Ground Water Department,
Rajasthan

Hydrogeological Atlas of Rajasthan

Kota District

European Union
State Partnership Programme

2013

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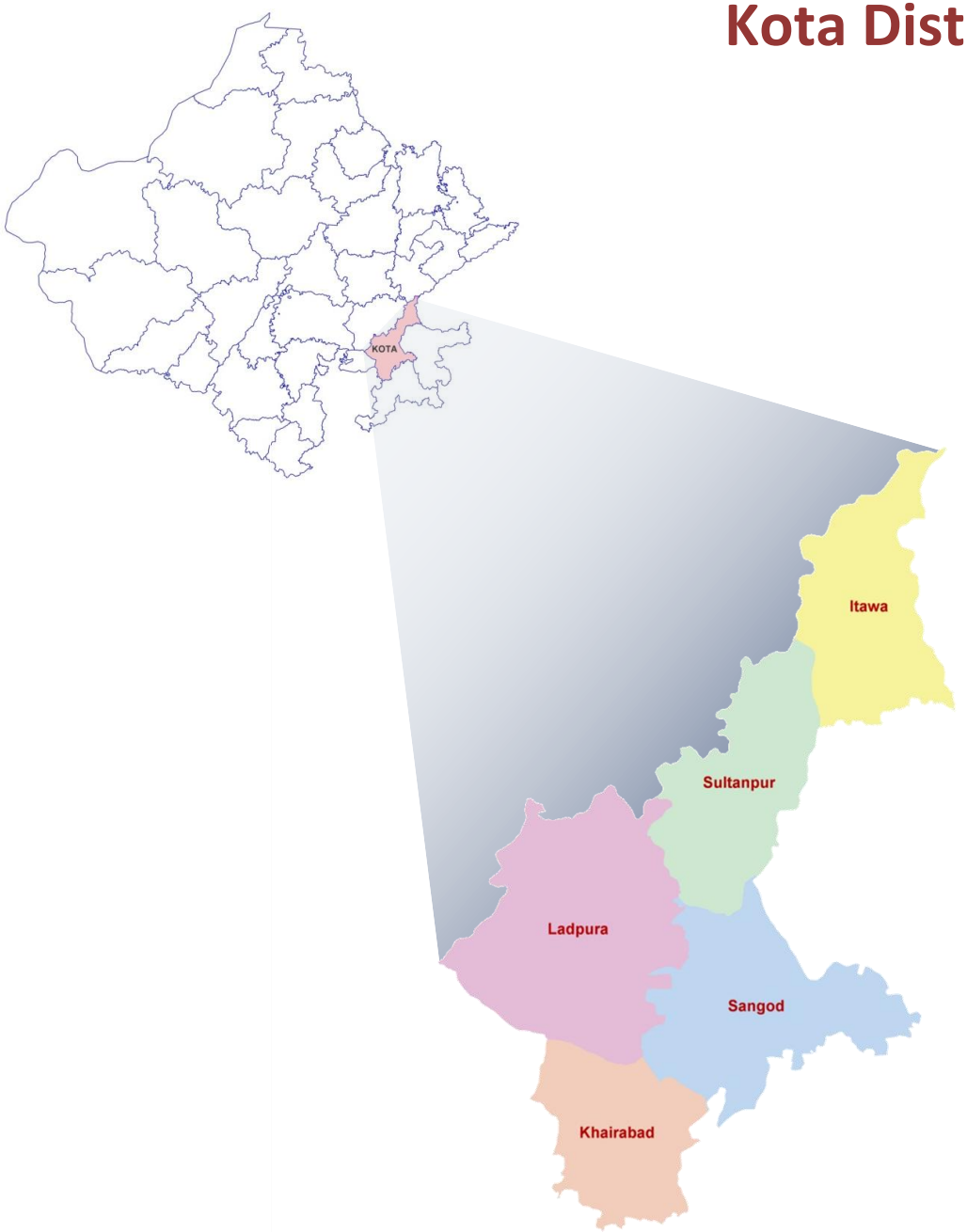
Hydrogeological Atlas of Rajasthan

Kota District



Contents:

2013

ADMINISTRATIVE SETUP

DISTRICT – KOTA

Location:

Kota district is located in the southeastern part of Rajasthan. It is bounded in the north by Sawai Madhopur district, in the east by Baran district and the state of Madhya Pradesh, in the south by Jhalawar and Chittaurgarh districts along with state of Madhya Pradesh and finally in the west by Bundi district. It stretches between 24° 32' 02.17" to 25° 51' 19.33" north latitude and 75° 36' 55.19'' to 76° 34' 57.10'' east longitude covering an approximate area of 5,122.3 sq kms. The whole district is the part of 'Chambal River Basin'.

Administrative Set-up:

Kota district is administratively divided into five 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	Itawa	1,55,646	906.2	17.7	169
2	Khairabad	2,28,479	734.6	14.3	166
3	Ladpura	8,68,213	1,478.2	28.9	185
4	Sangod	1,65,600	1,095.9	21.4	212
5	Sultanpur	1,50,587	907.4	17.7	171
Total		**15,68,525**	**5,122.3**	**100.0**	**903**

Kota district has 903 towns and villages, of which five are block headquarters as well.

Climate:

Kota district has a semi-arid climate. Summers are long, hot and dry, starting in late March and lasting till the end of June. The monsoon season follows summer with comparatively lower temperatures, but higher humidity and frequent, torrential downpours. The monsoons subside in October and temperatures rise again moderately. The brief but pleasant winter starts in late November and lasts until the last week of February. Temperatures hover between 26.7°C (max) to 12°C (min). The average annual rainfall in the Kota district is 707.7 mm. Most of the rainfall can be attributed to the southwest monsoon which has its beginning around the last week of June and may last till mid-September. Pre-monsoon showers begin towards the middle of June with post-monsoon rains occasionally occurring in October. The winter is largely dry, although some rainfall does occur as a result of the Western Disturbance passing over the region.

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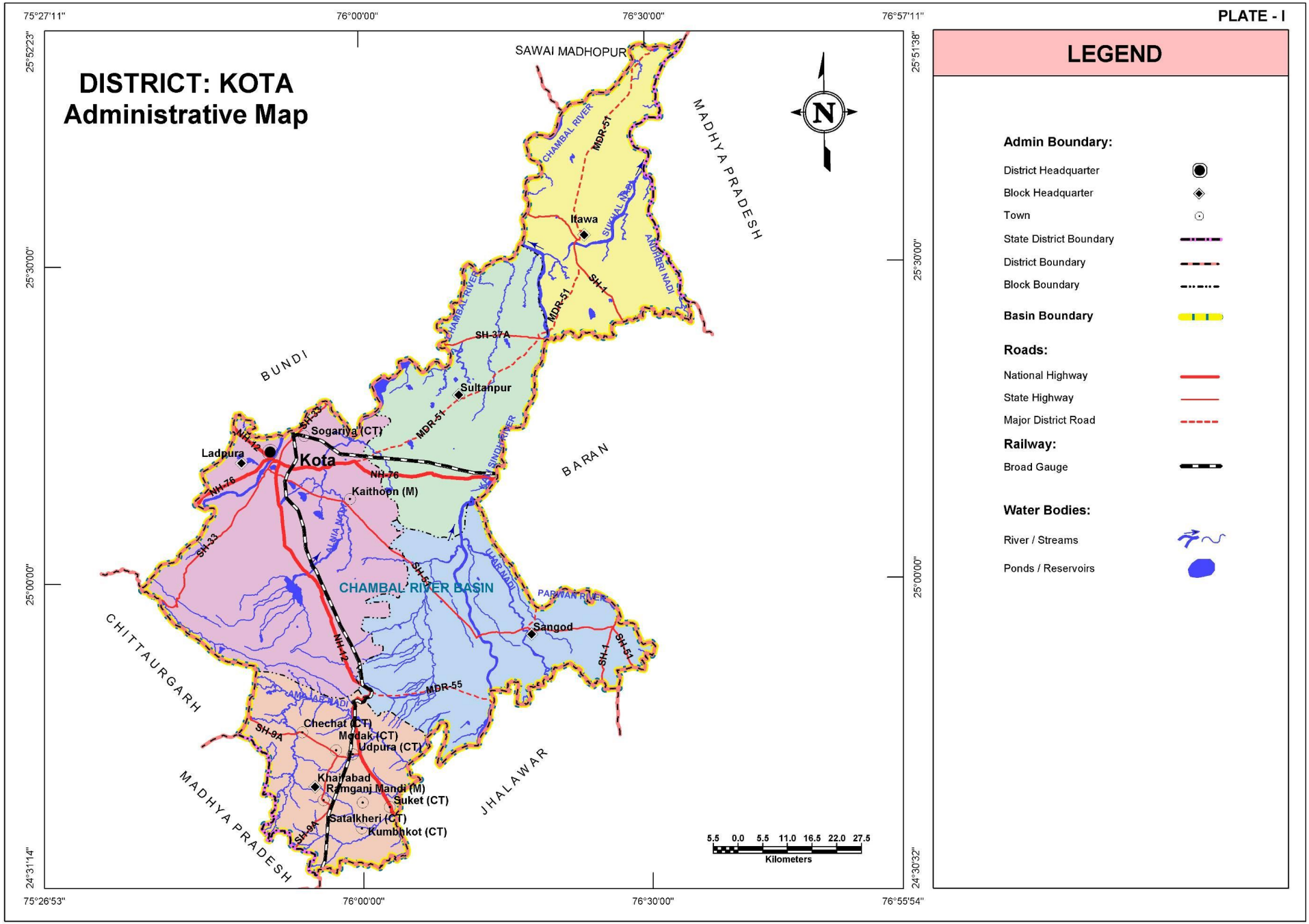
PLATE - I



LEGEND

Admin Boundary:

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

Roads:

- National Highway
- State Highway
- Major District Road

Railway:

- Broad Gauge

Water Bodies:

- River / Streams
- Ponds / Reservoirs

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TOPOGRAPHY

DISTRICT – KOTA

Major part of the district comes under plain area but hills occupysouthern part trending west to east. Kota is part of Chambal river basin. Chambal is the major river in the district which developed very good drainage system along with tributaries like Sukhal, Andheri, Alnia, Ujar, Parwan and Amajar. The general topographic elevation in the district is between 250 m to 300 m above mean sea level in most of the blocks. Elevation ranges from a minimum of 175.9 m above mean sea level in Itawa block in the northern part of the district to a maximum of 517.5 m amsl in Ladpura in southwestern part of the district.

Table: Block wise minimum and maximum elevation

S. No.	Block Name	Min. Elevation (m amsl)	Max. Elevation (m amsl)
1	Itawa	175.9	257.8
2	Khairabad	296.4	452.9
3	Ladpura	228.0	517.5
4	Sangod	224.9	442.6
5	Sultanpur	193.0	283.6

RAINFALL

Rainfall received in the district is fairly good. The general distribution of rainfall across can be visualized from isohyets presented in the Plate – III where most of the district received rainfall in the range of 600-700 mm in year 2010. The total annual average rainfall is 663.4 mm based on the data of available blocks. Itawa block received highest rainfall (917.6 mm) whereas lowest was in Sangod block (418.4 mm). Maximum average annual rainfall recorded in Itawa block was about 773.6 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)
Itawa	683.0	917.6	773.6
Khairabad	614.1	845.8	735.1
Ladpura	545.8	696.8	616.6
Sangod	418.4	643.7	538.6
Sultanpur	545.4	738.7	653.1

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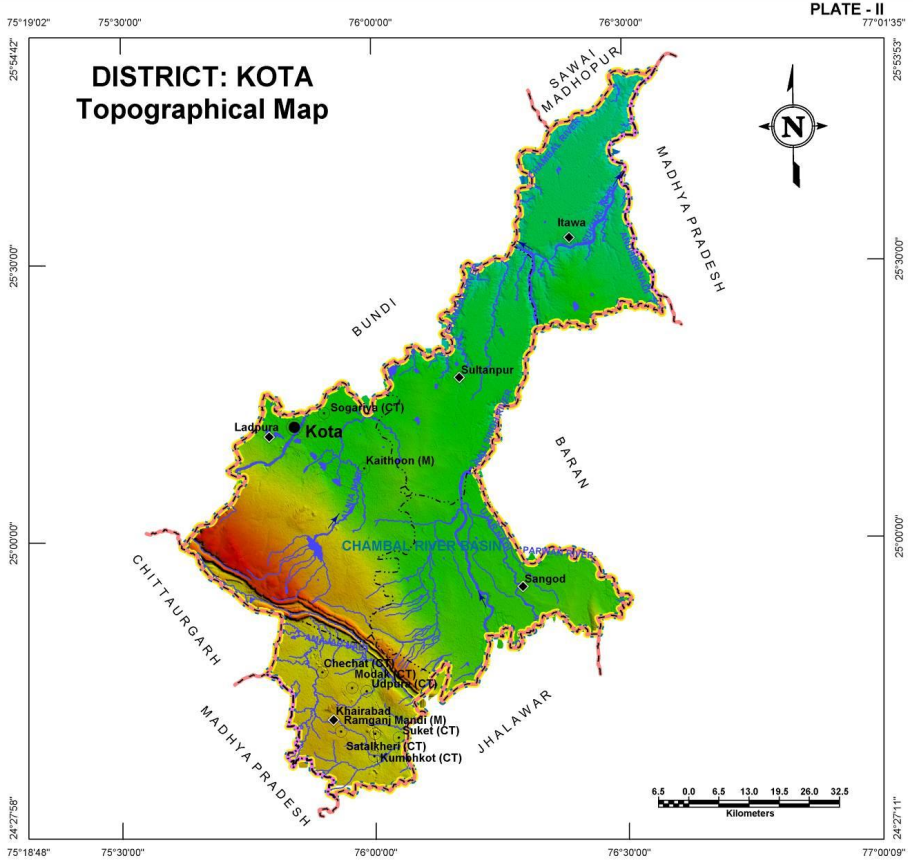
PLATE - II



LEGEND

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

Basin Boundary

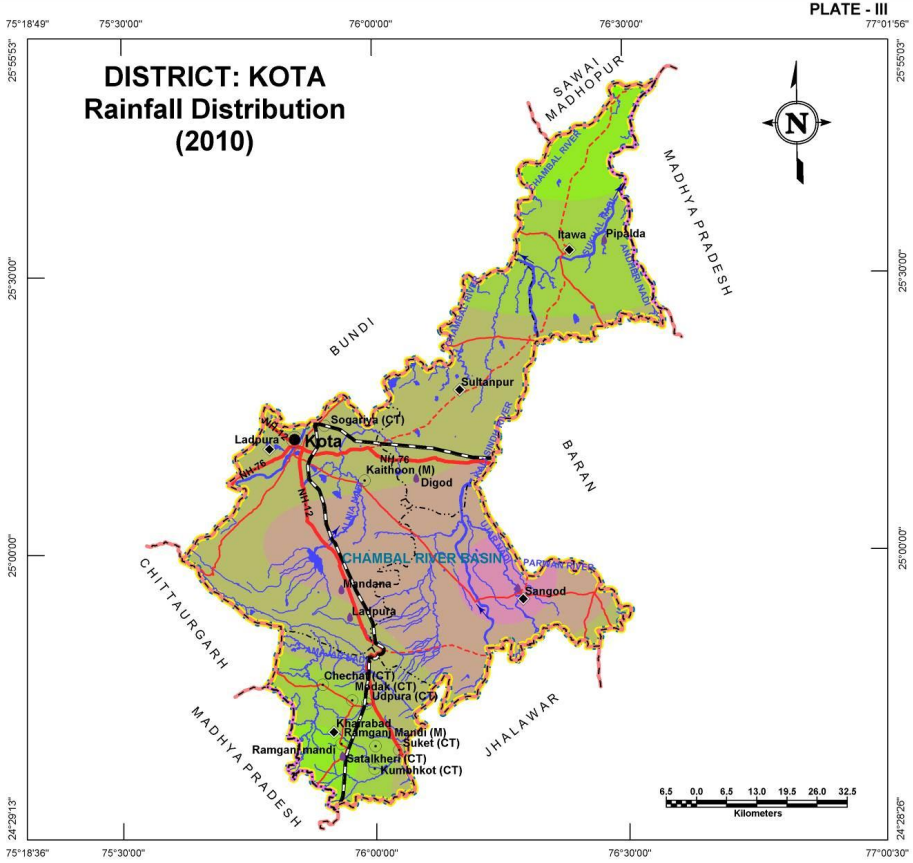
Water Bodies:
- River / Streams
- Ponds / Reservoirs

Source : SRTM DEM

Elevation (m amsl):

518
500
450
400
350
300
250
200
176

PLATE - III



LEGEND

Admin Boundary:
- District Headquarter
- Block Headquarter
- Town
- 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

Isohyets (mm):
- 400-500
- 500-600
- 600-700
- 700-800
- 800-900
- 900-1000

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GEOLOGY

DISTRICT – KOTA

Geologically, most of the parts of Kota district are occupied by Vindhyan Super Group which forms the part of Great Vindhyan basin. The Vindhyan Super Group is divided into Khorip, Kaimur, Rewa and Bhander Groups comprising Sandstones, Shales and Limestone. The Bhander Group comprises almost 70% of the area of the district. The southern part of the district consists of Deccan trap formation within Khairabad block. Rewa and Kaimur Group of rocks occupy small patches in Khairabad, Sangod and Ladpura block.

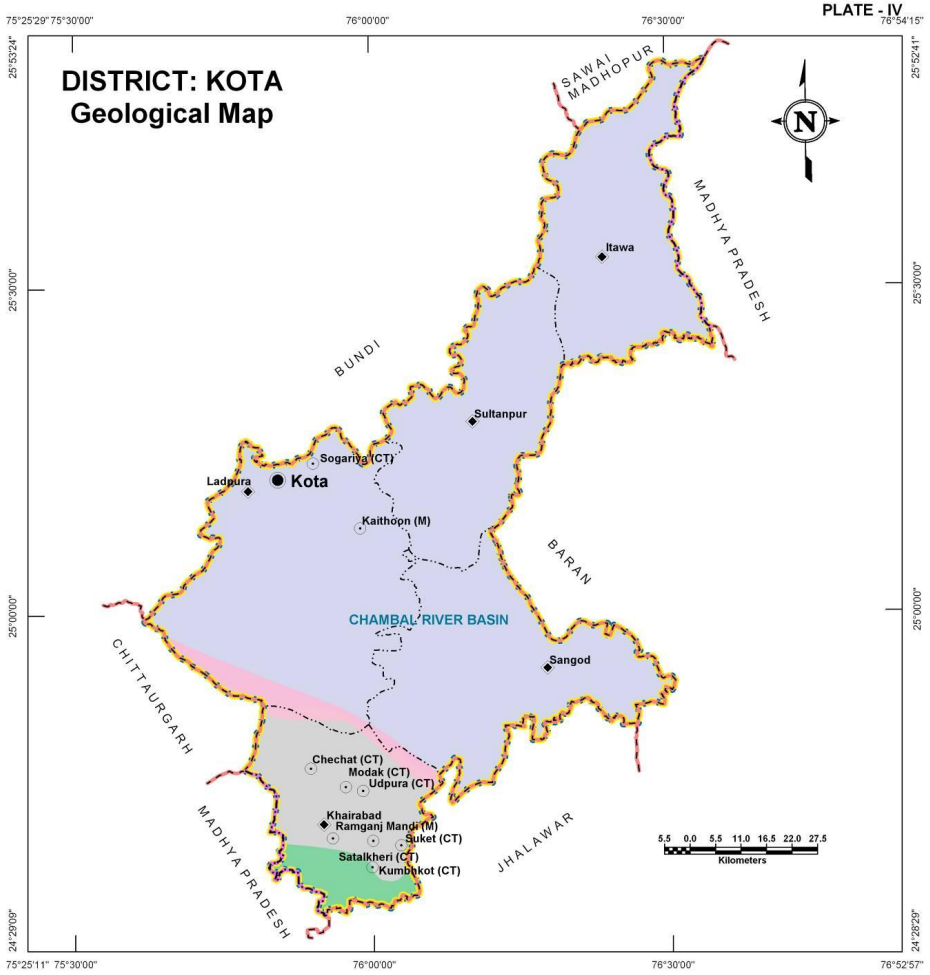
Super Group	Group	Formation
	Recent	Alluvium (Sand, silt & clay)
Vindhyan	Bhander	Shale, Limestone, Sandstone
	Rewa	Shale, Sandstone
	Kaimur	Sandstone
	Khorip	Shale

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.
	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.
	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:

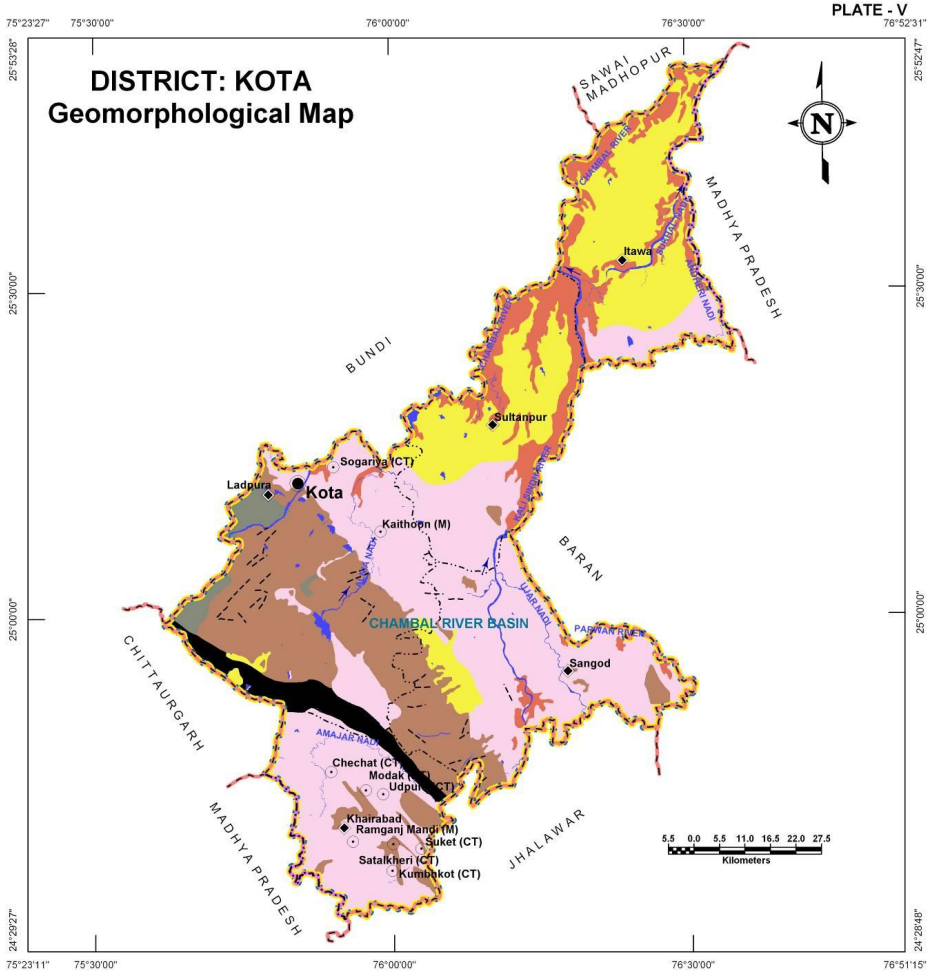
- District Headquarter
- Block Headquarter
- Town
- State Boundary
- District Boundary
- Block Boundary
- **Basin Boundary**

Geology:

- Bhander Group
- Rewa Group
- Kaimur Group
- Khorip Group
- Deccan Traps

Source: District Resource Map of Rajasthan - GSI

PLATE - V



LEGEND

Admin Boundary:

- District Headquarter
- Block Headquarter
- Town
- 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
- Ravine

Denudational Origin:

- Pediment
- Burried Pediment

Structural Origin:

- Plateau

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

AQUIFERS

DISTRICT – KOTA

In Kota district, aquifers are formed in both alluvial material and in sedimentary rocks. The alluvium is primarily Younger alluvium occupying about 28% of district area occurring as continuous patch in northern part of the district. Among hard rock aquifers, Sandstone and limestone are most prominent. Sandstones occupy almost half of the district area and form very promising aquifers in southern part of the district. Limestone aquifers hold water in secondary pores and form aquifers in about 22% of the district. Weathered and fractured shale also constitutes aquifers however with very limited spatial extent (about 3%) in eastern 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
Younger Alluvium	1,435.2	28.0	It is largely constituted of Aeolian and Fluvial sand, silt, clay, gravel and pebbles in varying proportions.
Limestone	1,142.3	22.3	In general, it is fine to medium grained, grey, red yellowish, pink or buff in colour.
Sandstone	2,395.5	46.8	Fine to medium grained, red colour and compact and at places.
Shale	149.3	2.9	Grey, light green and purple in colour and mostly splintery in nature.
Total	**5,122.3**	**100.0**	

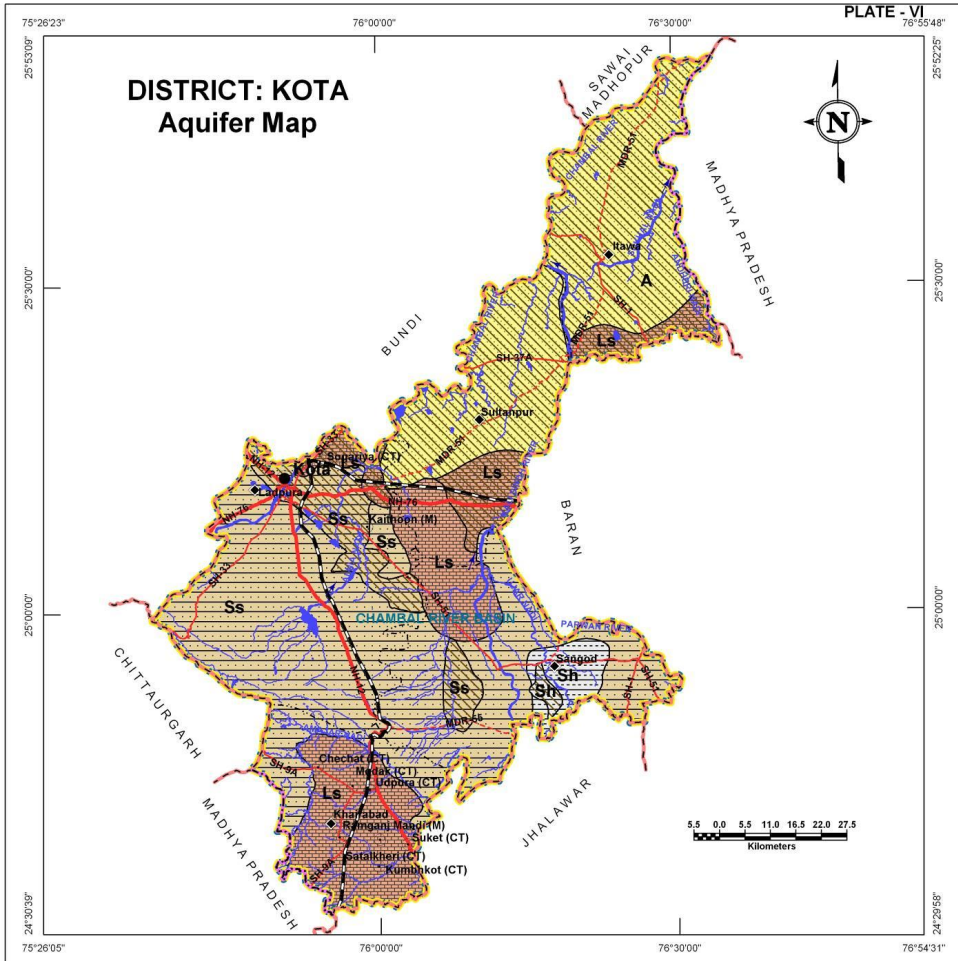
STAGE OF GROUND WATER DEVELOPMENT

Ground water resource studies reveal that the of the five blocks within the district, three are in 'Semi critical' category implying that ground water development is already close to 90%. The two other districts (Khairabad and Sangod) are even more stressed as they fall within the 'Over Exploited' category and further development of ground water be avoided.

Categorization on the basis of stage of development of ground water	Block Name
Semi-Critical	Ladpura, Sultanpur, Itawa
Over Exploited	Khairabad, Sangod

Basis for categorization: Ground water development <= 70 – 90% Semi critical and >100% - Over-Exploited.

PLATE - VI



LEGEND

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

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

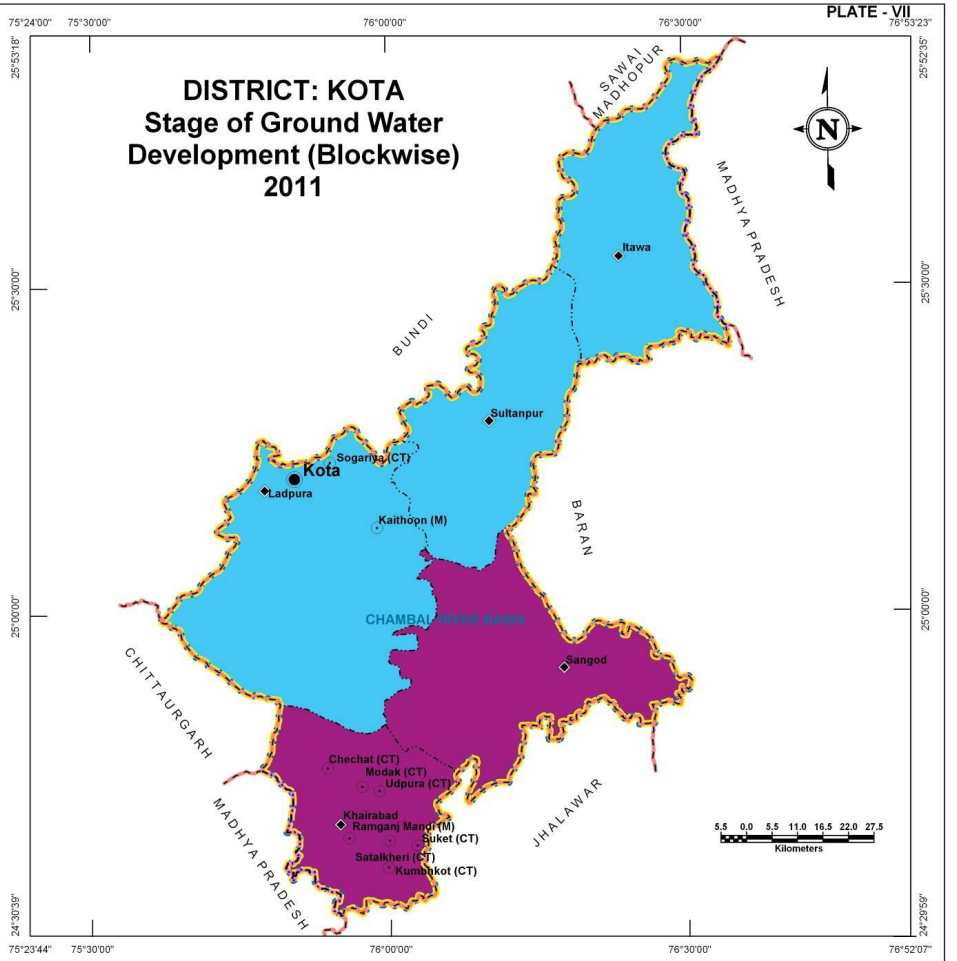
Railway:
- Broad Gauge

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

Aquifer:
- Younger Alluvium
- Limestone
- Sandstone
- Shale

Source: Ground Water Potential Zone Map - GWD, Rajasthan

PLATE - VII



LEGEND

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

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

Source: Ground Water Department, Rajasthan

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LOCATION OF EXPLORATORY AND GROUND WATER MONITORING WELLS DISTRICT – KOTA

Kota district has a well distributed network of exploratory wells (81) and ground water monitoring stations (178) in the district owned by RGWD (47 and 160 respectively) and CGWB (34 and 18 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 need to be strengthened by adding 17 additional wells to water level monitoring network and just 3 wells to water quality network for optimization of the network.

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
Itawa	3	7	**10**	8	32	**40**	0	2
Khairabad	3	9	**12**	-	32	**32**	17	0
Ladpura	7	10	**17**	5	36	**41**	0	1
Sangod	10	13	**23**	2	31	**33**	0	0
Sultanpur	11	8	**19**	3	29	**32**	0	0
Total	**34**	**47**	**81**	**18**	**160**	**178**	**17**	**3**

DEPTH TO WATER LEVEL (PRE MONSOON – 2010)

Depth to ground water levels in Kota district can be visualized from Plate – IX. Depth to water level varies from less than 10m below ground level to more than 40mbgl. Central part of the district i.e., Sultanpur-Sangod-Ladpura region, shows deeper water levels even reaching upto>40m bgl. In the northern and western sides, the water level is relatively shallow i.e., less than20m bgl, but in the eastern part, largely in Sangod block, the water level is moderately deeper 20-30m bgl.

Depth to water Level(mbgl)	Block wise area coverage (sq km) *					Total Area (sq km)
	Itawa	Khairabad	Ladpura	Sangod	Sultanpur	
< 10	178.8	22.8	510.6	27.8	463.1	**1,203.1**
10-20	540.2	624.0	654.2	356.4	317.6	**2,492.4**
20-30	184.6	87.8	228.7	669.1	87.9	**1,258.1**
30-40	2.6	-	64.9	40.7	38.5	**146.7**
> 40	-	-	19.8	1.8	0.4	**22.0**
Total	**906.2**	**734.6**	**1,478.2**	**1,095.8**	**907.5**	**5,122.3**

* 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

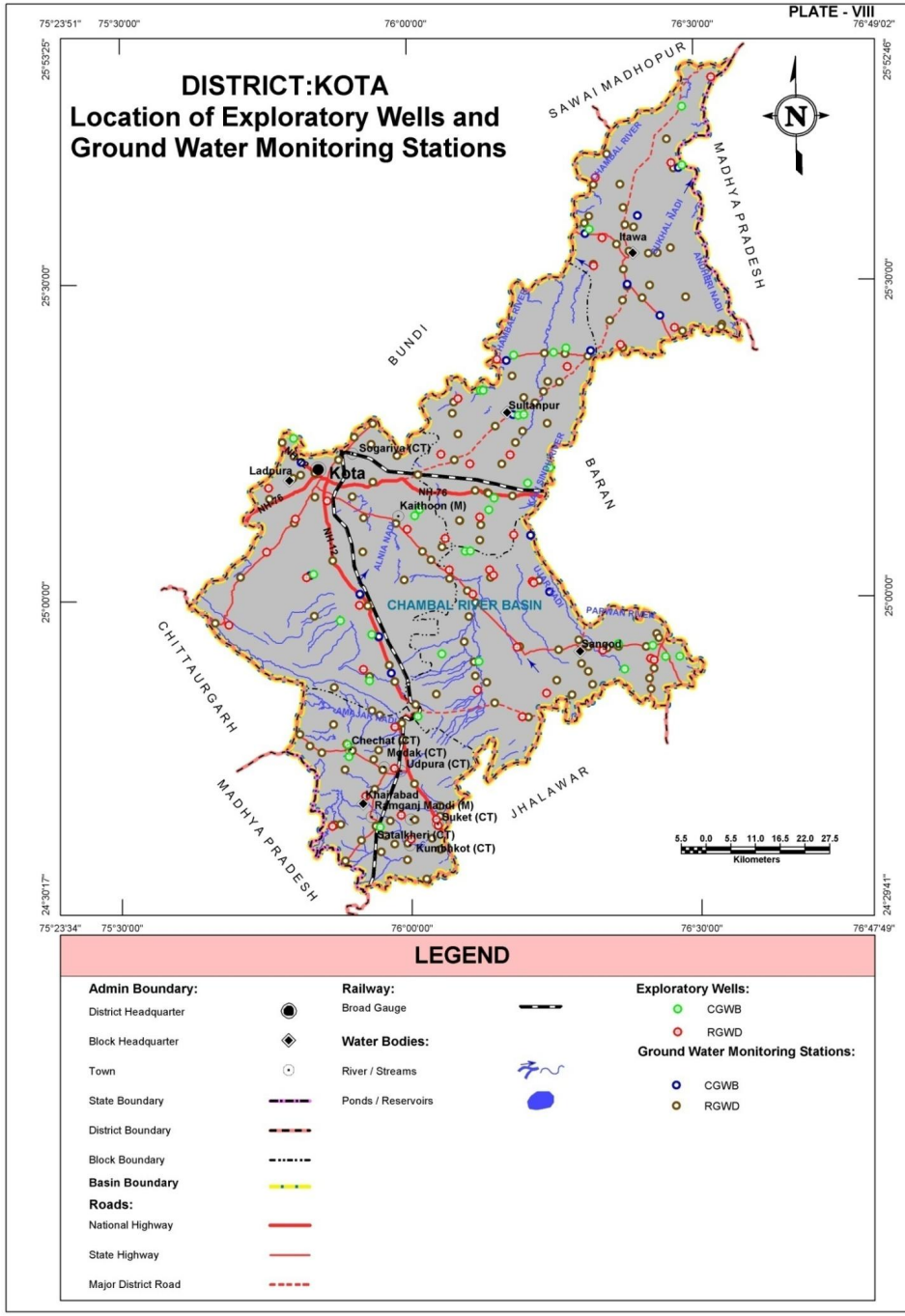
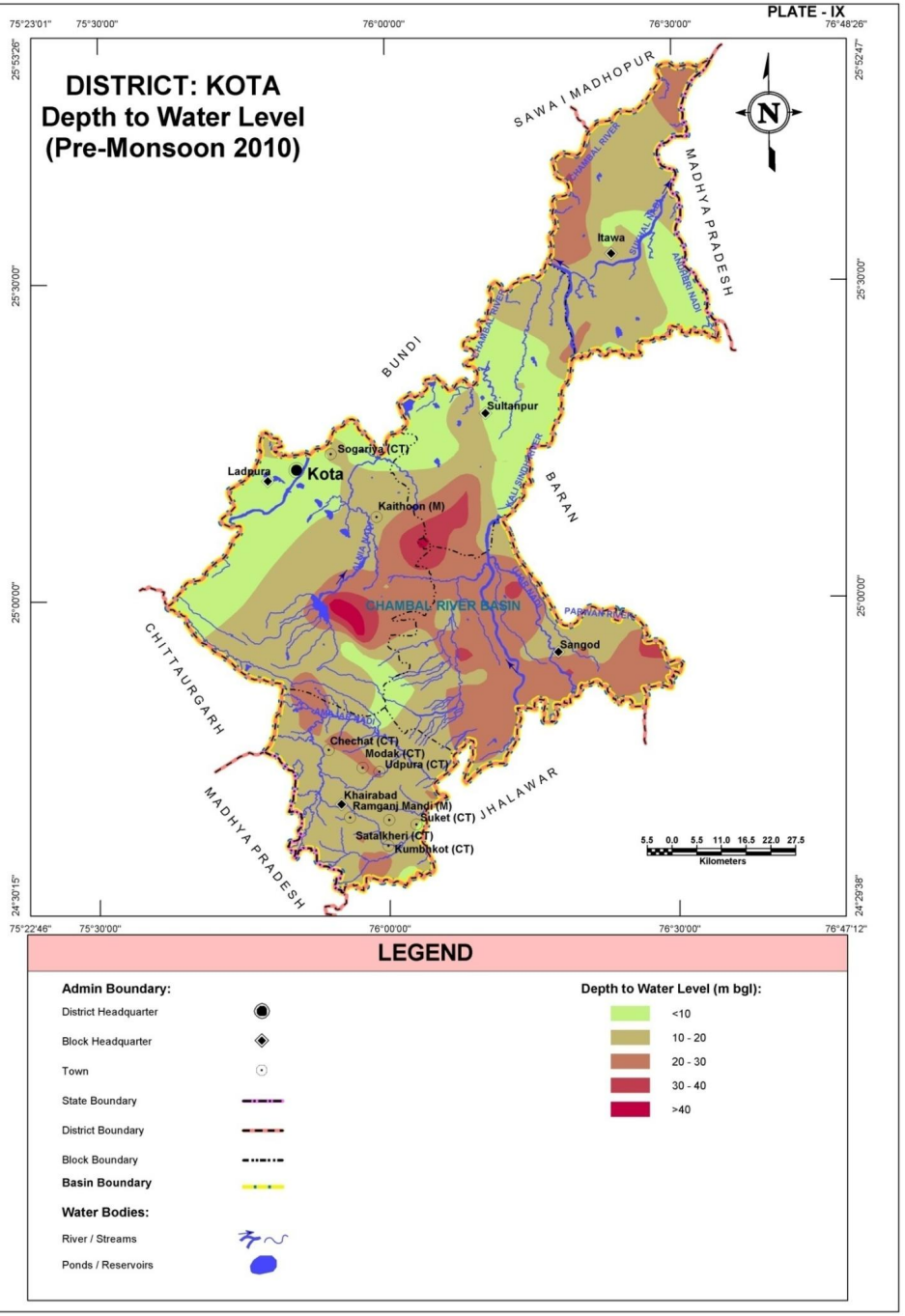


PLATE - IX



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

The regional ground water flow is broadly from west to east and finally to northeast in major part of the district. The general water table elevations are higher in western and southwestern parts of the district were the water table elevation varies from 240 – 320m above mean sea level and reaching to a maximum of about 400m amsl in extreme western part of the district (in Ladpura Block). In the northern part however, the elevation ranges are on the lower side, varying between about 200m (Itawa block) to 260m amsl.

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

Block Name	Block wise area coverage (sq km) per water table elevation range (m)												Total Area (sq km)
	<200	200-220	220-240	240-260	260-280	280-300	300-320	320-340	340-360	360-380	380-400	>400	
Itawa	99.3	560.5	244.9	1.5	-	-	-	-	-	-	-	-	**906.2**
Khairabad	-	-	-	-	93.0	428.8	196.6	14.2	2.0	-	-	-	**734.6**
Ladpura	-	-	83.0	246.6	181.5	154.1	186.4	160.0	145.5	153.6	159.1	8.4	**1,478.2**
Sangod	-	-	50.3	575.4	243.7	122.8	85.2	18.4	-	-	-	-	**1,095.8**
Sultanpur	-	47.9	747.8	111.8	-	-	-	-	-	-	-	-	**907.5**
Total	**99.3**	**608.4**	**1,126.0**	**935.3**	**518.2**	**705.7**	**468.2**	**192.6**	**147.5**	**153.6**	**159.1**	**8.4**	**5,122.3**

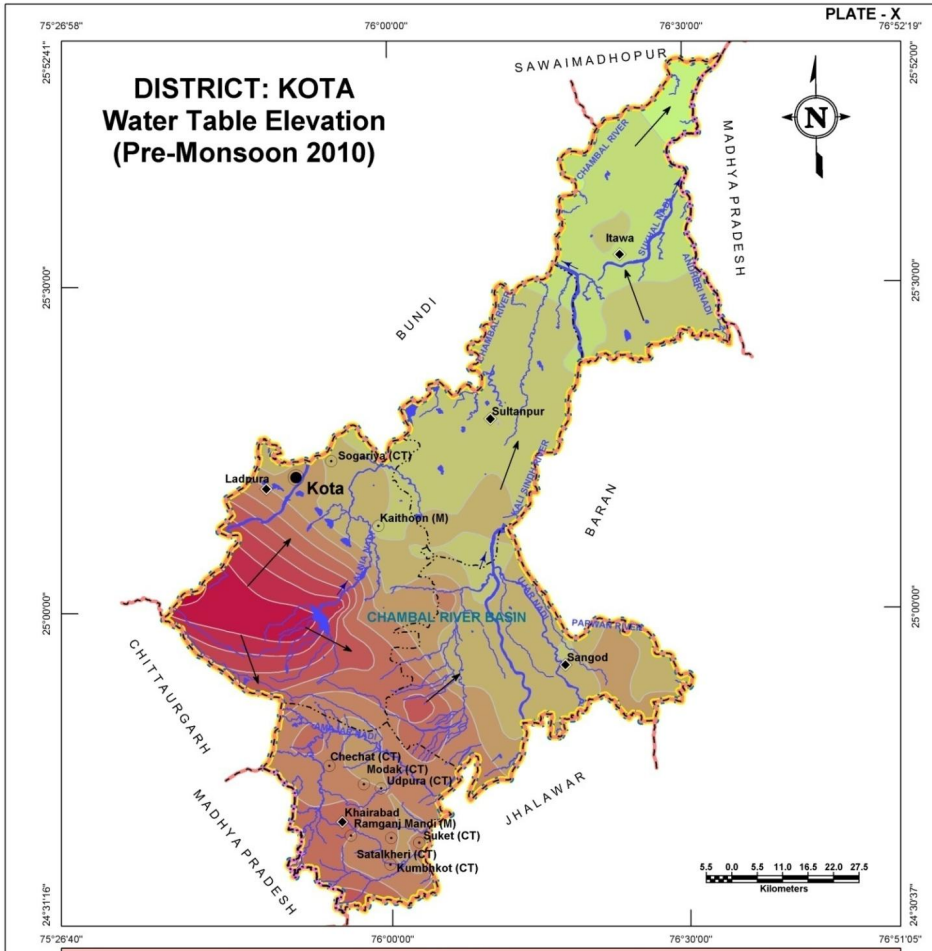
WATER LEVEL FLUCTUATION (PRE TO POST MONSOON 2010)

Ground water level fluctuation map (Plate – XI) reveals fall ground water level by 6 m in one area to rise in upto 16m in other areas between pre to post monsoon water levels. The negative fluctuation areas (indicated by pink and red coloured regions) are the areas where overexploitation is taking place and water level in the post monsoon season has actually gone down with respect to pre-monsoon levels. Such ground water depletion areas are located in the northern and northwestern part of the district, largely corresponding to alluvial aquifer areas. Rest of the district has shown a general to significant rise in ground water level as maximum rise of more than 16m is noticed in the central part of Ladpura block.

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	-6to-4	-4to-2	-2to0	0to2	2to4	4to6	6to8	8to10	10to12	12to14	14to16	>16	
Itawa	-	0.5	30.6	246.2	441.5	147.1	33.9	6.4	-	-	-	-	-	**906.2**
Khairabad	-	-	2.2	5.1	30.7	53.8	99.9	137.6	122.3	187.9	59.0	34.5	1.6	**734.6**
Ladpura	-	-	16.5	194.0	266.2	266.6	214.6	189.2	99.9	77.1	86.6	57.5	10.0	**1,478.2**
Sangod	-	-	7.8	54.3	153.2	296.2	209.8	117.6	117.0	88.5	38.0	10.4	3.0	**1,095.8**
Sultanpur	2.3	6.4	31.1	282.5	369.5	136.9	49.5	20.0	4.6	2.5	1.4	0.8	-	**907.5**
Total	**2.3**	**6.9**	**88.2**	**782.1**	**1,261.1**	**900.6**	**607.7**	**470.8**	**343.8**	**356.0**	**185.0**	**103.2**	**14.6**	**5,122.3**

PLATE - X



LEGEND

Admin Boundary:

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

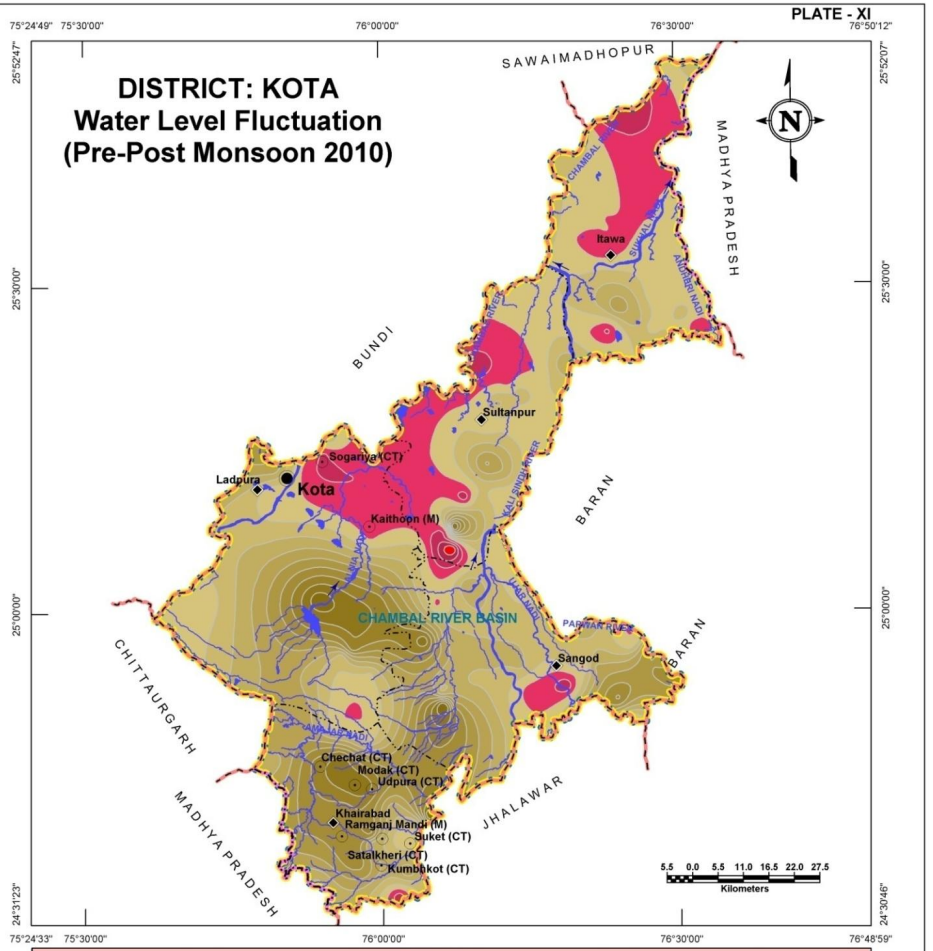
Water Bodies:

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

Water Table Elevation (m amsl):

- < 200
- 200 - 220
- 220 - 240
- 240 - 260
- 260 - 280
- 280 - 300
- 300 - 320
- 320 - 340
- 340 - 360
- 360 - 380
- 380 - 400
- > 400

PLATE - XI



LEGEND

Admin Boundary:

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

Water Bodies:

- River / Streams
- Ponds / Reservoirs

Water Level Fluctuation (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

GROUND WATER ELECTRICAL CONDUCTIVITY DISTRIBUTION DISTRICT – KOTA

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 90% of the district area indicating that, by and large the ground water in the whole of the district is suitable for domestic purpose. The areas with moderately high EC values (2000 -4000 µS/cm) are shown in green color which occupy only about 10% of the district area, largely in the northern part of the district around Sultanpur. An insignificantly small area (just about 0.1 sq km) in Itawa block has high EC values in ground water (>4000 µS/cm).

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)
	Itawa		Khairabad		Ladpura		Sangod		Sultanpur		
	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	
< 2000	683.5	75.4	695.9	94.7	1,473.6	99.7	1,081.7	98.7	687.5	75.8	**4,622.2**
2000-4000	222.6	24.6	38.7	5.3	4.6	0.3	14.1	1.3	220.0	24.2	**500.0**
>4000	0.1	-	-	-	-	-	-	-	-	-	**0.1**
Total	**906.2**	**100.0**	**734.6**	**100.0**	**1,478.2**	**100.0**	**1,095.8**	**100.0**	**907.5**	**100.0**	**5,122.3**

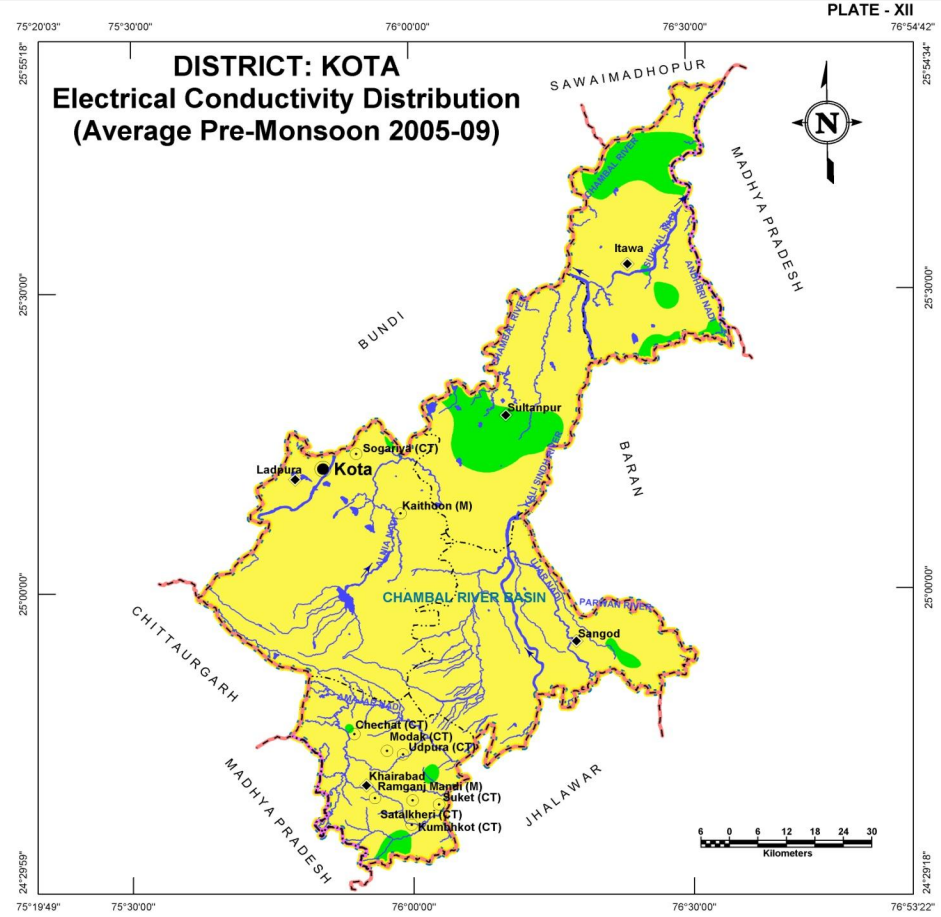
GROUND WATER CHLORIDE DISTRIBUTION

Chloride concentration map is presented in Plate – XIII. The yellow colored regions in map are such areas where chloride concentration is low (<250 mg/l) and these occupyabout 93% 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 occupy approximately 7% of the district area, largely northern part of the district and eastern part of Sultanpur.

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)
	Itawa		Khairabad		Ladpura		Sangod		Sultanpur		
	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	
< 250	715.3	79	645	88	1,475.8	100	1,083.0	99	842.1	93	**4,761.2**
250-1000	190.9	21	89.6	12	2.4	-	12.8	1	65.4	7	**361.1**
> 1000	-	-	-	-	-	-	-	-	-	-	**-**
Total	**906.2**	**100**	**734.6**	**100**	**1478.2**	**100**	**1095.8**	**100**	**907.5**	**100**	**5,122.3**

PLATE - XII



LEGEND

Admin Boundary:

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

Basin Boundary

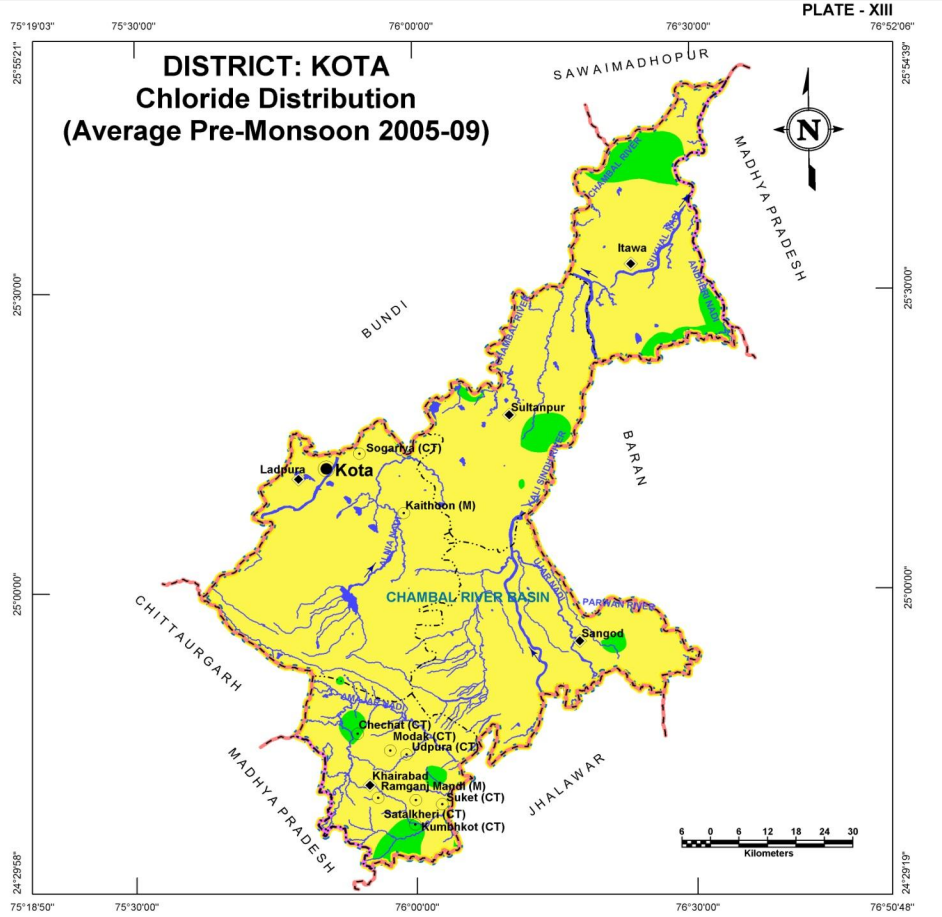
Water Bodies:

- River / Streams
- Ponds / Reservoirs

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

- < 2000
- 2000-4000
- >4000

PLATE - XIII



LEGEND

Admin Boundary:

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

Basin Boundary

Water Bodies:

- River / Streams
- Ponds / Reservoirs

Chloride Concentration (mg/l):

- < 250
- 250 - 1000

GROUND WATER FLUORIDE DISTRIBUTION

DISTRICT – KOTA

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 99% of the district area which is suitable for domestic purpose. The area with moderately high concentration (1.5-3.0 mg/l) in green color patches is covered a small portion of the district area, which is insignificant. Overall, the ground water is suitable for domestic purposes in the district from fluoride concentration perspective.

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)
	Itawa		Khairabad		Ladpura		Sangod		Sultanpur		
	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	
< 1.5	902.6	99.6	734.6	100.0	1,474.6	99.7	1,095.8	100.0	898.0	99.0	**5,105.6**
1.5-3.0	3.6	0.4	-	-	3.6	0.3	-	-	9.5	1.0	**16.7**
> 3.0	-	-	-	-	-	-	-	-	-	-	**-**
Total	**906.2**	**100.0**	**734.6**	**100.0**	**1,478.2**	**100.0**	**1,095.8**	**100.0**	**907.5**	**100.0**	**5,122.3**

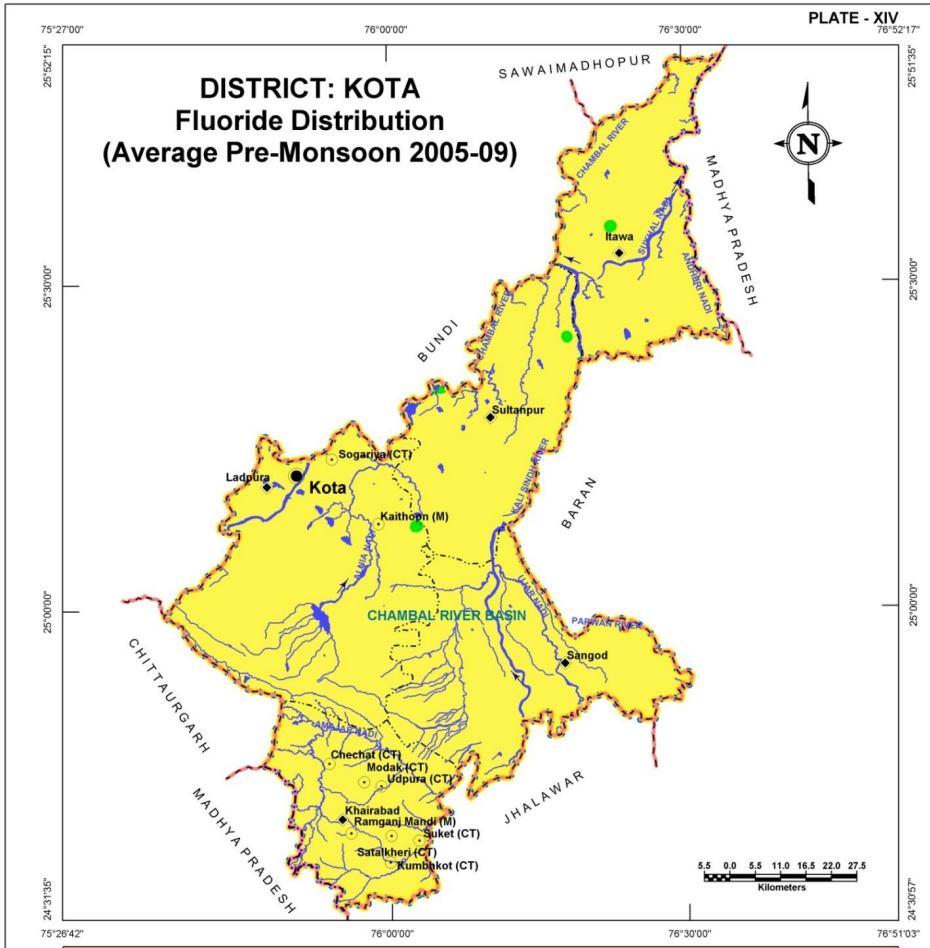
GROUND WATER NITRATE DISTRIBUTION

High nitrate concentration in ground water renders it unsuitable for agriculture purposes. Plate – XV shows distribution of Nitrate in ground water. Low nitrate concentration (<50 mg/l) is shown in yellow color occupy approximately 78% 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 color and occupy approximately 18% of the district area, largely southwestern and southern part of the district. Remaining part of the district area approximately 4% is covered with high nitrate concentration (>100 mg/l) which is shown in red colored patches where the ground water is unsuitable for agriculture purpose. The high nitrate concentration areas are seen in most of the districts but the affected areas are large in Itawa and Khairabad blocks.

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)
	Itawa		Khairabad		Ladpura		Sangod		Sultanpur		
	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	
< 50	660.5	72.9	500.1	68.1	1,053.1	71.2	961.2	87.7	805.3	88.7	**3,980.2**
50-100	130.4	14.4	171.0	23.3	419.9	28.4	118.4	10.8	102.2	11.3	**941.9**
>100	115.3	12.7	63.5	8.6	5.2	0.4	16.2	1.5	-	-	**200.2**
Total	**906.2**	**100.0**	**734.6**	**100.0**	**1,478.2**	**100.0**	**1,095.8**	**100.0**	**907.5**	**100.0**	**5,122.3**

PLATE - XIV



LEGEND

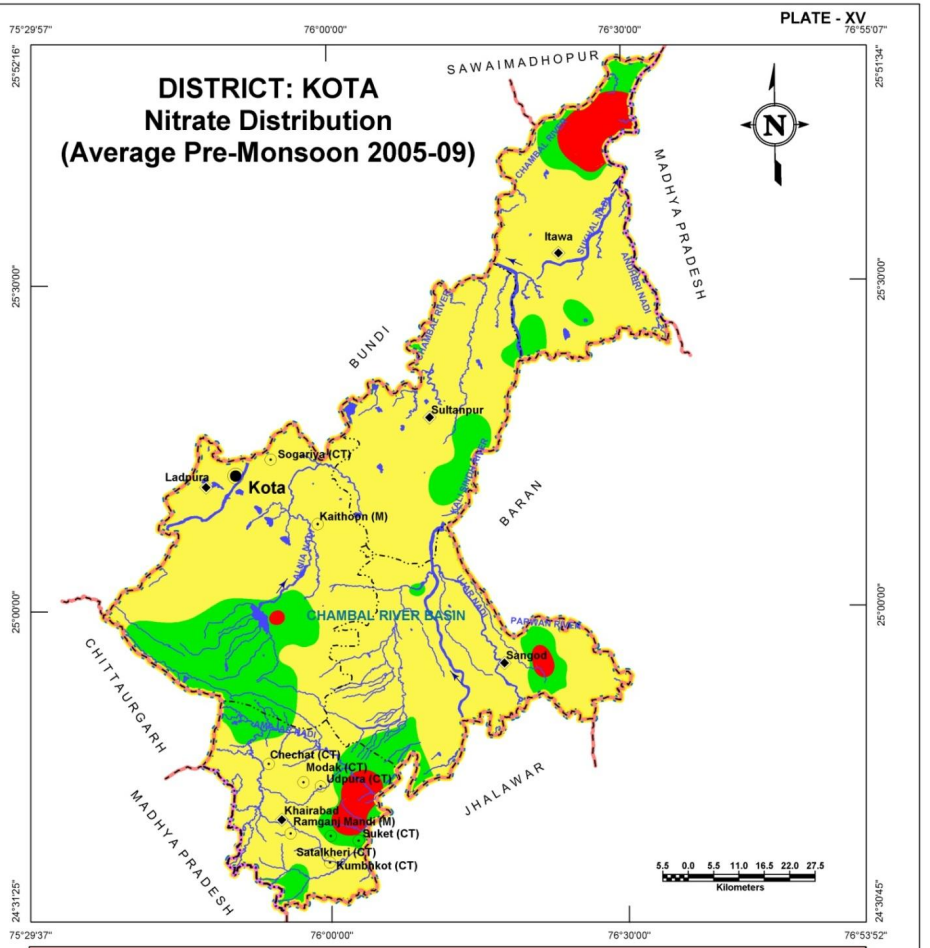
Admin Boundary:
- District Headquarter
- Block Headquarter
- Town
- State Boundary
- District Boundary
- Block Boundary

Basin Boundary

Water Bodies:
- River / Streams
- Ponds / Reservoirs

Fluoride Concentration (mg/l):
- < 1.5
- 1.5-3.0

PLATE - XV



LEGEND

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

Basin Boundary

Water Bodies:
- River / Streams
- Ponds / Reservoirs

Nitrate Concentration (mg/l):
- < 50
- 50-100
- >100

DEPTH TO BEDROCK

DISTRICT – KOTA

Plate – XVI depicts the bedrock depth from ground level in Kota district. The beginning of massive bedrock has been considered for defining top of bedrock surface. The major rocks types constituting the bedrock are limestone, sandstones and shale. 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 bedrock in meters below ground level reveals that the bedrock surface varies from being very shallow near hardrock exposures to more than 20m bgl. It has been observed from the map that the entire southern part of the district, the bedrock is quite closer to surface (less than 20m bgl) whereas, northwards in areas where alluvium constitutes aquifers, the depth to bedrock increases to more than 20m bgl. A small patch of near surface bedrock has observed in the northeastern part of Itawa block.

Depth to bedrock (m bgl)	Block wise area coverage (sq km)										Total Area (sq km)
	Itawa		Khairabad		Ladpura		Sangod		Sultanpur		
	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	
< 20	22.6	2.5	734.6	100.0	1,414.6	96.0	1,076.2	98.2	42.0	5.0	**3,290.0**
> 20	883.6	97.5	-	-	63.6	4.0	19.6	1.8	865.5	95.0	**1,832.3**
Total	**906.2**	**100.0**	**734.6**	**100.0**	**1,478.2**	**100.0**	**1,095.8**	**100.0**	**907.5**	**100.0**	**5,122.3**

UNCONFINED AQUIFER

Alluvial areas:

Alluvial material forms aquifers in most of northern half of the district. The thickness of unconfined aquifer varies from less than 10 m to about 20m with the thickest parts lying to the west of Sultanpur block. A Small portion in Ladpura area also has aquifers formed in thick alluvial aquifer. In Itawa block all of the alluvial aquifer is less than 10m thick.

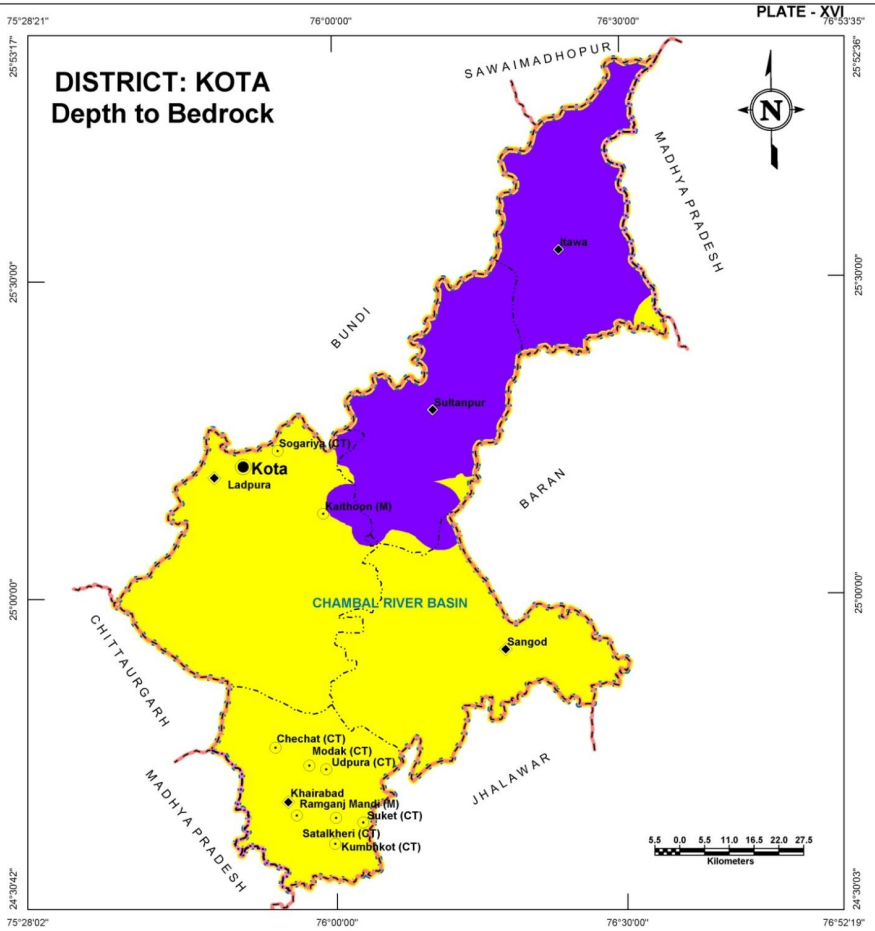
Unconfined aquifer Thickness (m)	Block wisearea coverage (sq km)					Total Area (sq km)
	Itawa	Khairabad	Ladpura	Sangod	Sultanpur	
< 10	906.2	-	-	-	436.2	**1,342.4**
> 10	-	-	14.9	-	192.1	**207.0**
Total	**906.2**	**-**	**14.9**	**-**	**628.3**	**1,549.4**

Hard rock areas:

Weathered, fractured and jointed rock formations occurring at shallower depths constitute good unconfined aquifers. Such zone ranges in thickness from less than 10 meter to just more than 10m covering almost entire parts of the district excluding the northern area. A small area in Ladpura block has more than 10m thick aquifer in hardrocks but is just about 2.2 sq kms in extent.

Unconfined aquifer Thickness (m)	Block wise Areacoverage (sq km)					Total Area (sq km)
	Itawa	Khairabad	Ladpura	Sangod	Sultanpur	
< 10	-	734.6	1,461.1	1,095.8	279.2	**3,570.7**
> 10	-	-	2.2	-	-	**2.2**
Total	**-**	**734.6**	**1,463.3**	**1,095.8**	**279.2**	**3,572.9**

PLATE - XVI



LEGEND

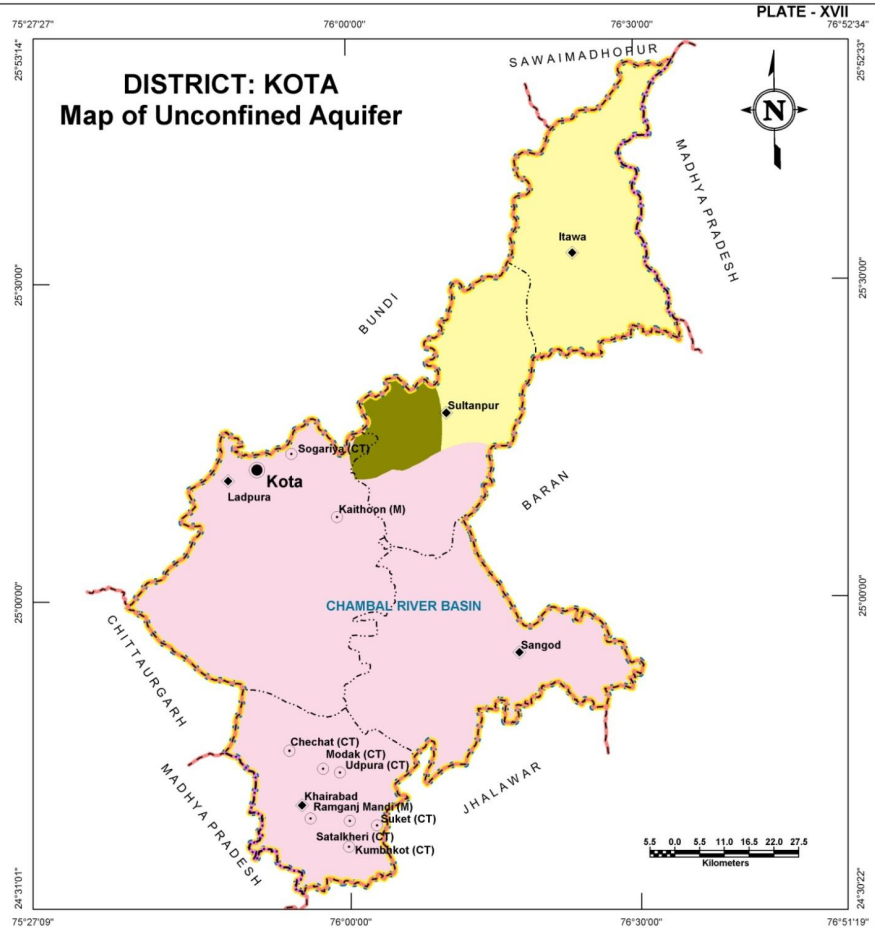
Admin Boundary:

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

Depth to Bedrock(m bgl):

- <20
- >20

PLATE - XVII



LEGEND

Admin Boundary:

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

Aquifer Thickness (m):

Alluvial Area		Weathered & Fractured Zone in Hardrock Area	
	<10		<10
	>10		>10

ROLTA
Rolta India Limited

Glossary of terms

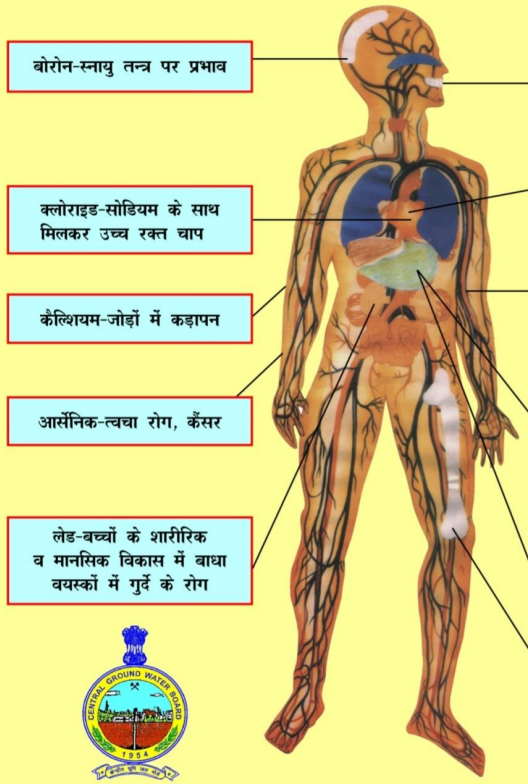
S. No.	Technical Terms	Definition
1	AQUIFER	A saturated geological formation which has good permeability to supply sufficient quantity of water to a Tube well, well or spring.
2	ARID CLIMATE	Climate characterized by high evaporation and low precipitation.
3	ARTIFICIAL RECHARGE	Addition of water to a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

(Contd…)

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,
पश्चिमी क्षेत्र, जयपुर
जल संसाधन मंत्रालय
भारत सरकार
e-mail:cgwbwr@sancharnet.in

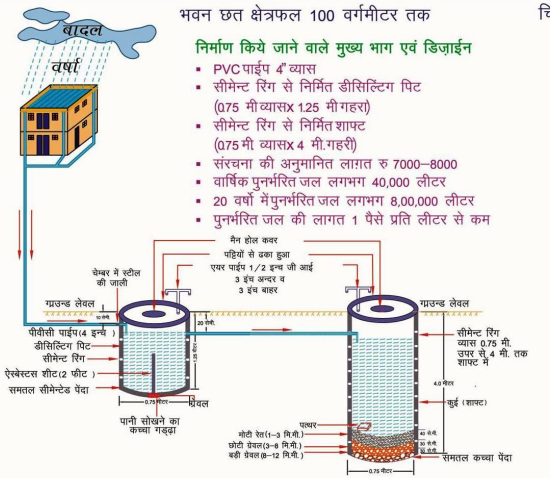
भूजल अमूल्य है इसे प्रदूषित न करें।

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 लाग़त रु 7000–8000
- वार्षिक पुनर्भरित जल लगभग 40,000 लीटर
- 20 वर्षो में पुनर्भरित जल लगभग 8,00,000 लीटर
- पुनर्भरित जल की लागत 1 पैसे प्रति लीटर से कम

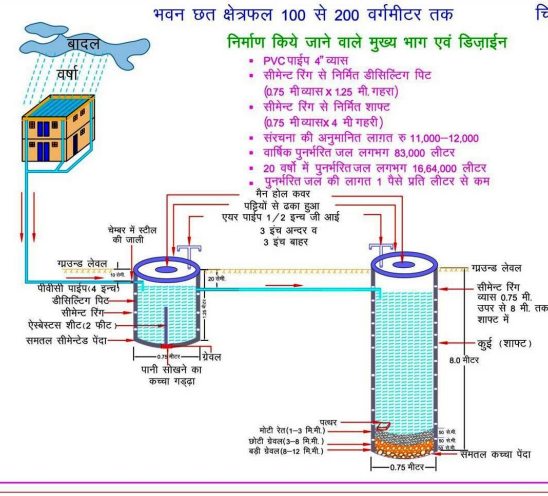


चित्र–2

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 लाग़त रु 11,000–12,000
- वार्षिक पुनर्भरित जल लगभग 83,000 लीटर
- 20 वर्षो में पुनर्भरित जल लगभग 16,64,000 लीटर
- पुनर्भरित जल की लागत 1 पैसे प्रति लीटर से कम

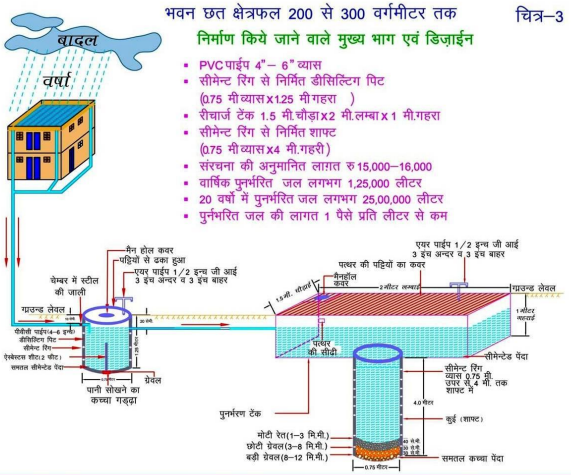


चित्र–3

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 टेंक 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 लाग़त रु 15,000–16,000
- वार्षिक पुनर्भरित जल लगभग 1,25,000 लीटर
- 20 वर्षो में पुनर्भरित जल लगभग 25,00,000 लीटर
- पुनर्भरित जल की लागत 1 पैसे प्रति लीटर से कम

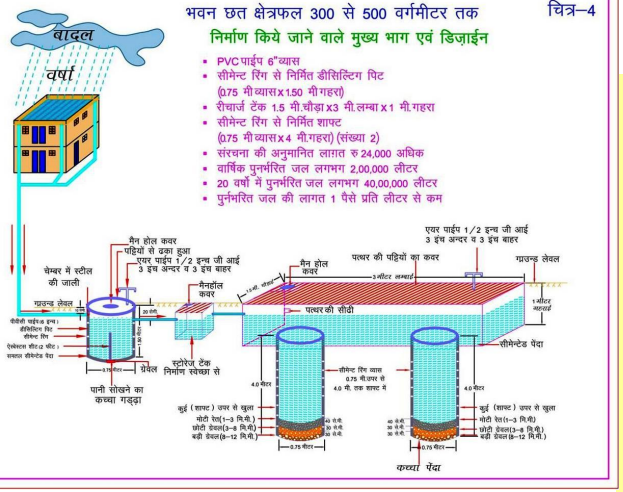


चित्र–4

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 टेंक 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 लाग़त रु 24,000 अधिक
- वार्षिक पुनर्भरित जल लगभग 2,00,000 लीटर
- 20 वर्षो में पुनर्भरित जल लगभग 40,00,000 लीटर
- पुनर्भरित जल की लागत 1 पैसे प्रति लीटर से कम



Rolta India Limited

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

ROLTA

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