUND WATER MONITORING WELLS

DISTRICT – CHITTAURGARH

Chittaurgarh district has a well distributed network of exploratory wells (36) and ground water monitoring stations (246) in the district owned by RGWD (31 and 232 respectively) and CGWB (5 and 14 respectively). The exploratory wells have formed the basis for delineation of subsurface aquifer distribution scenario in three dimensions. Benchmarking and optimization studies suggest that ground water level monitoring network is sufficiently distributed for appropriate monitoring and for water quality, 44 additional wells in different blocks have been recommended to be added to existing network for optimum monitoring of the aquifers.

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

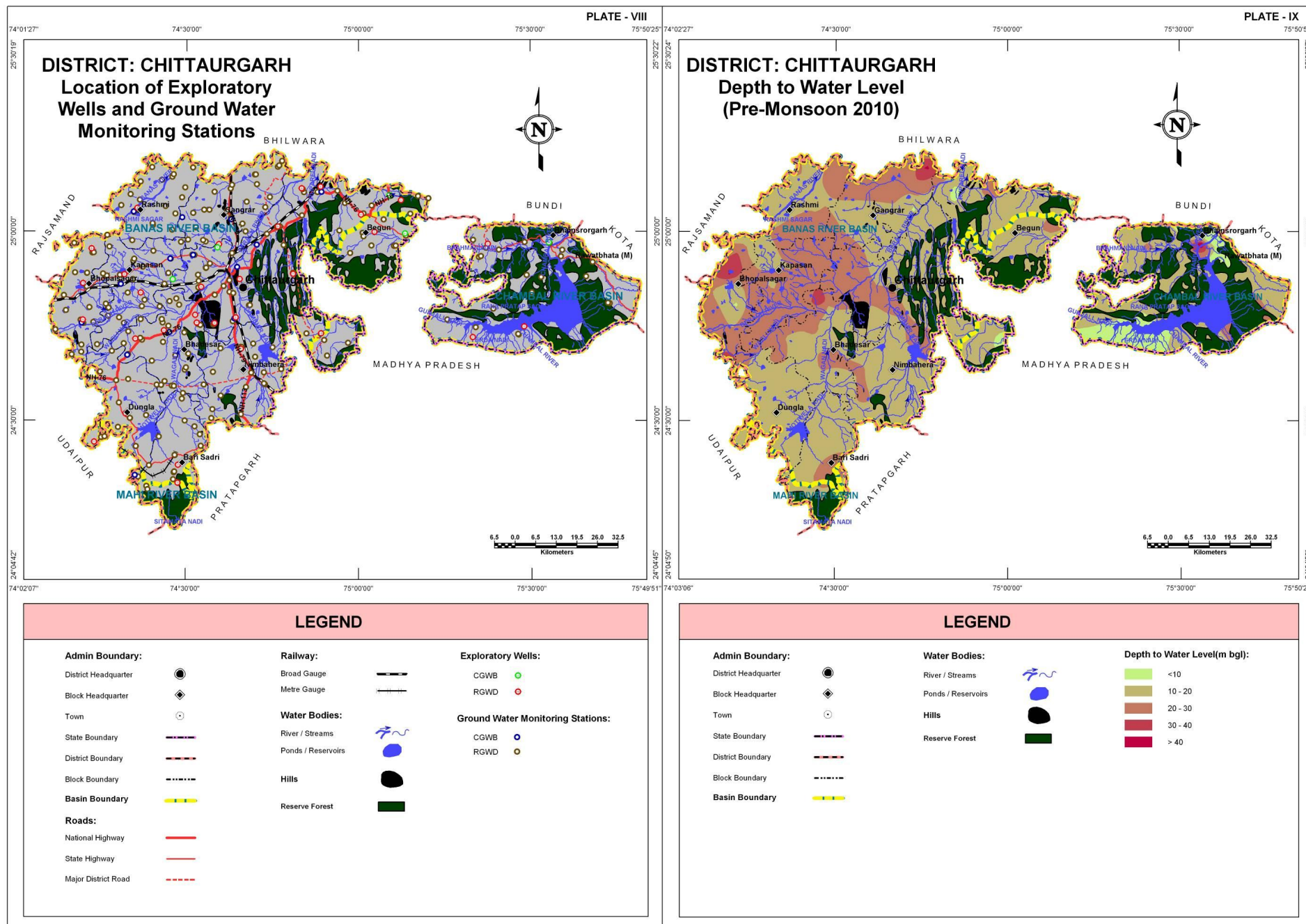
Block Name	Exploratory Wells			Ground Water Monitoring Stations			Recommended additional wells for optimization of monitoring network	
	CGWB	RGWD	Total	CGWB	RGWD	Total	Water Level	Water Quality
Bari Sadri	-	2	2	-	15	15	-	2
Begun	2	5	7	1	23	24	-	4
Bhadesar	-	4	4	2	27	29	-	6
Bhainsrorgarh	1	3	4	-	22	22	-	-
Bhopalsagar	-	3	3	1	19	20	-	1
Chittaurgarh	2	7	9	4	24	28	-	5
Dungla	-	2	2	1	14	15	-	1
Gangrar	-	-	-	2	24	26	-	5
Kapasan	-	2	2	2	24	26	-	3
Nimbahera	-	2	2	-	21	21	-	16
Rashmi	-	1	1	1	19	20	-	1
Total	5	31	36	14	232	246	-	44

DEPTH TO WATER LEVEL (PRE MONSOON – 2010)

In spite of being a predominantly hard rock area, the district shows moderate variation in depth to ground water levels from less than 10m bgl to around 40m bgl. Shallow water levels (below 10m bgl) are seen as small isolated patches mainly around Bhainsrorgarh and Nimbahera blocks. The general depth to water level in most part of the district varies in the moderate range (between 10m bgl and 30m bgl). Deeper water levels of more than 30m bgl are found in small patches in Bhainsrorgarh, Bhopalsagar and Gangrar. Large part of the district is covered with reserve forest.

Depth to water level (m bgl)	Block wise area coverage (sq km) *											Total Area (sq km)
	Bari Sadri	Begun	Bhadesar	Bhainsrorgarh	Bhopalsagar	Chittaurgarh	Dungla	Gangrar	Kapasan	Nimbahera	Rashmi	
<10	-	13.1	-	229.2	0.9	-	-	0.8	-	12.0	-	256.0
10-20	323.1	581.9	309.8	632.0	120.8	441.2	463.2	284.3	73.6	670.0	233.4	4,133.3
20-30	53.3	47.9	188.3	80.0	223.2	258.8	42.6	242.5	438.4	94.9	213.7	1,883.6
30-40	-	0.3	14.6	9.0	49.7	-	4.0	32.6	0.2	-	-	110.4
>40	-	-	-	2.0	1.0	-	-	0.9	-	-	-	3.9
Total	376.4	643.2	512.7	952.2	395.6	700.0	509.8	561.1	512.2	776.9	447.1	6,387.2

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



WATER TABLE ELEVATION (PRE MONSOON – 2010)

DISTRICT – CHITTAURGARH

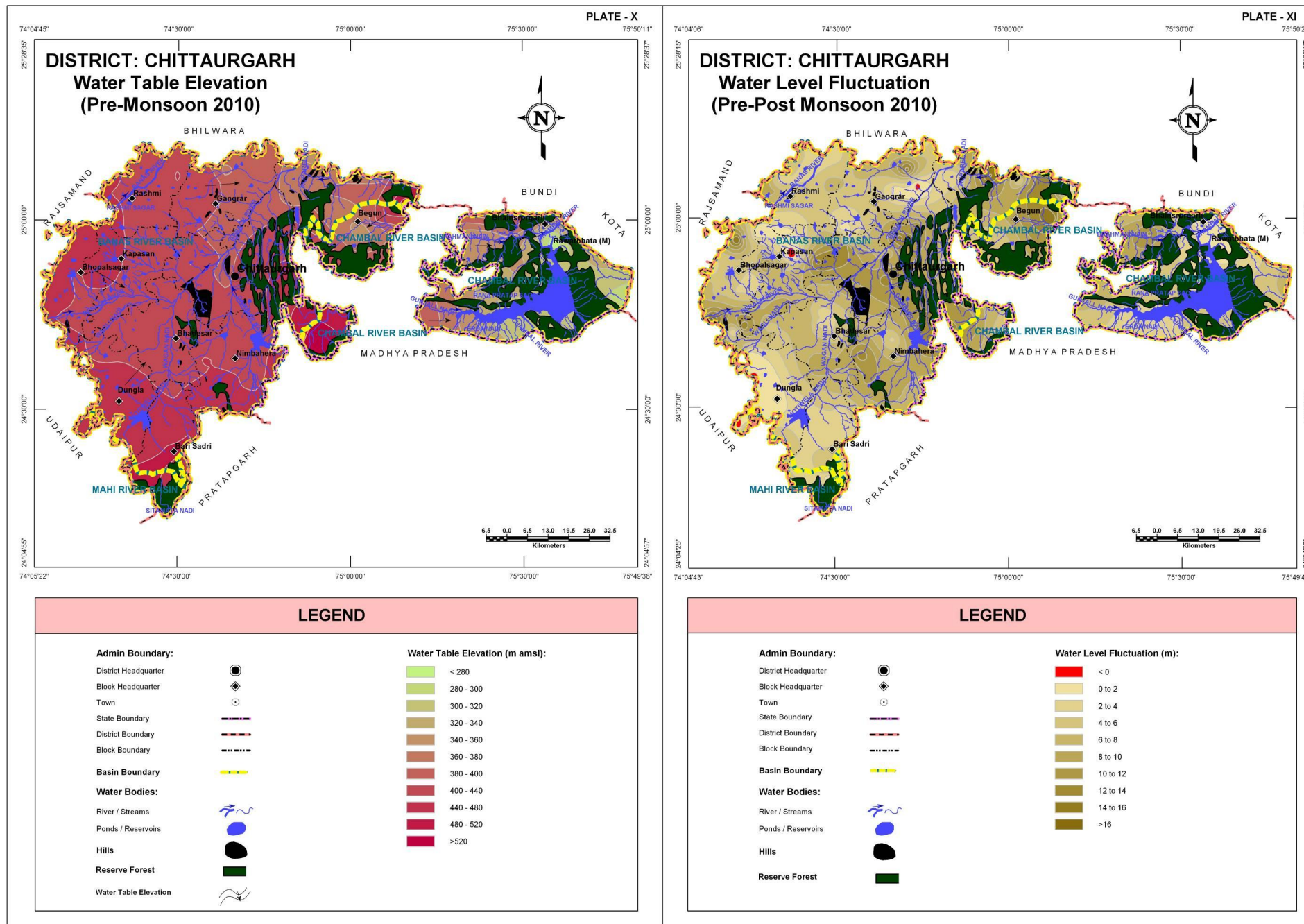
The district has in general, higher ground water elevation where, maximum parts of the area come under 440 to 520m amsl. There is large variation in water table elevation in the district wherein the highest elevation is >520m amsl in the southeastern part (Nimbahera Block) and minimum elevation (<280m amsl) in the far eastern part within Bhainsrogarh block.

Water table elevation (m amsl) range	Block wise area coverage (sq km)											Total Area (sq km)
	Bari Sadri	Begun	Bhadesar	Bhainsrogarh	Bhopalsagar	Chittaurgarh	Dungla	Gangrar	Kapasan	Nimbahera	Rashmi	
< 280	-	-	-	10.0	-	-	-	-	-	-	-	10.0
280 - 300	-	-	-	50.6	-	-	-	-	-	-	-	50.6
300 - 320	-	-	-	374.0	-	-	-	-	-	-	-	374.0
320 - 340	-	-	-	159.2	-	-	-	-	-	-	-	159.2
340 - 360	-	43.4	-	174.9	-	-	-	-	-	-	-	218.3
360 - 380	-	320.3	-	110.6	-	4.8	-	6.0	-	-	-	441.7
380 - 400	-	188.6	-	62.4	-	189.5	-	346.2	-	-	-	786.7
400 - 440	24.5	58.6	505.4	10.5	104.6	455.6	104.1	208.9	383.6	356.4	381.4	2,593.6
440 - 480	261.0	11.9	7.3	-	291.0	50.1	405.7	-	128.6	250.2	65.7	1,471.5
480 - 520	90.9	18.3	-	-	-	-	-	-	-	108.5	-	217.7
> 520	-	2.1	-	-	-	-	-	-	-	61.8	-	63.9
Total	376.4	643.2	512.7	952.2	395.6	700.0	509.8	561.1	512.2	776.9	447.1	6,387.2

WATER LEVEL FLUCTUATION (PRE TO POST MONSOON 2010)

A 2m contour interval adopted to visualize the ground water level fluctuation reveals 0 m in one area to rise in other areas reaching upto more than 16m, as seen in Plate – XI. This district has shown 'no change' to significant rise in ground water level in the post monsoon season with respect to pre monsoon season. Maximum rise of more than 16m is noticed at western part of Bhopalsagar block. The general rise has been in the 2m to 10m range in most parts of the district.

Water level fluctuation range (m)	Block wise area coverage (sq km)											Total Area (sq km)
	Bari Sadri	Begun	Bhadesar	Bhainsrogarh	Bhopalsagar	Chittaurgarh	Dungla	Gangrar	Kapasan	Nimbahera	Rashmi	
<0	-	-	-	-	-	-	9.4	3.5	5.1	-	-	18.0
0to2	5.8	4.9	-	84.8	0.7	9.6	163.2	47.0	56.0	-	14.9	386.9
2to4	245.6	43.2	28.4	298.2	52.0	30.0	149.1	97.1	49.5	1.8	141.1	1,136.0
4to6	95.7	92.2	106.1	354.8	125.7	48.1	121.2	231.6	87.2	49.2	233.8	1,545.6
6to8	29.3	112.8	262.9	111.8	84.2	132.1	53.7	112.9	175.2	215.8	41.5	1,332.2
8to10	-	163.2	112.3	67.3	73.3	162.9	10.8	45.3	83.0	296.1	14.1	1,028.3
10to12	-	101.4	3.0	34.4	35.9	257.5	2.1	16.3	33.6	176.0	1.7	661.9
12to14	-	95.1	-	0.9	14.9	58.3	0.3	6.7	21.4	38.0	-	235.6
14to16	-	30.0	-	-	7.4	1.5	-	0.7	1.2	-	-	40.8
>16	-	0.4	-	-	1.5	-	-	-	-	-	-	1.9
Total	376.4	643.2	512.7	952.2	395.6	700.0	509.8	561.1	512.2	776.9	447.1	6,387.2



GROUND WATER ELECTRICAL CONDUCTIVITY DISTRIBUTION

DISTRICT – CHITTAURGARH

The Electrical conductivity (at 25°C) distribution map is presented in Plate – XII. The areas with low EC values in ground water (<2000 $\mu\text{S}/\text{cm}$) are shown in yellow color and occupies almost 87% of the district area indicating that, by and large the ground water in this district is suitable for domestic purpose. The areas with moderately high EC values (2000 - 4000 $\mu\text{S}/\text{cm}$) are shown in green color and occupy 12% of the district area in western part of the district. Remaining small part of the district (approximately 1%) has high EC values in ground water (>4000 $\mu\text{S}/\text{cm}$) which is shown in red color in the map is seen mostly in western part of the district as a result the water is unsuitable for domestic purposes.

Table: Block wise area of Electrical conductivity distribution

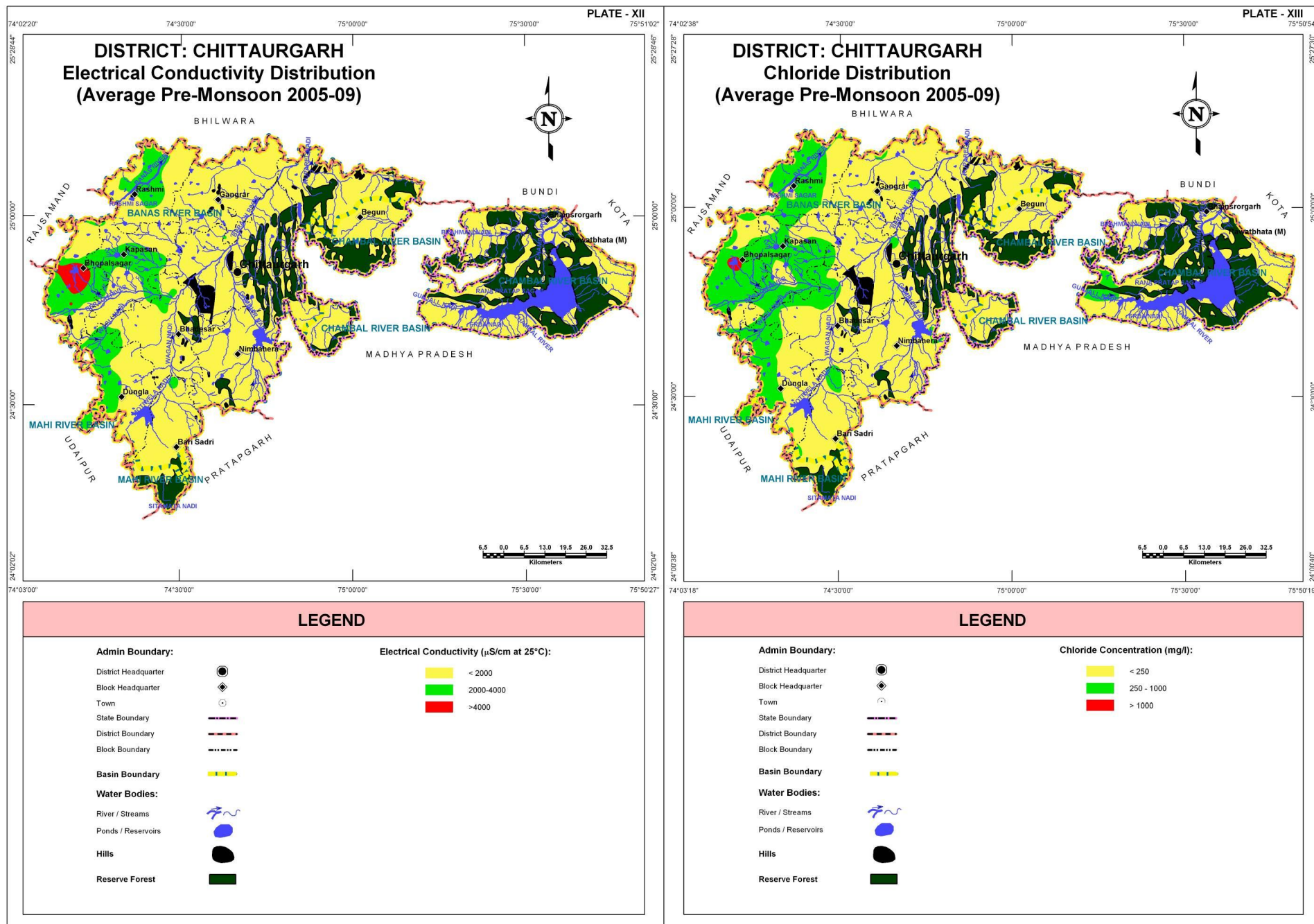
Electrical Conductivity Ranges ($\mu\text{S}/\text{cm}$ at 25°C) (Ave. of years 2005-09)	Block wise area coverage (sq km)																						Total Area (sq km)
	Bari Sadri		Begun		Bhadesar		Bhainsrorgarh		Bhopalsagar		Chittaurgarh		Dungla		Gangrar		Kapasan		Nimbahera		Rashmi		
	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	
<2000	368.8	98.0	643.2	100.0	462.8	90.3	952.2	100.0	151.3	38.2	699.5	99.9	312.7	61.3	560.4	99.9	323.3	63.1	776.9	100.0	297.9	67.0	5,549.0
2000-4000	7.6	2.0	-	-	49.9	9.7	-	-	177.9	45.0	0.5	0.1	197.1	38.7	0.7	0.1	188.0	36.7	-	-	149.2	33.0	770.9
>4000	-	-	-	-	-	-	-	-	66.4	16.8	-	-	-	-	-	-	0.9	0.2	-	-	-	-	67.3
Total	376.4	100.0	643.2	100.0	512.7	100.0	952.2	100.0	395.6	100.0	700.0	100.0	509.8	100.0	561.1	100.0	512.2	100.0	776.9	100.0	447.1	100.0	6,387.2

GROUND WATER CHLORIDE DISTRIBUTION

The chloride concentration distribution map is presented in Plate – XIII. The yellow colored regions in the map are such areas where chloride concentration is low (<250 mg/l) occupies approximately 77% of the district area and is suitable for domestic purpose. The areas with moderately high chloride concentration (250-1000mg/l) are shown in green color and cover approximately 22% of the district area occupying large tracts in the western part of the district. Remaining small part of the district area falls under high chloride concentration (>1000 mg/l) which is shown in red color is negligible in comparison to other regions of the district. Overall, the district has good quality of ground water for domestic purposes from chloride perspective.

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)
	Bari Sadri		Begun		Bhadesar		Bhainsrorgarh		Bhopalsagar		Chittaurgarh		Dungla		Gangrar		Kapasan		Nimbahera		Rashmi		
	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	
<250	342.5	91.0	642.9	100.0	375.2	73.0	892.0	94.0	95.4	24.0	676.9	97.0	273.7	54.0	544.5	97.0	187.3	37.0	765.8	99.0	147.1	33.0	4,943.3
250-1000	33.9	9.0	0.3	-	137.5	27.0	60.2	6.0	282.8	72.0	23.1	3.0	236.1	46.0	16.6	3.0	324.9	63.0	11.1	1.0	300.0	67.0	1,426.5
>1000	-	-	-	-	-	-	-	-	17.4	4.0	-	-	-	-	-	-	-	-	-	-	-	-	17.4
Total	376.4	100.0	643.2	100.0	512.7	100.0	952.2	100.0	395.6	100.0	700.0	100.0	509.8	100.0	561.1	100.0	512.2	100.0	776.9	100.0	447.1	100.0	6,387.2



GROUND WATER FLUORIDE DISTRIBUTION

DISTRICT – CHITTAURGARH

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 and occupies almost 96% of the district area which is suitable for domestic purpose. The areas with moderately high concentration (1.5-3.0 mg/l) in green color patches scattered, largely western part of the district. Remaining small part of the district has high Fluoride concentration (>3.0 mg/l) which is shown in red color, largely western part of the district where ground water 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)
	Bari Sadri		Begun		Bhadesar		Bhainsrorgarh		Bhopalsagar		Chittaurgarh		Dungla		Gangrar		Kapasan		Nimbahera		Rashmi		
	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	
< 1.5	374.2	99.4	633.8	98.5	507.9	99.1	952.2	100.0	314.3	79.5	700.0	100.0	449.4	88.1	561.1	100.0	444.7	86.8	776.9	100.0	437.5	98.0	6,152.0
1.5-3.0	2.2	0.6	9.4	1.5	4.8	0.9	-	-	47.5	12.0	-	-	47.4	9.3	-	-	49.4	9.6	-	-	9.6	2.0	170.3
> 3.0	-	-	-	-	-	-	-	-	33.8	8.5	-	-	13.0	2.6	-	-	18.1	3.5	-	-	-	-	64.9
Total	376.4	100.0	643.2	100.0	512.7	100.0	952.2	100.0	395.6	100.0	700.0	100.0	509.8	100.0	561.1	100.0	512.2	100.0	776.9	100.0	447.1	100.0	6,387.2

GROUND WATER NITRATE DISTRIBUTION

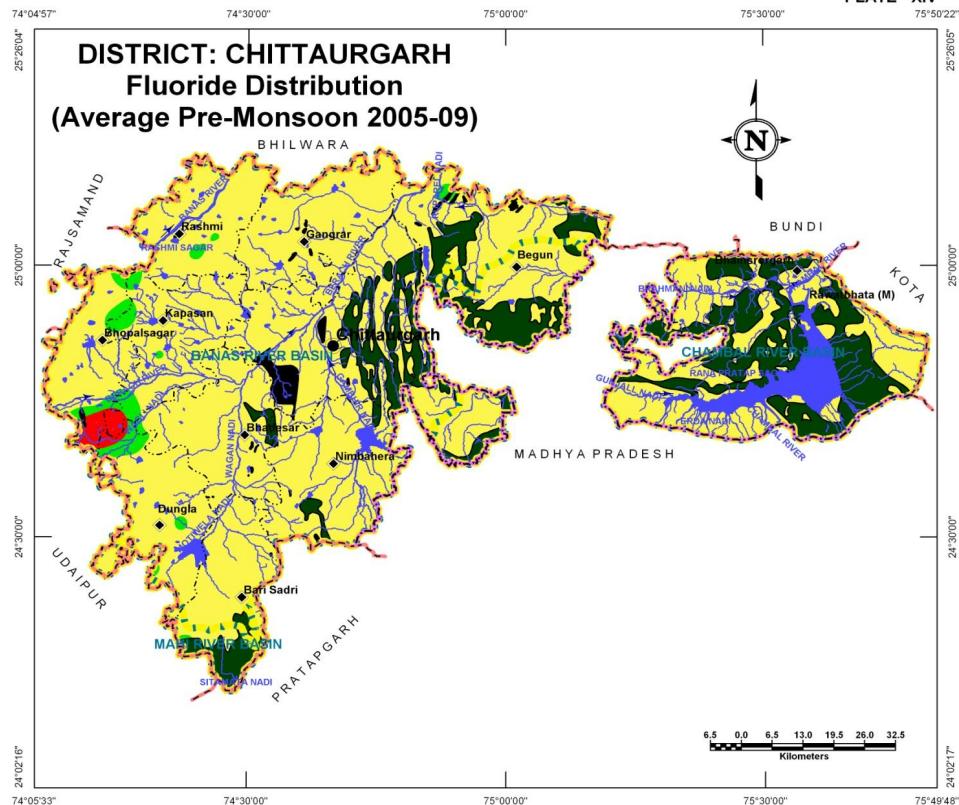
Plate – XV shows distribution of Nitrate in ground water. High nitrate concentration in ground water renders it unsuitable for agriculture purposes and in Chittaurgarh district large parts of western half of the district falls within high nitrate zone. Low nitrate concentration (<50 mg/l) is shown in yellow colour and occupies approximately 36% of the district area which is suitable for agriculture purpose. The areas with moderately high nitrate concentration (50-100 mg/l) are shown in green colour and occupy approximately 38% of the district area. Remaining part of the district area is covered with high nitrate concentration (>100 mg/l) which is shown in red coloured patches indicating that the ground water in this region is not suitable for agriculture purpose.

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)
	Bari Sadri		Begun		Bhadesar		Bhainsrorgarh		Bhopalsagar		Chittaurgarh		Dungla		Gangrar		Kapasan		Nimbahera		Rashmi		
	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	
<50	10.6	2.8	551.7	85.8	86.8	16.9	475.9	50.0	102.8	26.0	370.9	53.0	-	-	100.2	17.9	18.8	3.7	459.1	59.1	143.3	32.0	2,320.1
50-100	128.1	34.1	90.8	14.1	253.9	49.5	476.3	50.0	63.7	16.1	242.0	34.6	186.5	36.6	335.3	59.8	207.0	40.4	307.0	39.5	156.7	35.0	2,447.3
>100	237.7	63.1	0.7	0.1	172.0	33.6	-	-	229.1	57.9	87.1	12.4	323.3	63.4	125.6	22.4	286.4	55.9	10.8	1.4	147.1	33.0	1,619.8
Total	376.4	100.0	643.2	100.0	512.7	100.0	952.2	100.0	395.6	100.0	700.0	100.0	509.8	100.0	561.1	100.0	512.2	100.0	776.9	100.0	447.1	100.0	6,387.2



PLATE - XIV



LEGEND

Admin Boundary:

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

Basin Boundary

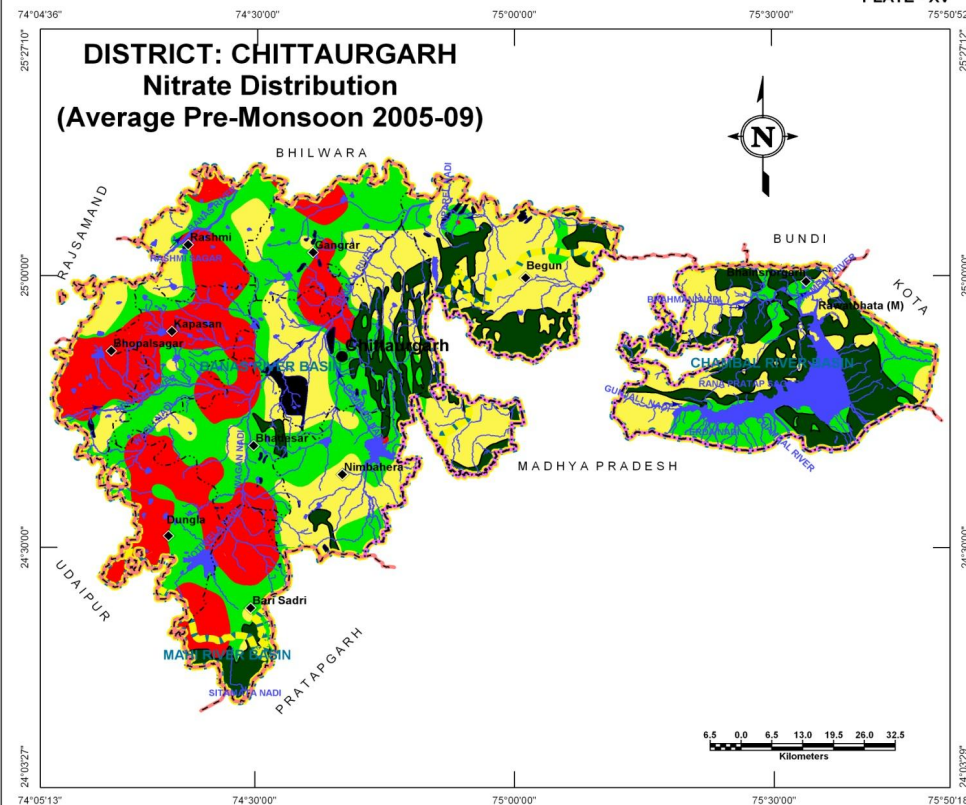
Water Bodies:

- River / Streams
- Ponds / Reservoirs
- Hills
- Reserve Forest

Fluoride Concentration (mg/l):

- < 1.5
- 1.5-3.0
- > 3.0

PLATE - XV



LEGEND

Admin Boundary:

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

Basin Boundary

Water Bodies:

- River / Streams
- Ponds / Reservoirs
- Hills
- Reserve Forest

Nitrate Concentration (mg/l):

- < 50
- 50-100
- > 100

DEPTH TO BEDROCK

DISTRICT – CHITTAURGARH

Depth to bedrock map of Chittaurgarh district (Plate – XVI) reveals wide variation of more than 100m across the district. The low depth to bedrock areas are seen in Bhainsrorgarh Kapasan and Bhadesar blocks and higher depths to bedrock (of more than 100m) is found in the northeastern part of the district around Bari Sadri, Begun and Dungla blocks. Apart from the very high depth to bedrock areas which seem to be localized in occurrence only, the general depth to bedrock is less than 60m bgl as seen all over the district.

Depth to bedrock (m bgl)	Block wise area coverage (sq km)																						Total Area (sq km)
	Bari Sadri		Begun		Bhadesar		Bhainsrorgarh		Bhopalsagar		Chittaurgarh		Dungla		Gangrar		Kapasana		Nimbahera		Rashmi		
	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	
< 20	-	-	20.3	3.2	50.7	9.9	861.7	90.5	8.6	2.2	5.3	0.8		-		-	94.7	18.5	9.2	1.2		-	1,050.5
20-40	110.0	29.2	328.4	51.1	426.6	83.2	90.5	9.5	227.6	57.5	694.7	99.2	26.5	5.2	561.1	100.0	326.4	63.7	767.7	98.8	140.0	31.3	3,699.5
40-60	243.4	64.6	289.6	45.0	35.4	6.9	-	-	159.4	40.3	-	-	336.0	65.9	-	-	91.1	17.8	-	-	307.1	68.7	1,462.0
60-80	23.0	6.1	1.9	0.3	-	-	-	-	-	-	-	-	144.5	28.3	-	-	-	-	-	-	-	-	169.4
80-100	-	-	-	-	-	-	-	-	-	-	-	-	2.8	0.5	-	-	-	-	-	-	-	-	2.8
> 100	-	-	3.0	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.0
Total	376.4	100.0	643.2	100.0	512.7	100.0	952.2	100.0	395.6	100.0	700.0	100.0	509.8	100.0	561.1	100.0	512.2	100.0	776.9	100.0	447.1	100.0	6,387.2

UNCONFINED AQUIFER

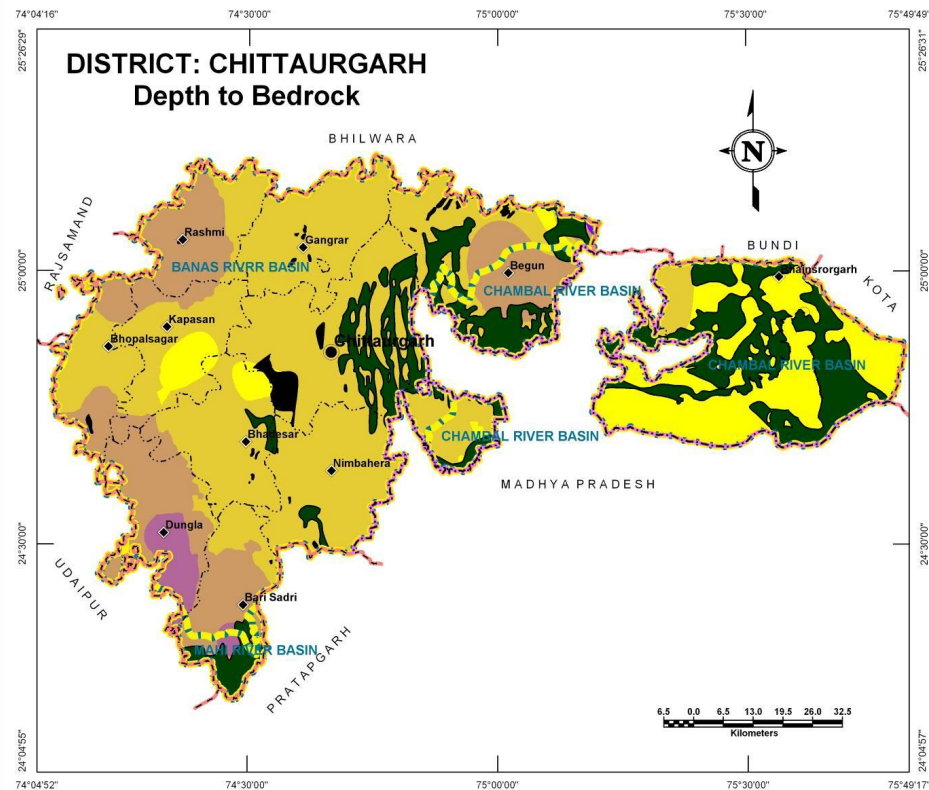
Hardrock areas

Aquifers in the district are predominantly formed in weathered, fractured and jointed rock formations occurring at shallower depths and these constitute good unconfined aquifers. The thickness of aquifers thus formed varies from less than 10m to around 50m. The southwestern part has very thick zones especially in Bhopalsagar, Dungla, Kapasana and Rashmi blocks and occasionally in Begun and Bhadesar blocks. Rest of the blocks (i.e., Bari Sadri, Bhainsrorgarh, Gangrar, Nimbahera) have moderate to low thickness of aquifers in hardrock often ranging between 20 and less than 10m.

Unconfined aquifer Thickness (m)	Block wise area coverage (sq km)											Total Area (sq km)
	Bari Sadri	Begun	Bhadesar	Bhainsrorgarh	Bhopalsagar	Chittaurgarh	Dungla	Gangrar	Kapasana	Nimbahera	Rashmi	
<10	84.9	24.9	267.4	952.2	3.1	26.0	22.1	43.4	22.9	660.8	15.1	2,122.8
10-20	229.7	369.1	121.4	-	50.1	407.7	174.6	401.3	82.0	107.0	108.6	2,051.5
20-30	61.8	137.1	99.6	-	149.7	213.3	247.7	78.1	197.8	9.1	210.2	1,404.4
30-40	-	79.1	13.3	-	189.0	52.5	65.2	38.3	186.0	-	96.5	719.9
> 40	-	33.0	11.0	-	3.7	0.5	0.2	-	23.5	-	16.7	88.6
Total	376.4	643.2	512.7	952.2	395.6	700.0	509.8	561.1	512.2	776.9	447.1	6,387.2



PLATE - XVI



LEGEND

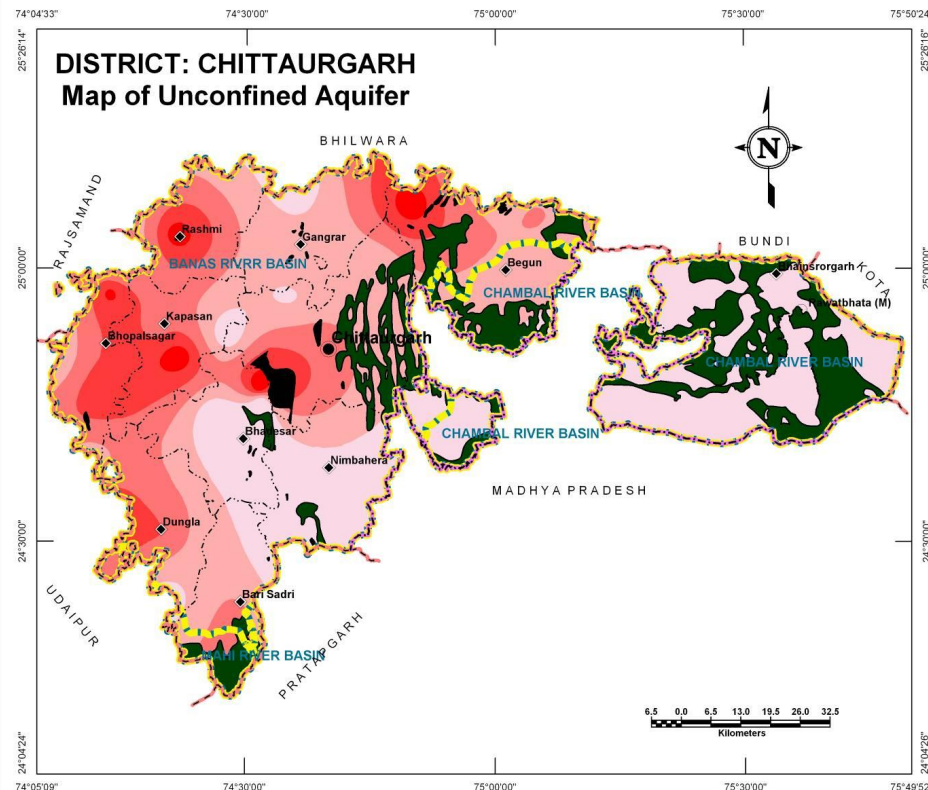
Admin Boundary:

- District Headquarter
- Block Headquarter
- Town
- State Boundary
- District Boundary
- Block Boundary
- Basin Boundary
- Hills
- Reserve Forest

Depth to Bedrock(m bgl):

- <20
- 20-40
- 40-60
- 60-80
- 80-100
- >100

PLATE - XVII



LEGEND

Admin Boundary:

- District Headquarter
- Block Headquarter
- Town
- State Boundary
- District Boundary
- Block Boundary
- Basin Boundary
- Hills
- Reserve Forest

Aquifer Thickness (m):

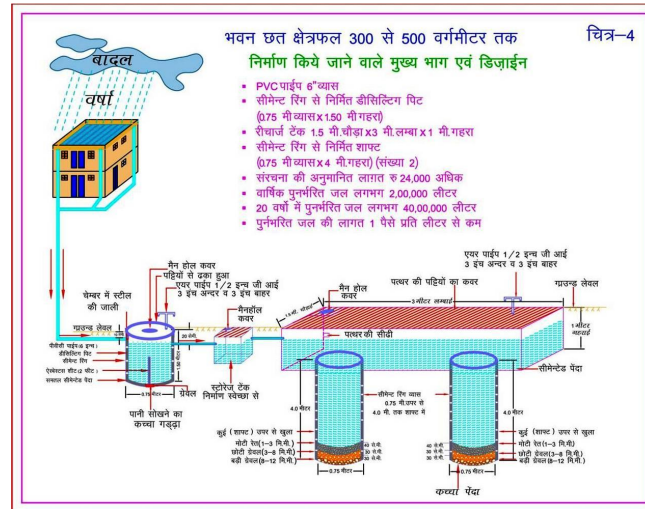
- Weathered & Fractured Zone in Hardrock Area**
- <10
 - 10-20
 - 20-30
 - 30-40
 - >40

Glossary of terms

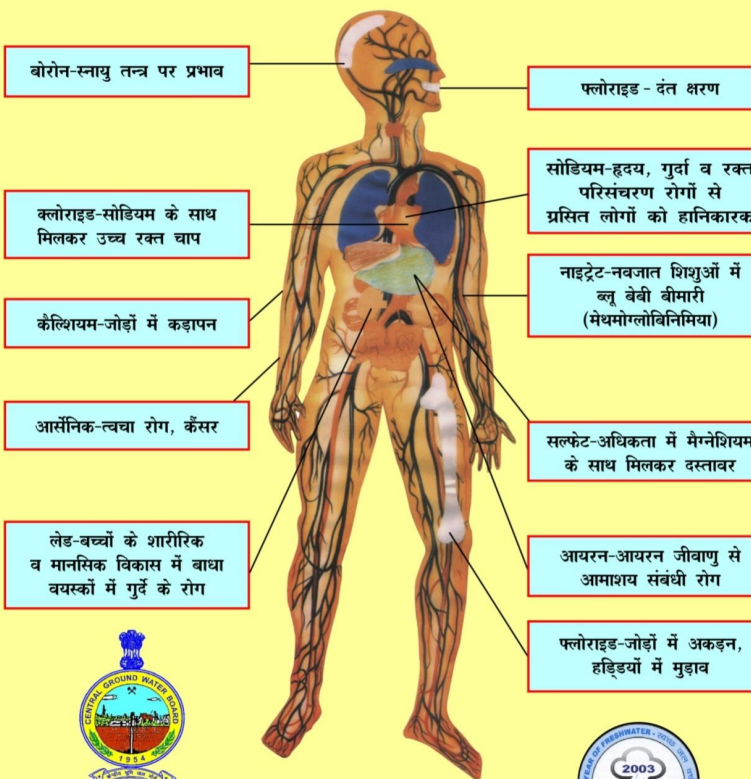
S. No.	Technical Terms	Definition
1	AQUIFER	A saturated geological formation which has good permeability to supply sufficient quantity of water to a Tube well, well or spring.
2	ARID CLIMATE	Climate characterized by high evaporation and low precipitation.
3	ARTIFICIAL RECHARGE	Addition of water to a 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 semi arid 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 level 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

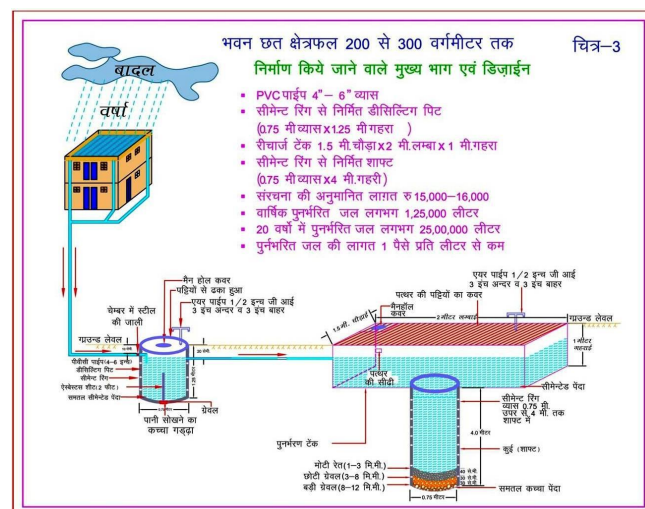
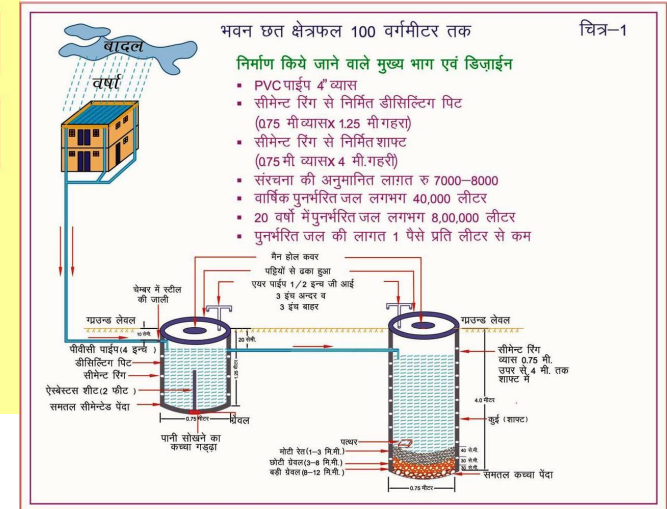
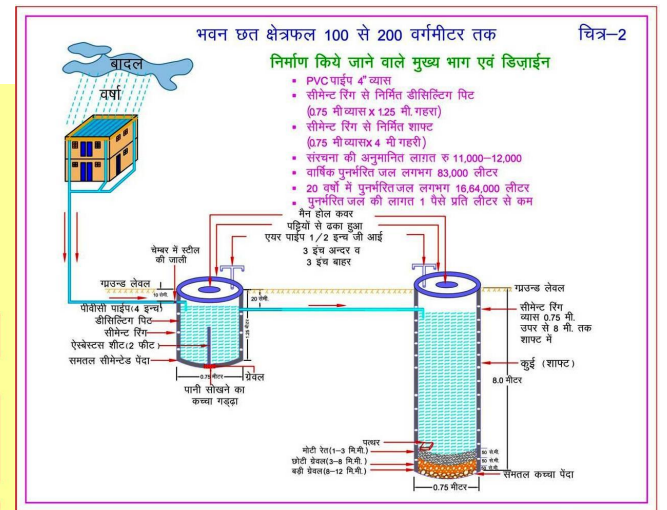


भूजल में घुले मुख्य तत्वों की अधिकता का मानव शरीर पर दुष्प्रभाव



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





Myths and Facts about Ground Water

S No	Myths	Facts
1	What is Ground Water <ul style="list-style-type: none"> • 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 adjoining 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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