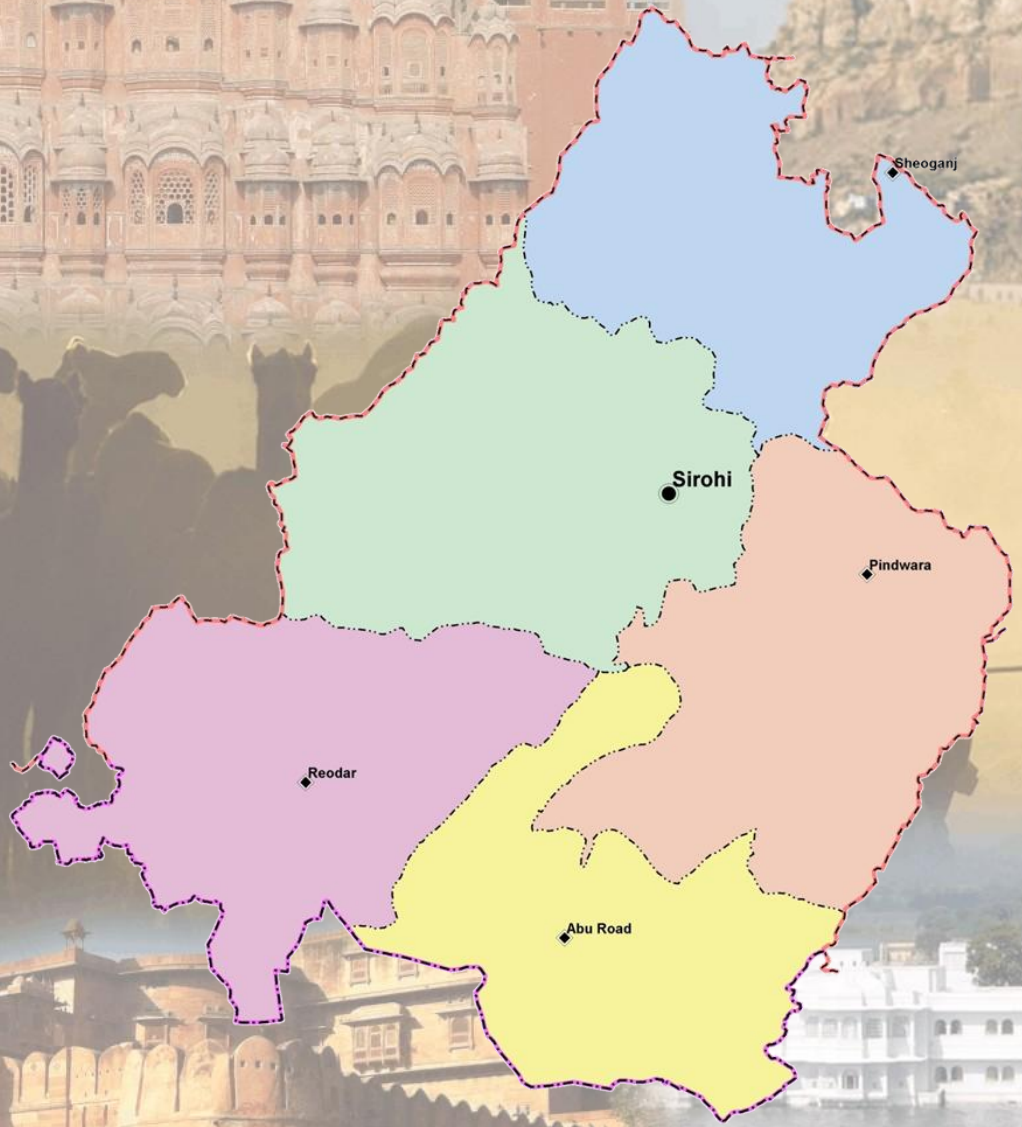
Ground Water Department,
Rajasthan

Hydrogeological Atlas of Rajasthan

Sirohi District

European Union
State Partnership Programme



2013

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Hydrogeological Atlas of Rajasthan

Sirohi District

Contents:

2013

ADMINISTRATIVE SETUP

DISTRICT – SIROHI

Location:

Sirohidistrict is located in the southern part of Rajasthan. It is bounded in the north by Pali district, in the east by Udaipur district, south by state of Gujarat and the western boundary is shared with Jalor district. It stretches between 24° 19' 34.72" to 25° 17' 21.54" north latitude and 72° 13' 52.86'' to 73° 10' 44.57'' east longitude covering area of 5,139.1 sq km. The district has well developed drainage system, as three major river basins constitute parts of the district, viz. 'Luni River Basin' occupies more than one third area of the district and drains the northwestern part, the 'West Banas River Basin' is next most important river in the basin and drains the southeastern part of the district and 'Sukli River Basin' occupies southwestern part. Apart from these three, 'Other Nallhas' and 'Sabarmati River Basin' also form small parts of the district.

Administrative Set-up:

Sirohi district is administratively divided into 5 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	Abu Road	1,84,307	911.0	17.7	83
2	Pindwara	2,05,568	1,096.0	21.3	101
3	Reodar	1,75,344	1,084.0	21.1	126
4	Sheoganj	1,24,452	897.5	17.5	71
5	Sirohi	1,61,133	1,150.6	22.4	86
Total		**8,50,804**	**5,139.1**	**100.0**	**467**

Sirohi district has 467 towns and villages, of which five are block headquarters as well.

Climate:

The district is located on the eastern edge of semi-arid part of Rajasthan and therefore, the climate varies between dry and partially sub-humid.Maximum average temperature in this district is around 47 °C during summer months of March to June and minimum average temperature is 23 °C in winters. The temperature during winter season drops significantly to the range of 3-5 °C. The district experienced draughts of Pindwara (2000) and Reodar (1987). The monsoon season brings fairly good rains as indicated by the average annual rainfall of 741.1mm in the district.

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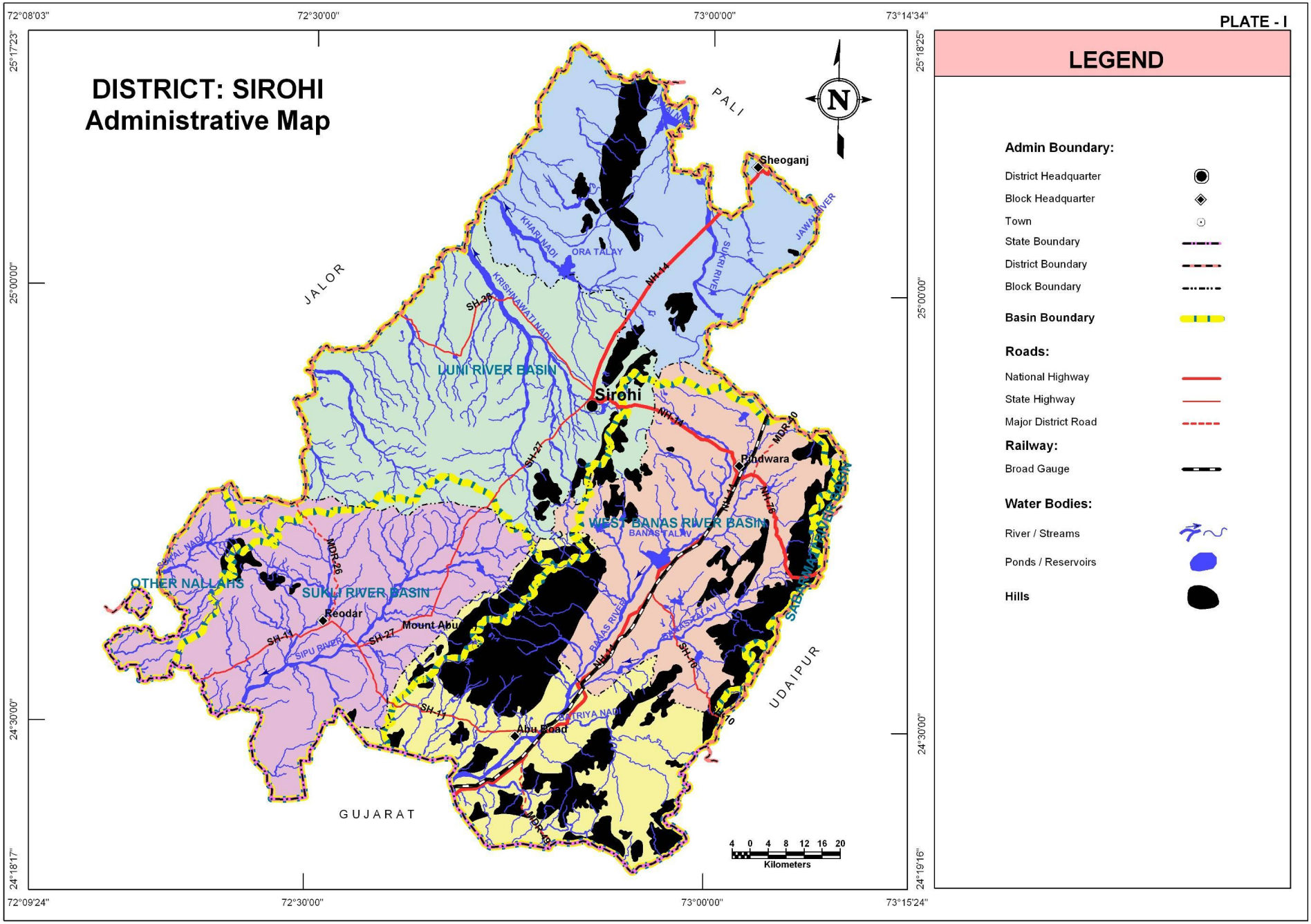
PLATE - I



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

Hills

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TOPOGRAPHY

DISTRICT – SIROHI

The district is characterized by undulating topography in the west and hilly in the northern, central and eastern parts of the district. Abu-Sirohi hill ranges divide the district in two parts. The highest elevation in the district is 1,689 m in Abu Road block. The main rivers of the district are Jawai, Sukri, Banas and Sipu, Rivers along with their tributaries creates well develop drainage system in the district. Excluding hilly areas, the general topographic elevation in the district ranges between 250 m to 500 m above mean sea level. Elevation ranges from a minimum of 184.0 m above mean sea level in Sheoganj block in the NE part of the district to a maximum of 1,689 m above mean sea level In Abu Road in southern part of the district.

Table: Block wise minimum and maximum elevation

S. No.	Block Name	Minimum Elevation (m amsl)	Maximum Elevation (m amsl)
1	Abu Road	217.5	1,689.0
2	Pindwara	274.6	1,440.6
3	Reodar	191.2	1,046.8
4	Sheoganj	184.0	799.1
5	Sirohi	190.5	805.6

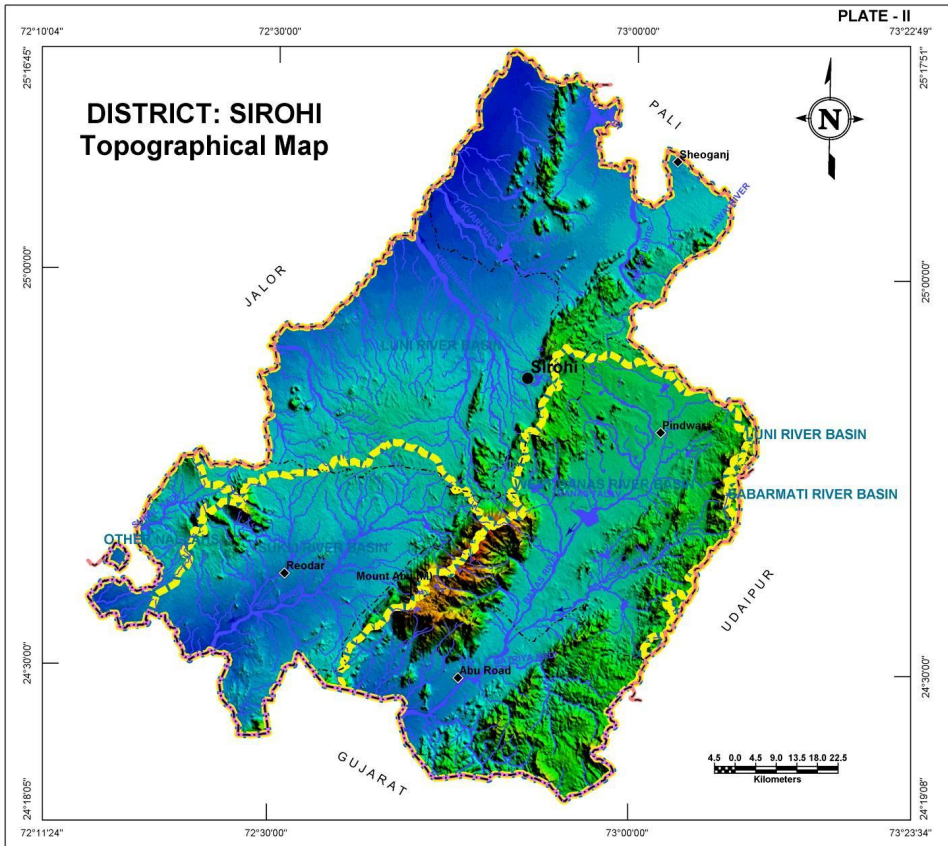
RAINFALL

The general distribution of rainfall across the district can be visualized from isohyets presented in the Plate – III. The rainfall is high in the central part of the district around the hills and decrease northwards and southwards from here. The general range of rainfall received in the year 2010 is from 900mm to more than 1000 mm across the district. The annual average rainfall is 933.7 mm based on the data of available blocks. Highest annual rainfall was noticed in Pindwara block (1,568.7 mm) whereas lowest was in Sheoganj block (569.3 mm). The highest average annual rainfall was noticed in Reodar block (1,059.7 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)
Abu Road	769.7	1,650.3	1,009.8
Pindwara	779.1	1,568.7	1,016.1
Reodar	894.1	1,489.1	1,059.7
Sheoganj	569.3	807.0	662.9
Sirohi	682.0	1,234.7	920.0

PLATE - II



LEGEND

Admin Boundary:

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

Basin Boundary

Water Bodies:

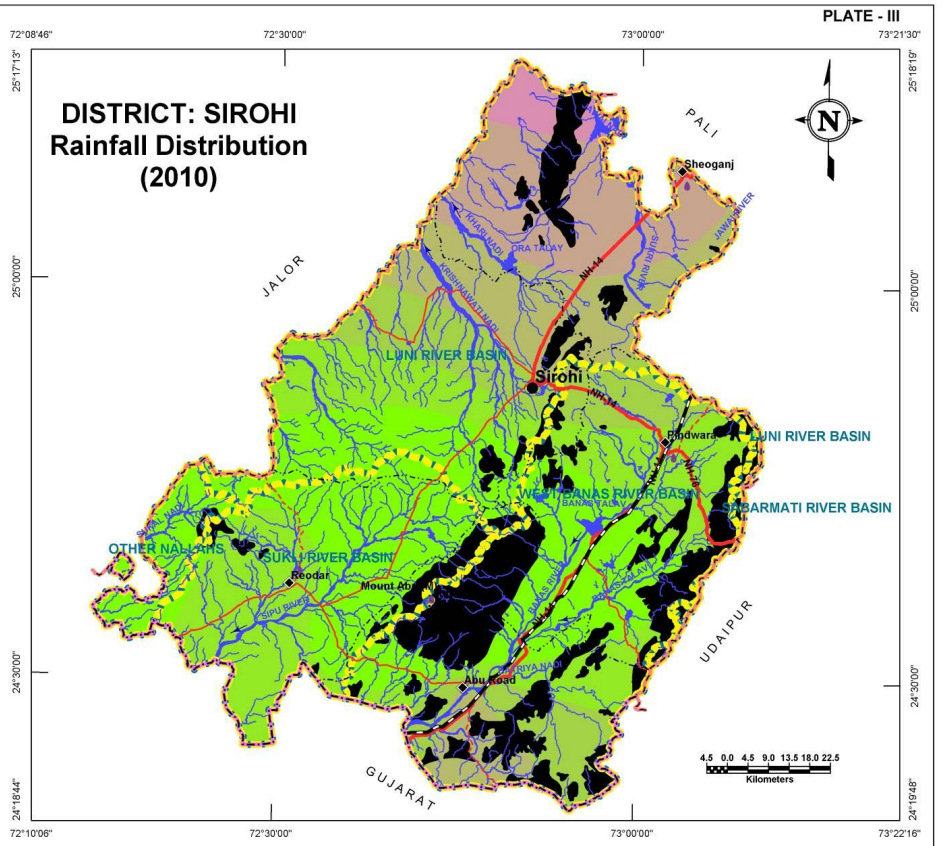
- River / Streams
- Ponds / Reservoirs

Elevation (m amsl):

1,691 – 1,500 – 1,250 – 1,000 – 750 – 500 – 250

Source : STRM DEM

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
- Metre Gauge

Water Bodies:

- River / Streams
- Ponds / Reservoirs

Hills

Isohyets (mm):

- 500-600
- 600-700
- 700-800
- 800-900
- 900-1000
- > 1000

GEOLOGY

DISTRICT – SIROHI

Alluvium and Wind-blown sand coverssome areas in the northwest and southwestern part of the district. Sirohi Group is a part of Vindhyan Super Group which consist Quartzite, schist and marble. Sirohi Group exposed from north to southwest covering Sheoganj, Sirohi, Pindwara, and Reodar blocks of the district. The Delhi Super Group is divided into Kumbhalgarh, Senderth Ambaji, Phulad Ophiolite Suite and Ryanhala Group. Delhi Super Group consists of arkose, granite, gneiss, amphibolites, conglomerate and quartzite rock formation which are exposed in the eastern and southeastern parts of the district.

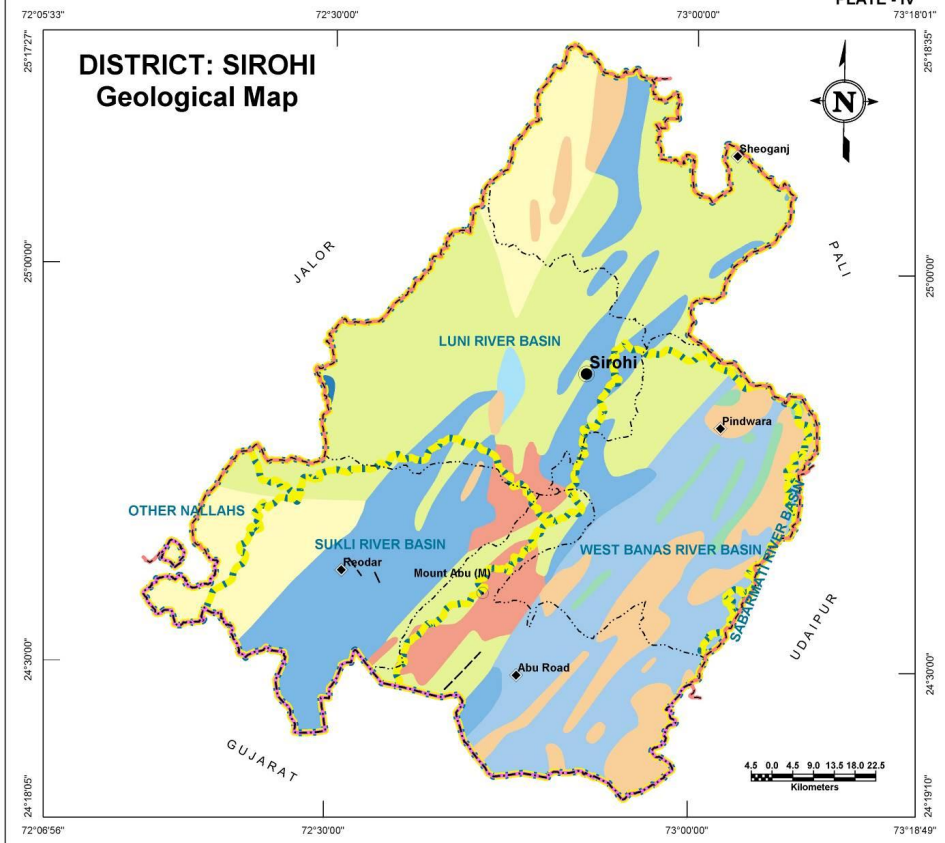
Super Group	Group	Formation
	Recent to Sub-Recent	Alluvium &Wind-blown sand
	Malani Igneous Suite	Dyke, Granites
	Erinpura Granite & Gneiss	Grey and Pink Granites, Granitic Gneisses
	Sindreth	Mafic and Felsic volcanics, conglomerate, quartzite
Vindhyan	Sirohi	Carbonaceous phyllite, quartzite, schists, marble.
Delhi	Ajabgarh/Kumbhalgarh	Arkose, marble, metabasalt, metapelite, metagreywacke
	SendrAmbaji Granite & Gneiss	Granite & Gneiss
	PhuladOphiolite Suite	Hornblends schist, amphibolite, pyroxene granulite, gabbro &ultramafics.
	Ryanhala	Conglomerate, Quartzite

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.
	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.
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

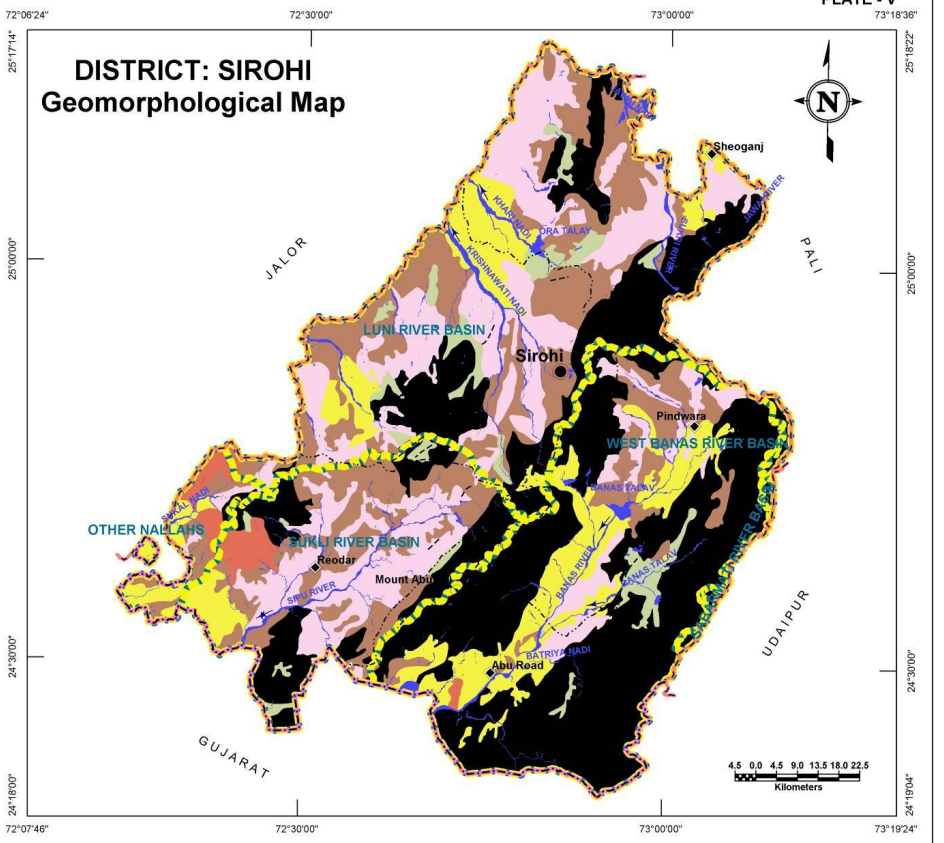
Admin Boundary:
- District Headquarter
- Block Headquarter
- Town
- State Boundary
- District Boundary
- Block Boundary
- **Basin Boundary**

Structural Features:
- Fault

Geology:
- Alluvium and Wind blown sand
- Sindreth Group
- Sirohi Group
- Kumbhalgarh Group
- Mundwara Alkaline Complex
- Malani Plutonic
- Volcanic Suite
- Erinpura Granite & Gneiss
- Sendra-Ambaji Granite & Gneiss
- Phulad Ophiolite Suite

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
- Valley Fill
- Ravine

Denudational Origin:
- Pediment
- Burried Pediment

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

AQUIFERS

DISTRICT – JODHPUR

Alluvial aquifers occupy about 20% of the district area and prominent in northwest and southwestern parts of the district. Apart from this, the weathered, fractured and jointed openings in hardrocks also constitute good aquifers in the district as the granite aquifers occupy very large areas and occur as NE-SW trending wide belts in western, central and eastern parts. The other two hardrock aquifers are phyllite and schist appearing in the west and east of central hilly ridge line.

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	1,022.2	19.9	It is largely constituted of Aeolian and Fluvial sand, silt, clay, gravel and pebbles in varying proportions.
Phyllite	841.2	16.4	These include meta sediments and represented by carbonaceous phyllite.
Schist	616.7	12.0	Medium to fine grained compact rock. The litho-units are soft, friable and have closely spaced cleavage.
Granite	1,855.9	36.1	Light grey to pink colour, medium to coarse grained, and characteristically have porphyritic texture.
Hills	803.1	15.6	
Total	**5,139.1**	**100.0**	

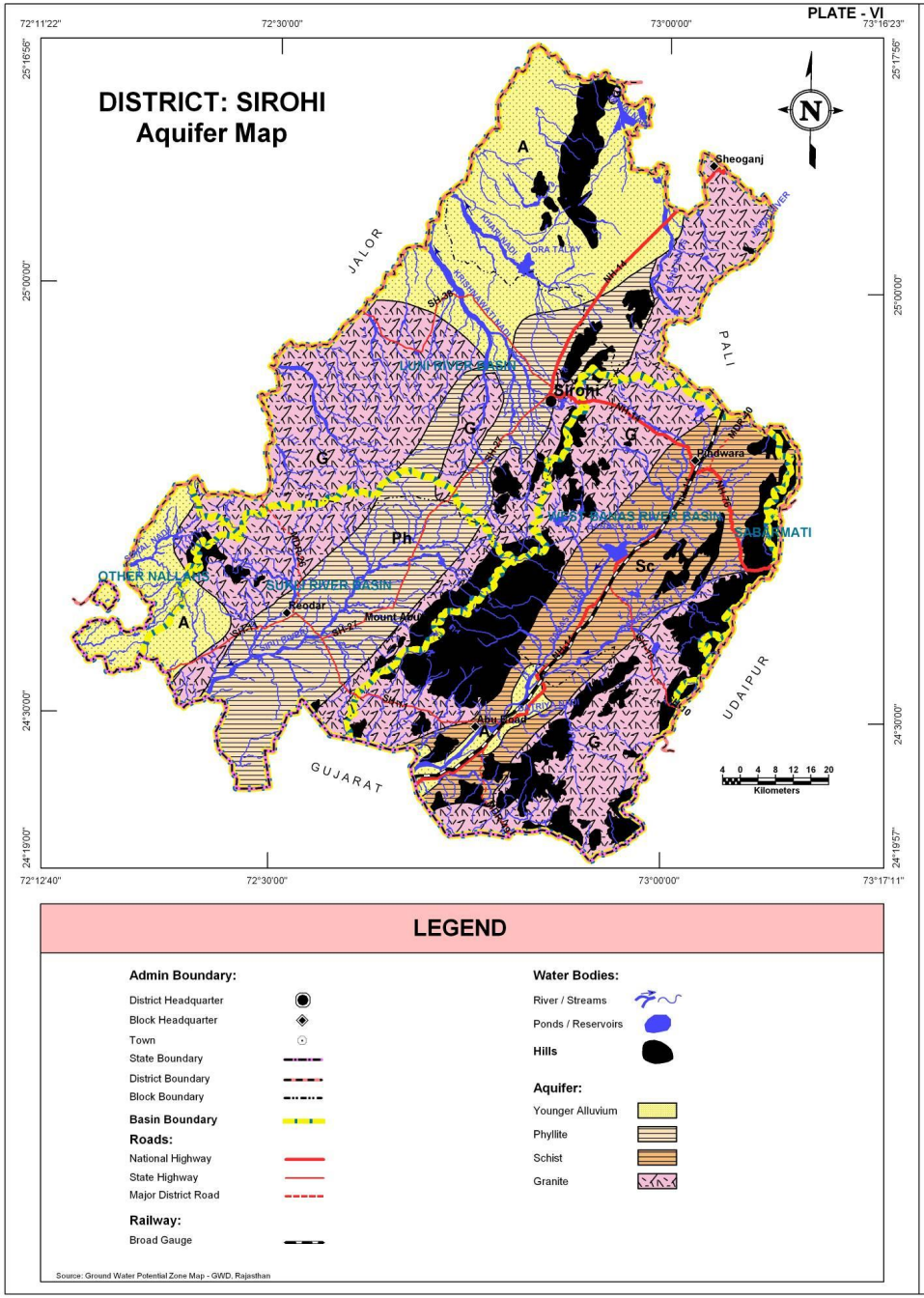
STAGE OF GROUND WATER DEVELOPMENT

Ground water resource assessment in the district has revealed a scarce availability of the same. In all the blocks of the district the stage of development has exceeded existing dynamic resources since two of the blocks are in 'Critical stage' implying close to 100% development and the other three blocks are in 'Over Exploited' category which means already exhausted state of ground water.

Categorization on the basis of stage of development of GW	Block Name
Critical	Pindwara,Abu Road
Over Exploited	Reodar,Sheoganj,Sirohi

Basis for categorization: Ground water development <=100% - 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

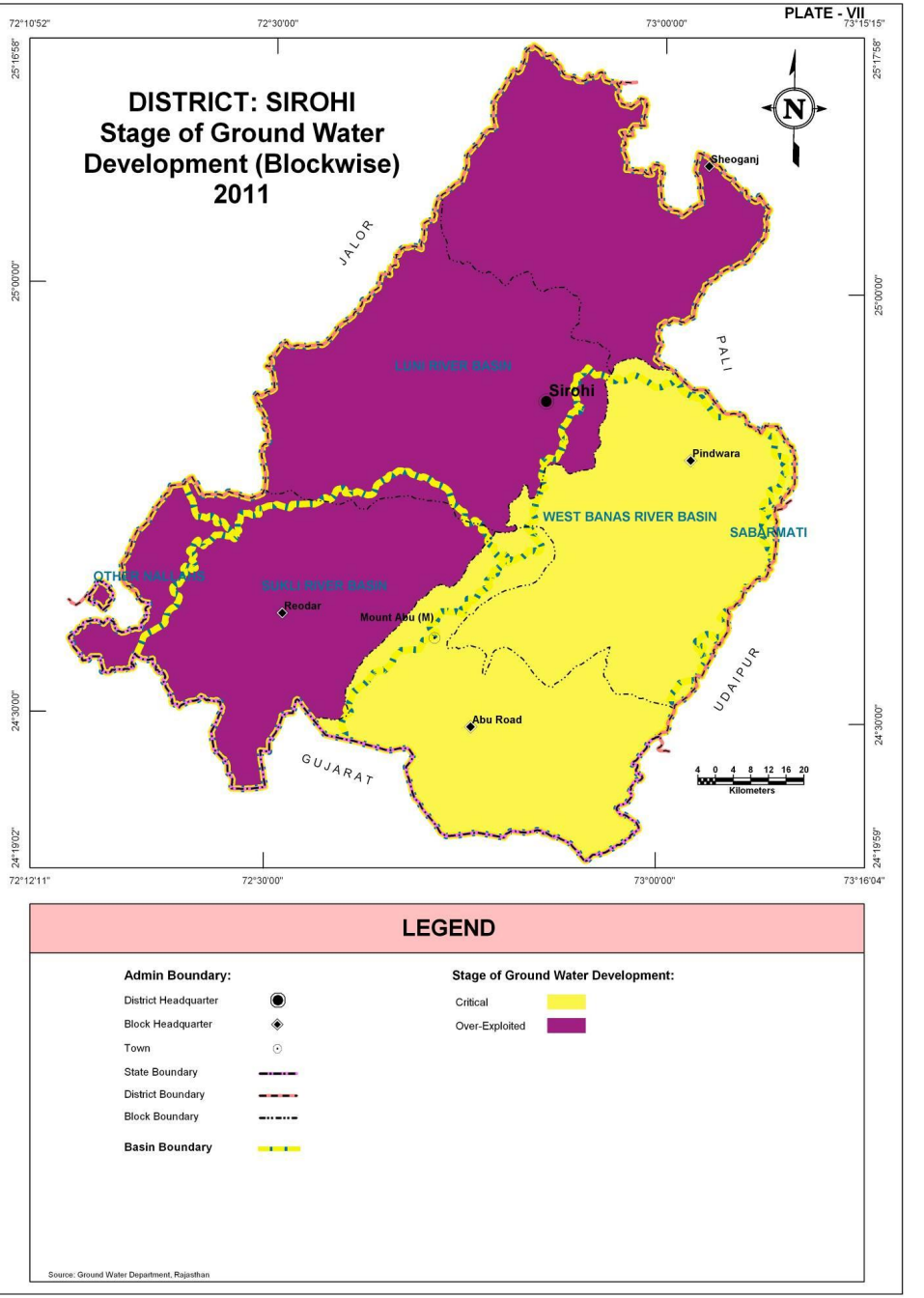
Railway:
- Broad Gauge

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

Aquifer:
- Younger Alluvium
- Phyllite
- Schist
- Granite

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:
- Critical
- Over-Exploited

Source: Ground Water Department, Rajasthan

LOCATION OF EXPLORATORY AND GROUND WATER MONITORING WELLS DISTRICT – SIROHI

Sirohidistrict has a well distributed network of exploratory wells (142) and ground water monitoring stations (253) in the district owned by RGWD (123 and 253 respectively) and incidentally, CGWB has 19 exploratory wells in the district but no monitoring wells . 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 is being sufficiently monitored but for effectively monitoring the water quality in the district,3 additional wells mustbe added to the network in Reodar and Sheoganj 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
Abu Road	11	18	**29**	-	45	**45**	0	0
Pindwara	6	17	**23**	-	50	**50**	0	0
Reodar	1	39	**40**	-	55	**55**	0	2
Sheoganj	1	16	**17**	-	45	**45**	0	1
Sirohi	-	33	**33**	-	58	**58**	0	0
Total	**19**	**123**	**142**	**-**	**253**	**253**	**0**	**3**

DEPTH TO WATER LEVEL (PRE MONSOON – 2010)

Depth to water level shows variation ranging from less than 10m below ground level to more than 40m bgl. In most of the alluvial part of Sheoganj and Sirohi blocks, the ground water occurs at moderate depths ranging from 20 – 40m bgland sometimes reaching to >40m bgl. There is also a shallow water depth to water zone in southern part of Abu Road and Reodar blocks where the depth to water level is less than 10m bgl. Otherwise the ground water generally, occurs at 10-30m below ground level.

Depth to water level (mbgl)	Block wise area coverage (sq km) *					Total Area (sqkm)
	Abu Road	Pindwara	Reodar	Sheoganj	Sirohi	
< 10	37.1	-	0.7	-	-	**37.8**
10-20	490.2	626.1	275.6	47.0	557.5	**1,996.4**
20-30	40.3	191.2	771.6	408.2	440.3	**1,851.6**
30-40	-	-	14.0	273.3	92.4	**379.7**
> 40	-	-	-	66.3	4.1	**70.4**
Total	**567.6**	**817.3**	**1,061.9**	**794.8**	**1,094.3**	**4,335.9**

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

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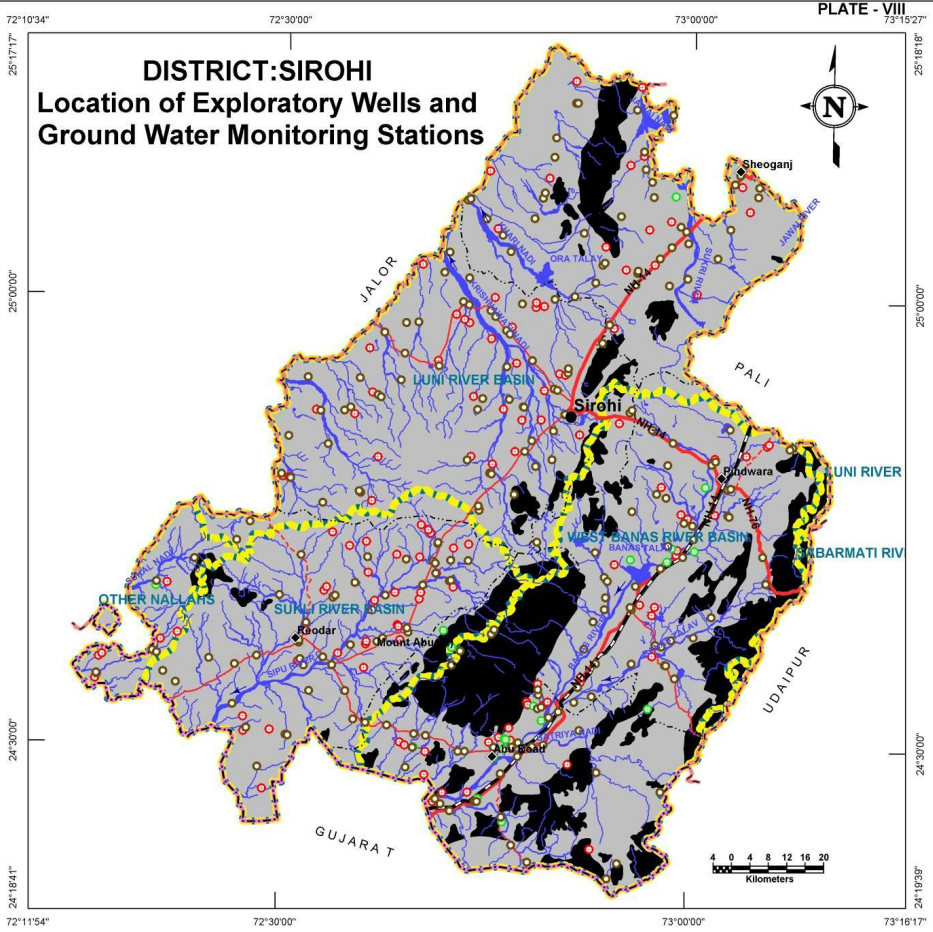
PLATE - VIII



LEGEND

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

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

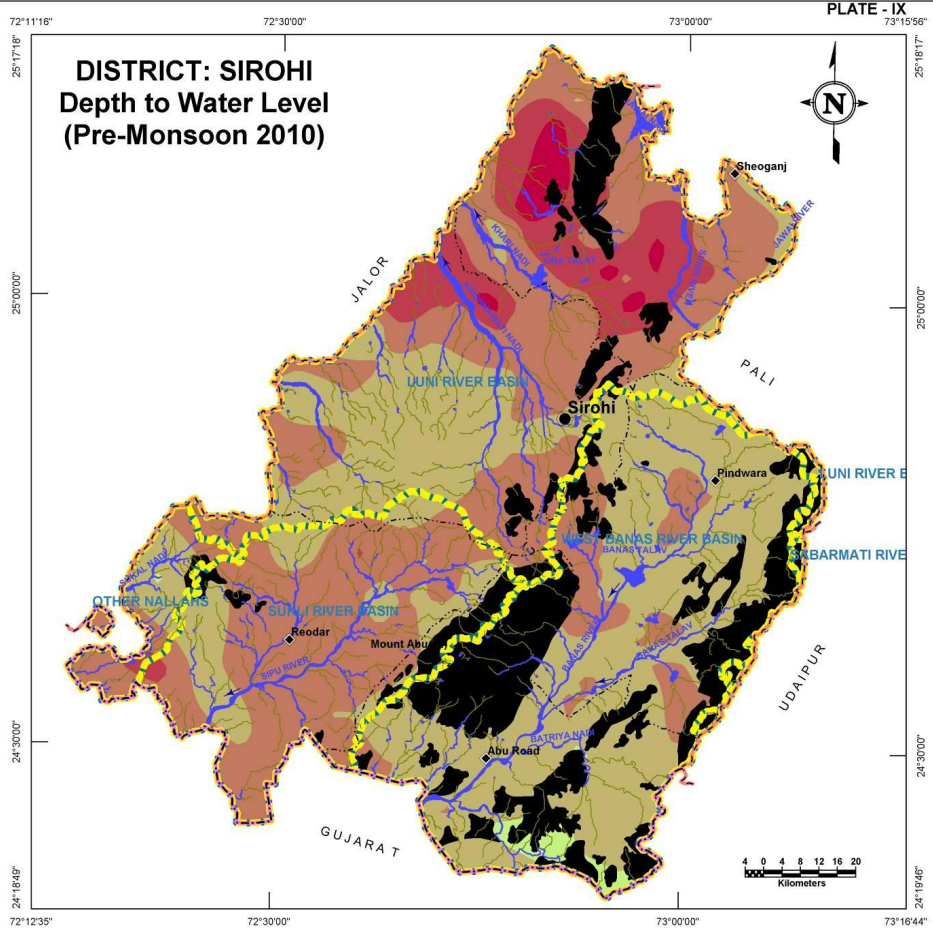
Railway:
- Broad Gauge
- Metre Gauge

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

Exploratory Wells:
- CGWB
- RGWD

Ground Water Monitoring Stations:
- CGWB
- RGWD

PLATE - IX



LEGEND

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

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

Water table elevation map is presented in Plate – X. It not only shows distribution of water table elevations but also reveals the regional ground water flow directions. The regional ground water flow typically follows the topography and the flow directions of the main streams of the basins i.e., NE-SW in the West Banas and Sukli River basin parts; SE-NW in Luni River basin area.The highest water table elevation is more than400m amsl in east of Pindwara block and lowest elevation of less than 180m amsl in the Sheoganj and Sirohi blocks implying an overall 220m of elevation difference in different parts of the district. Flow gradients are steep in eastern part adjacent to hilly areas but more sluggish in northwestern and southwestern parts of the district.

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

Block Name	Block wise area coverage (sq km) within water table elevation range (m amsl)													Total Area (sq km)
	< 180	180 - 200	200 - 220	220 - 240	240 - 260	260 - 280	280 - 300	300 - 320	320 - 340	340 - 360	360 - 380	380 - 400	> 400	
Abu Road	-	-	50.8	138.4	72.4	62.5	35.9	27.2	32.0	31.1	29.5	38.1	49.7	**567.6**
Pindwara	-	-	-	-	6.4	44.0	112.4	85.5	153.2	134.9	144.4	87.4	49.1	**817.3**
Reodar	-	51.2	165.8	273.7	215.2	248.7	92.2	13.1	2.0	-	-	-	-	**1,061.9**
Sheoganj	76.9	158.4	119.7	146.4	96.6	88.0	58.9	25.9	14.6	9.1	0.3	-	-	**794.8**
Sirohi	15.4	42.8	100.4	180.5	197.4	177.3	238.9	64.5	33.0	20.3	14.0	7.4	2.4	**1,094.3**
Total	**92.3**	**252.4**	**436.7**	**739.0**	**588.0**	**620.5**	**538.3**	**216.2**	**234.8**	**195.4**	**188.2**	**132.9**	**101.2**	**4,335.9**

WATER LEVEL FLUCTUATION (PRE TO POST MONSOON 2010)

A 2m contour interval adopted to visualize the ground water level fluctuation reveals a fall of around 2 m in one area to rise in other areas by about 18m, as seen in Plate – XI. The negative fluctuation areas are very limited and occupy just about 8 sqkms in the western part of the Reodar block. Rest of the district has shown a general to significant rise in ground water level in the post monsoon season with respect to pre monsoon season. While the general rise has been in the 0m to about 12m range, the maximum rise of more than 18m is also noticed in central part of Pindwara block.

Table: Block wise area covered in each water fluctuation zone

Block Name	Block wise area coverage (sq km) within water level fluctuation range (m)											Total Area (sq km)
	<0	0 – 2	2 – 4	4 – 6	6 – 8	8 – 10	10 – 12	12 – 14	14 – 16	16 – 18	>18	
Abu Road	-	3.6	171.8	220.8	113.9	36.4	9.3	2.8	7.2	1.8	-	**567.6**
Pindwara	-	5.0	40.2	111.1	115.4	302.1	107.1	64.8	41.7	24.8	5.1	**817.3**
Reodar	8.0	158.8	139.7	155.8	210.5	310.4	49.8	18.0	10.8	0.1	-	**1,061.9**
Sheoganj	-	75.6	145.9	245.7	182.0	95.5	35.0	15.1	-	-	-	**794.8**
Sirohi	-	12.4	56.3	121.1	449.1	322.7	57.3	47.4	18.0	9.9	0.1	**1,094.3**
Total	**8.0**	**255.4**	**553.9**	**854.5**	**1,070.9**	**1,067.1**	**258.5**	**148.1**	**77.7**	**36.6**	**5.2**	**4,335.9**

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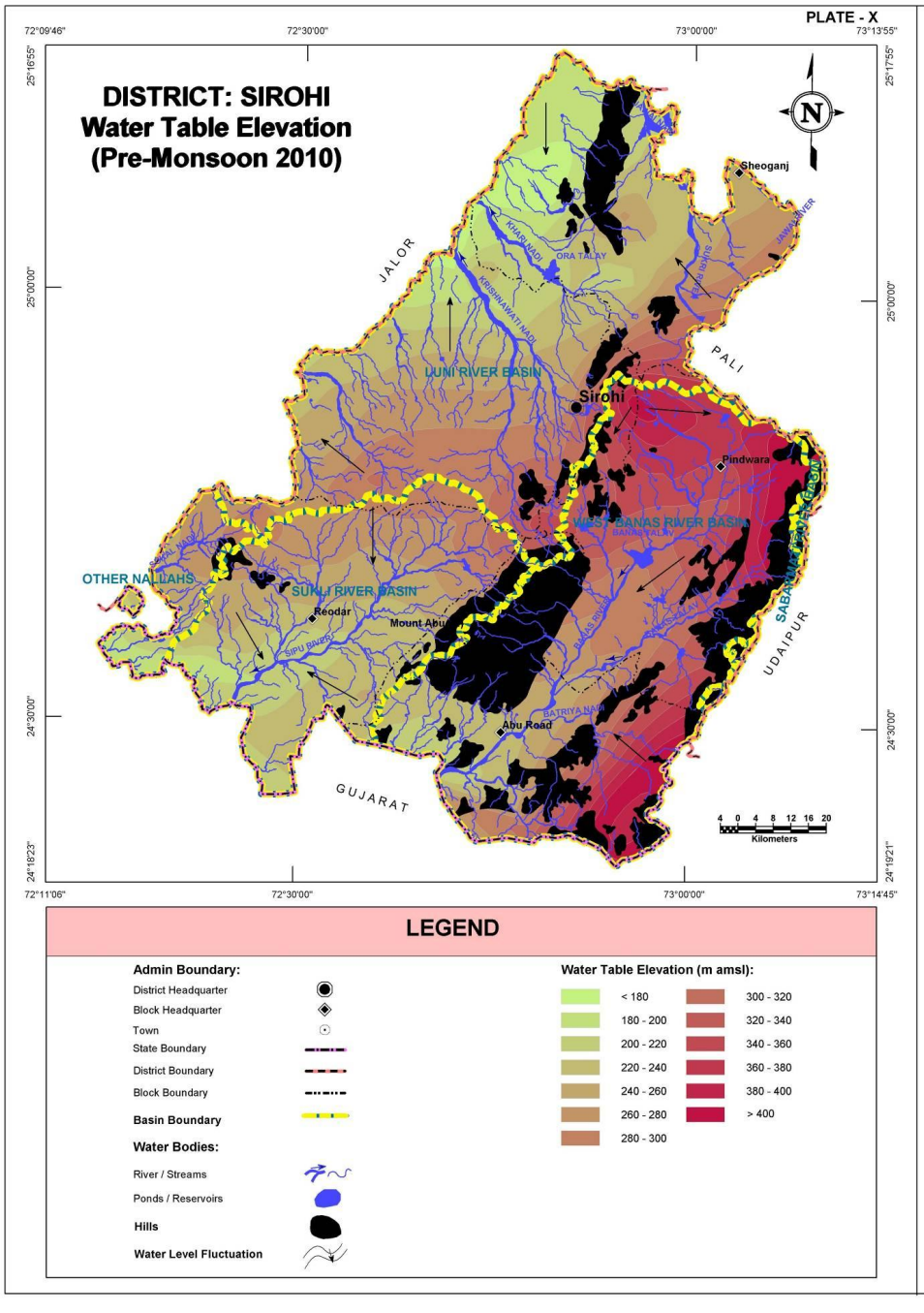
PLATE - X



LEGEND

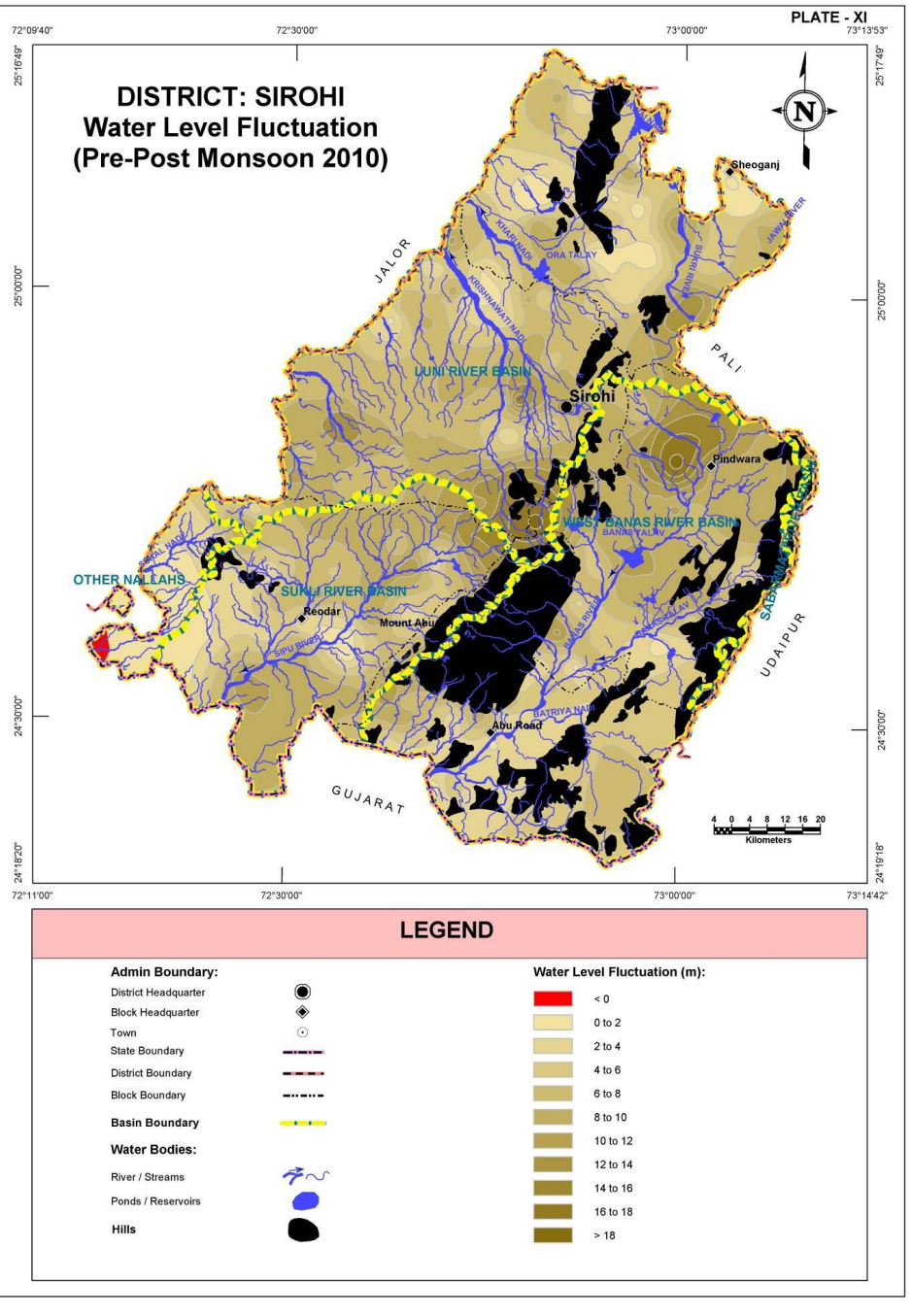
Admin Boundary:
- District Headquarter
- Block Headquarter
- Town
- State Boundary
- District Boundary
- Block Boundary
- **Basin Boundary**

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

Water Table Elevation (m amsl):

< 180	300 - 320
180 - 200	320 - 340
200 - 220	340 - 360
220 - 240	360 - 380
240 - 260	380 - 400
260 - 280	> 400
280 - 300	

PLATE - XI



LEGEND

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

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

Water Level Fluctuation (m):
- < 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

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GROUND WATER ELECTRICAL CONDUCTIVITY DISTRIBUTION — DISTRICT – SIROHI

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 which occupy almost 62% of the district area ishaving ground water suitable for domestic purpose. The areas with moderately high EC values (2000-4000 µS/cm) are shown in green color and occupy 33% of the district area, largely northern and western part of Sirohi. Remaining part of the district area approximately 5% has high EC values in ground water (>4000 µS/cm) which is shown in red color, largely in the northern and western part of the district where the ground water is not suitable for domestic purpose.

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)
	Abu Road		Pindwara		Reodar		Sheoganj		Sirohi		
	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	
<2000	460.9	81.2	535.8	65.6	964.9	90.9	189.7	23.9	536.4	49.0	**2,687.7**
2000-4000	105.3	18.6	274.7	33.6	95.7	9.0	436.4	54.9	506.9	46.3	**1,419.0**
>4000	1.4	0.2	6.8	0.8	1.3	0.1	168.7	21.2	51.0	4.7	**229.2**
Total	**567.6**	**100.0**	**817.3**	**100.0**	**1,061.9**	**100.0**	**794.8**	**100.0**	**1,094.3**	**100.0**	**4,335.9**

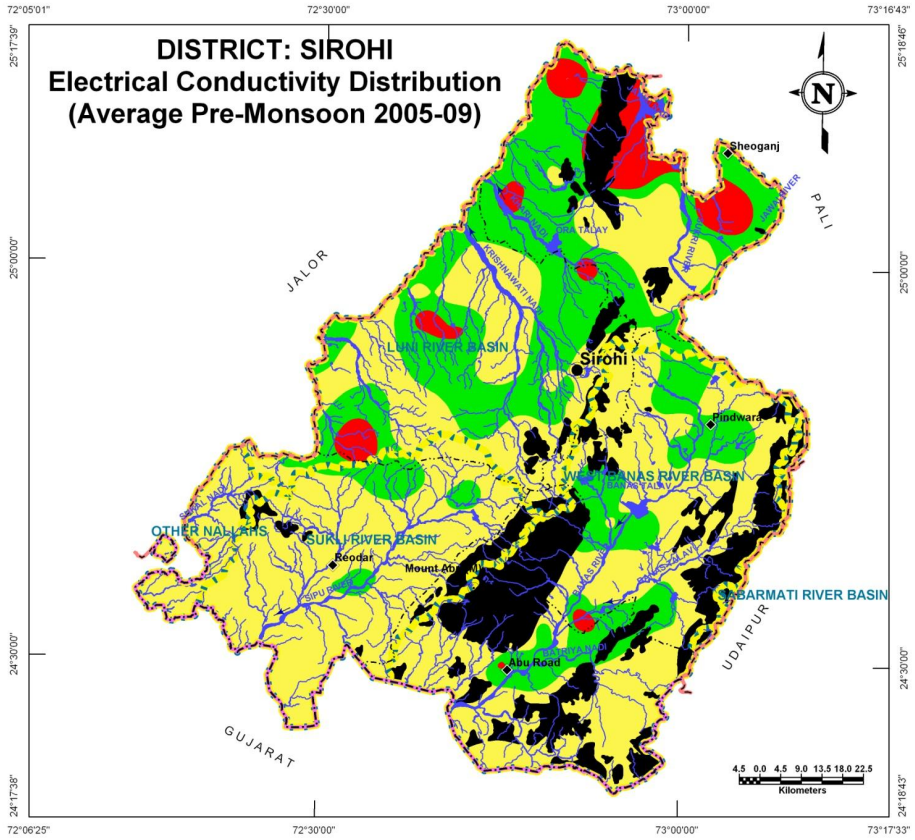
GROUND WATER CHLORIDE DISTRIBUTION

High chloride concentration in ground water also renders it unsuitable for domestic and other purposes. The green colored regions in Plate – XIII are such areas where chloride concentration is moderately high (250-1000 mg/l) occupies approximately 56% of the district area. The ground water in this region is suitable for domestic purpose in absence of better quality ground water. The areas with low chloride concentration (<250 mg/l) are shown in yellow color which occupy approximately 40% of the district area, which is suitable for domestic purpose. Remaining part of the district (approximately 4%) has high chloride concentration (>1000 mg/l), which is shown in red color, largely northern part of the district where the ground water is not suitable for domestic purpose.

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)
	Abu Road		Pindwara		Reodar		Sheoganj		Sirohi		
	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	
< 250	396.2	70.0	271.4	33.3	729.8	69.0	104.4	13.0	218.7	20.0	**1,720.5**
250-1000	171.0	30.0	543.1	66.7	329.9	31.0	563.0	71.0	834.0	76.0	**2,441.0**
> 1000	0.4	-	2.8	-	2.2	-	127.4	16.0	41.6	4.0	**174.4**
Total	**567.6**	**100.0**	**817.3**	**100.0**	**1,061.9**	**100.0**	**794.8**	**100.0**	**1,094.3**	**100.0**	**4,335.9**

PLATE - XII



LEGEND

Admin Boundary:

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

Basin Boundary

Water Bodies:

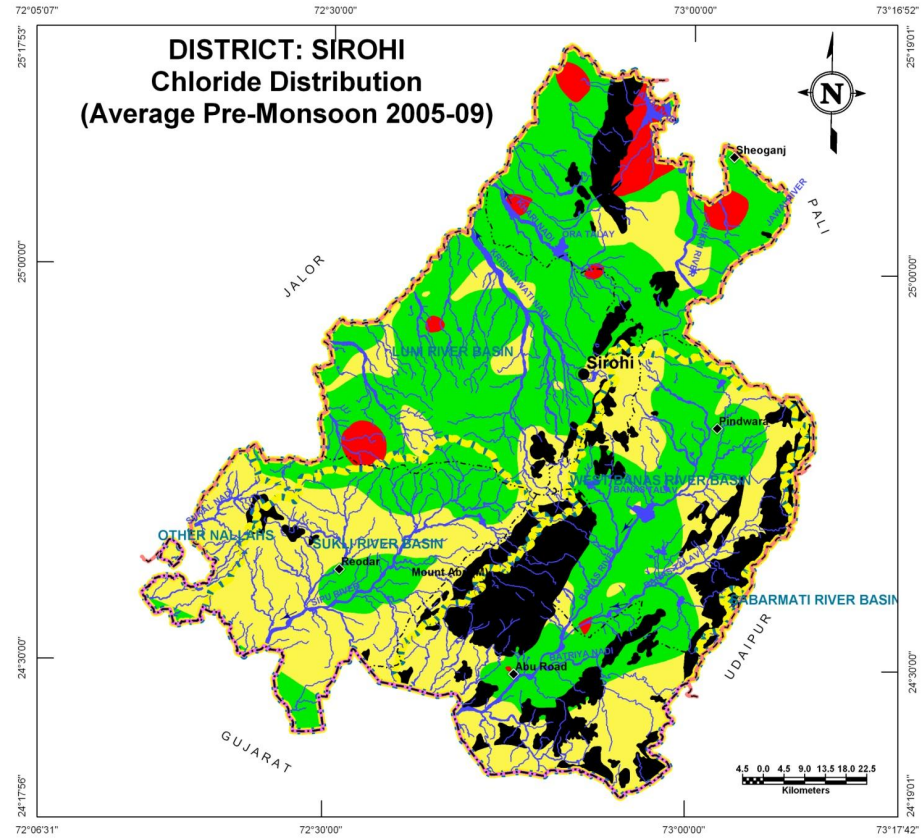
- River / Streams
- Ponds / Reservoirs

Hills

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

- < 2000
- 2000-4000
- >4000

PLATE - XIII



LEGEND

Admin Boundary:

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

Basin Boundary

Water Bodies:

- River / Streams
- Ponds / Reservoirs

Hills

Chloride Concentration (mg/l):

- < 250
- 250 - 1000
- > 1000

GROUND WATER FLUORIDE DISTRIBUTION — DISTRICT – SIROHI

The Fluoride concentration map is presented in Plate – XIV which raises concern on usage of ground water for domestic purpose since on 33% of the district has low fluoride concentration (<1.5 mg/l) in ground water scattered as discontinuous patches in eastern northern and southwestern parts of the district.The area with moderately high concentration (1.5-3.0 mg/l) is shown in green color that occupies almost 45% of the district area. Remaining part of the district (approximately 22%) has high Fluoride concentration (>3.0 mg/l) is shown in red color, largely in the western half of the district where the 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)
	Abu Road		Pindwara		Reodar		Sheoganj		Sirohi		
	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	
< 1.5	329.6	58.0	437.1	53.5	408.3	38.5	230.4	29.0	40.6	3.7	**1,446.0**
1.5-3.0	201.9	35.6	315.0	38.5	459.5	43.2	428.2	53.8	536.4	49.0	**1,941.0**
> 3.0	36.1	6.4	65.2	8.0	194.1	18.3	136.2	17.2	517.3	47.3	**948.9**
Total	**567.6**	**100.0**	**817.3**	**100.0**	**1,061.9**	**100.0**	**794.8**	**100.0**	**1,094.3**	**100.0**	**4,335.9**

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 and occupies approximately 45% 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 33% of the district area. Remaining part of the district area is havingnitrate concentration (>100 mg/l) which as seen in red color patches distributed all over the district where ground water is not suitable for agriculture purpose.

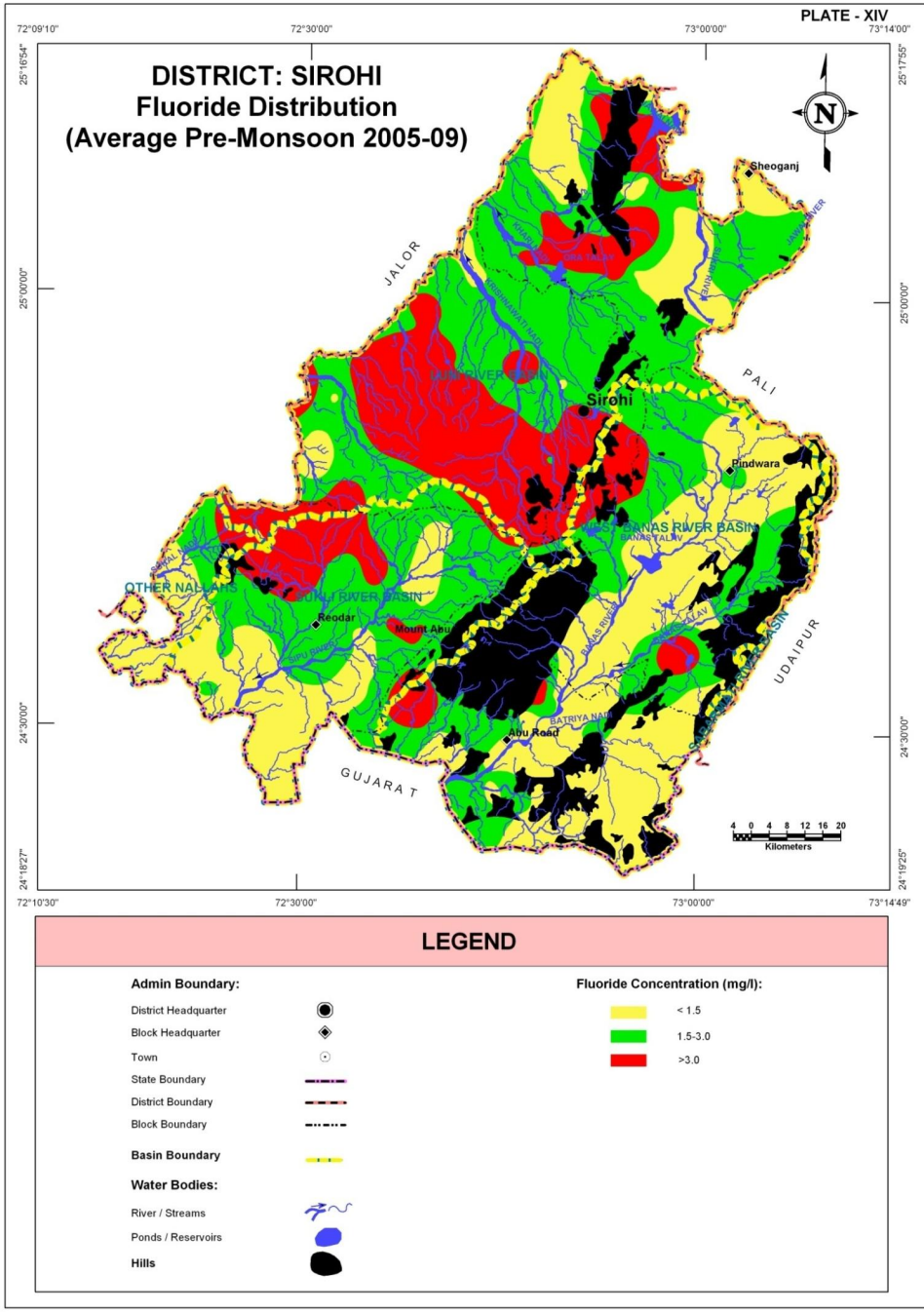
Table: Block wise area of Nitrate distribution

Nitrate concentration Range(mg/l) (Ave. of years 2005-09)	Block wise area coverage (sq km)										Total Area (sq km)
	Abu Road		Pindwara		Reodar		Sheoganj		Sirohi		
	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	
< 50	426.5	75.1	257.2	31.5	590.5	55.6	327.1	41.2	354.9	32.4	**1,956.2**
50-100	129.9	22.9	294.2	36.0	329.3	31.0	236.1	29.7	430.1	39.3	**1,419.6**
>100	11.2	2.0	265.9	32.5	142.1	13.4	231.6	29.1	309.3	28.3	**960.1**
Total	**567.6**	**100.0**	**817.3**	**100.0**	**1,061.9**	**100.0**	**794.8**	**100.0**	**1,094.3**	**100.0**	**4,335.9**

Ground Water Department,
Rajasthan

European Union
State Partnership Programme

PLATE - XIV



LEGEND

Admin Boundary:

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

Basin Boundary

Water Bodies:

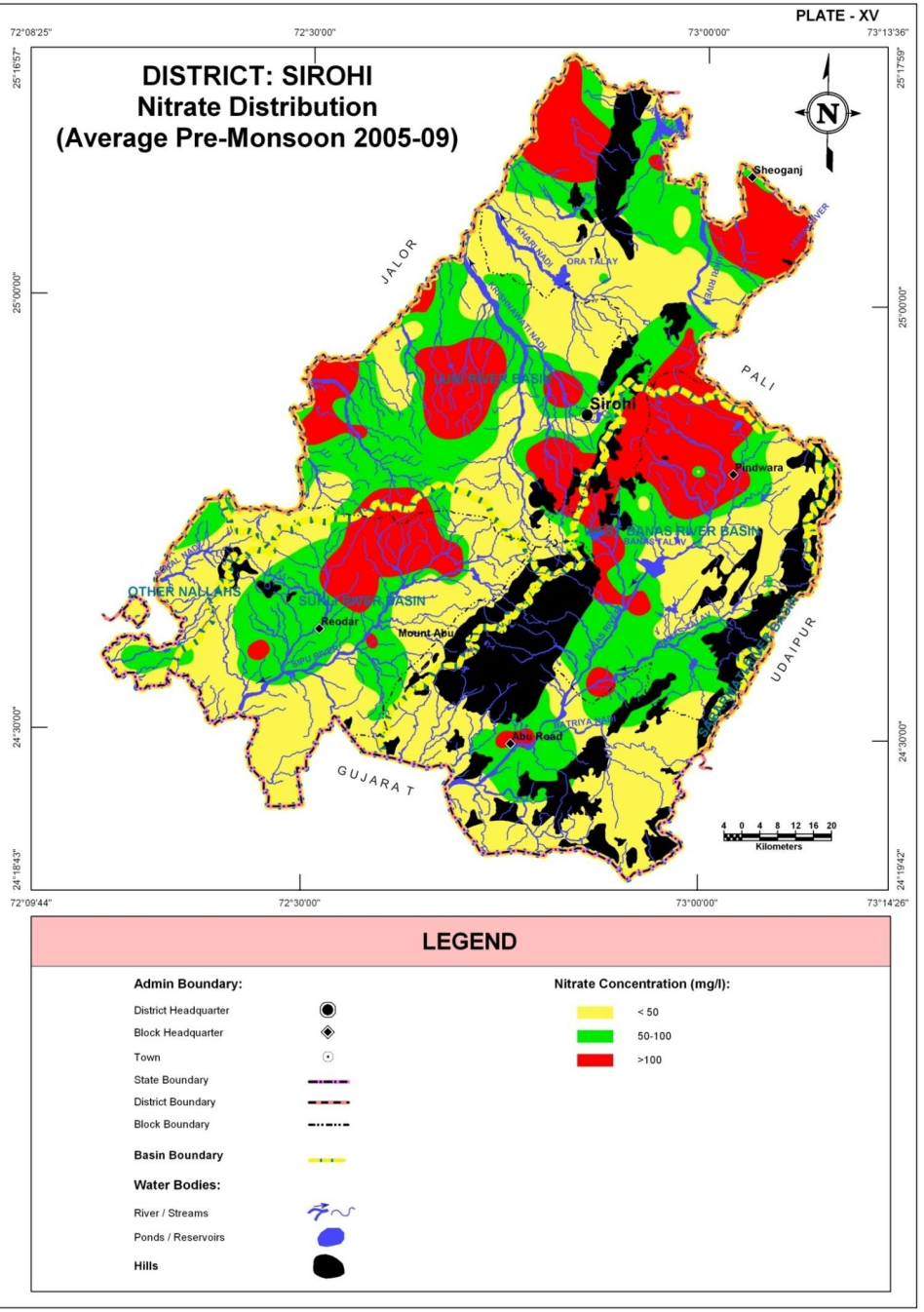
- River / Streams
- Ponds / Reservoirs

Hills

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

Nitrate Concentration (mg/l):

- < 50
- 50-100
- >100

ROLTA
Rolta India Limited

DEPTH TO BEDROCK

DISTRICT – SIROHI

Plate – XVI depicts the bedrock depth below ground level in Sirohi 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 40m bgl. The major rocks types constituting the bedrock in the district are schist, phyllite and granite. 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 reveals that the bedrock surface is relatively flat as the depth distribution shows very limited variation of less than 40m. About 82% of the district has its bedrock occurring in the range of 20 to 40 m bglonly. The region in the eastern part of the district in between the two hill ranges has still less deep bedrock i.e., <20m bgl. A small patch of >40m deep bedrock is seen in the western most part in Reodar block of the district.

Depth to bedrock (mbgl)	Block wise area coverage (sq km)										Total Area (sq km)
	Abu Road		Pindwara		Reodar		Sheoganj		Sirohi		
	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	
< 20	87.4	15.4	519.0	63.5	12.1	1.1	-	-	15.9	1.4	**634.4**
20-40	480.2	84.6	298.3	36.5	894.4	84.2	794.8	100.0	1,078.4	98.6	**3,546.1**
> 40	-	-	-	-	155.4	14.6	-	-	-	-	**155.4**
Total	**567.6**	**100.0**	**817.3**	**100.0**	**1,061.9**	**100.0**	**794.8**	**100.0**	**1,094.3**	**100.0**	**4,335.9**

UNCONFINED AQUIFER

Alluvial areas

Aquifer in alluvial material is formed in northern and southwestern part of the district, with thickness varying from less than 10 meter and reaching upto 40 meter. Most part of Sheoganj block has unconfined aquifer formed in alluvial material with thickness from less than 10 meter and reaching a maximum of 30m at the northeast corner of the block. Alluvial aquifer thickness less than 10m has been observed in northern part of Sirohi block as alsoin Reodar block in (10m to 30m thickness). Small patch of high thicknesses more than 30m found in Abu Road block.

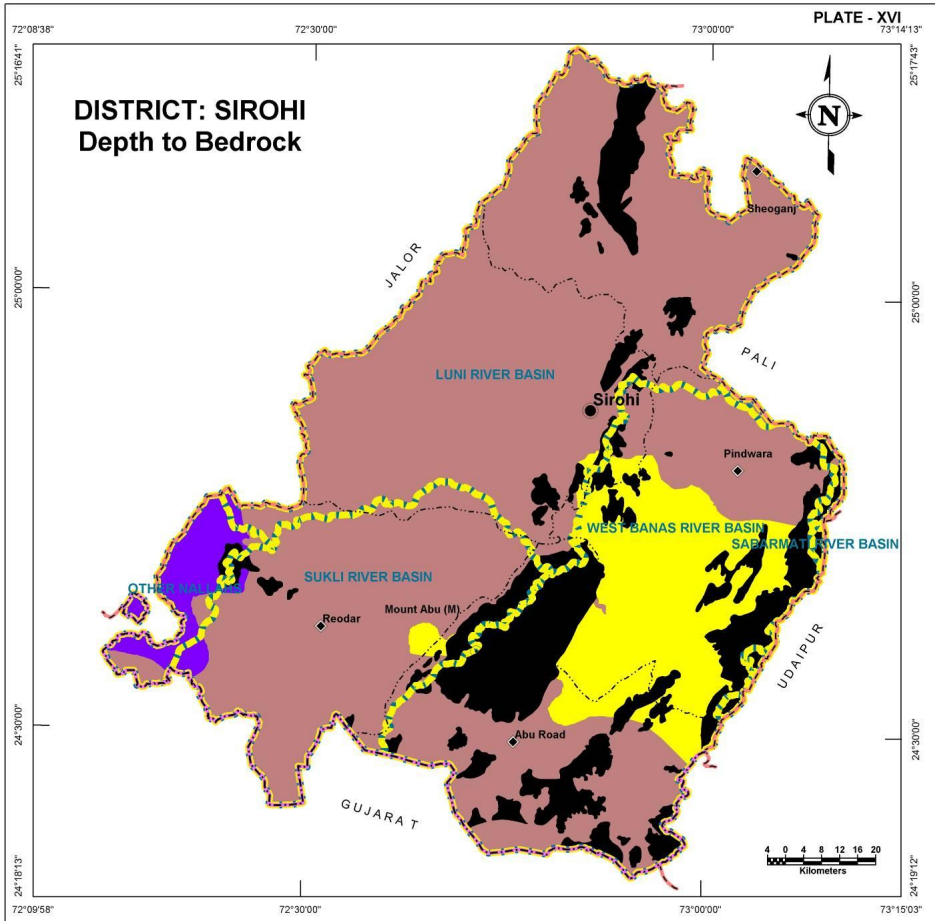
Unconfined aquifer Thickness (m)	Block wise Area (sq km) coverage					Total Area (sq km)
	Abu Road	Pindwara	Reodar	Sheoganj	Sirohi	
< 10	58.8	1.8	168.8	424.4	193.4	**847.2**
10-20	6.6	-	42.2	55.0	-	**103.8**
20-30	2.3	-	3.1	48.7	-	**54.1**
> 30	0.1	-	-	19.8	-	**19.9**
Total	**67.8**	**1.8**	**214.1**	**547.9**	**193.4**	**1,025.0**

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 in Sirohi district ranges in thickness from less than 10m to more than 100m throughout the district except in the northern part. These high thickness zones occur as isolated patches mostly in the eastern part of the district i.e., Pindwara block, where the thickness attained is more than 90m. Rest of the blocks have moderate to low thickness of unconfined aquifers in hardrock. The general thickness in the district is less than 40m.

Unconfined aquifer Thickness (m)	Block wise Area (sq km) coverage					Total Area (sq km)
	Abu Road	Pindwara	Reodar	Sheoganj	Sirohi	
<10	32.8	64.7	368.8	-	196.2	**662.5**
10-20	90.2	275.1	461.3	156.1	234.6	**1,217.3**
20-30	77.0	148.5	17.7	90.8	173.2	**507.2**
30-40	55.5	195.1	-	-	172.7	**423.3**
40-50	75.1	84.1	-	-	110.1	**269.3**
50-60	162.5	35.8	-	-	11.1	**209.4**
60-70	6.7	6.0	-	-	2.7	**15.4**
70-80	-	3.4	-	-	0.3	**3.7**
80-90	-	2.2	-	-	-	**2.2**
> 90	-	0.6	-	-	-	**0.6**
Total	**499.8**	**815.5**	**847.8**	**246.9**	**900.9**	**3,310.9**

PLATE - XVI



LEGEND

Admin Boundary:

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

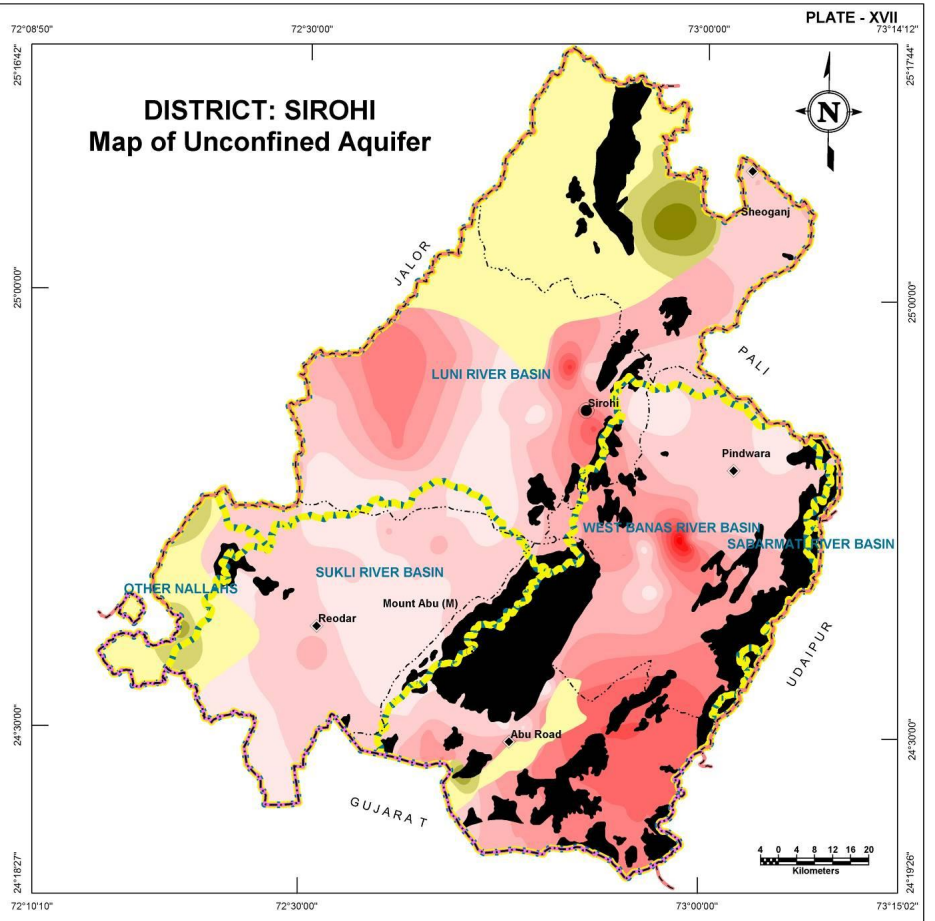
Basin Boundary

Hills

Depth to Bedrock (m bgl):

- <20
- 20-40
- >40

PLATE - XVII



LEGEND

Admin Boundary:

- District Headquarter
- Block Headquarter
- Town
- 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	30-40	80-90
	40-50	>90

Glossary of terms

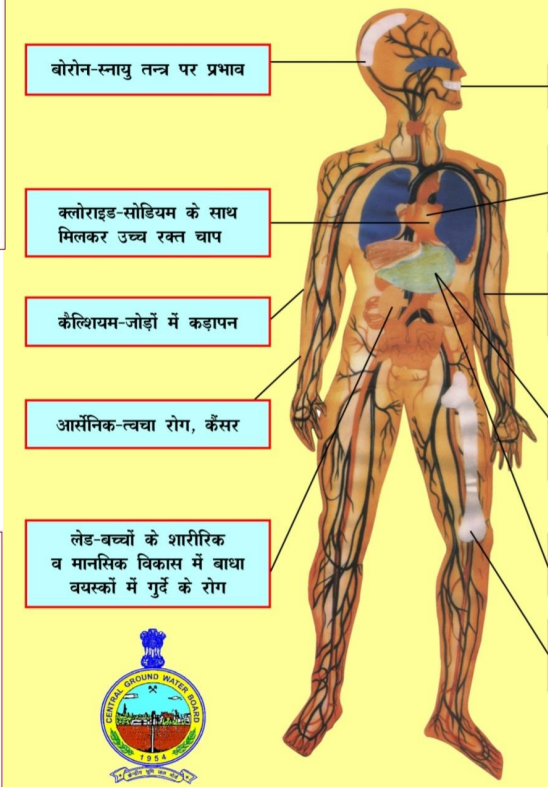
S. No.	Technical Terms	Definition
1	AQUIFER	A saturated geological formation which has good permeability to supply sufficient quantity of water to a Tube well, well or spring.
2	ARID CLIMATE	Climate characterized by high evaporation and low precipitation.
3	ARTIFICIAL RECHARGE	Addition of water to a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

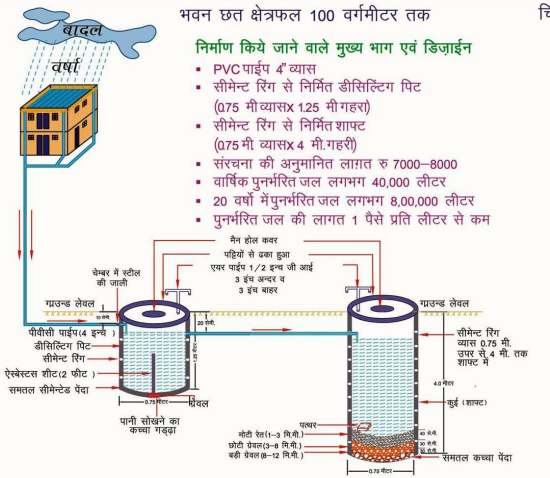
भूजल अमूल्य है इसे प्रदूषित न करें।

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

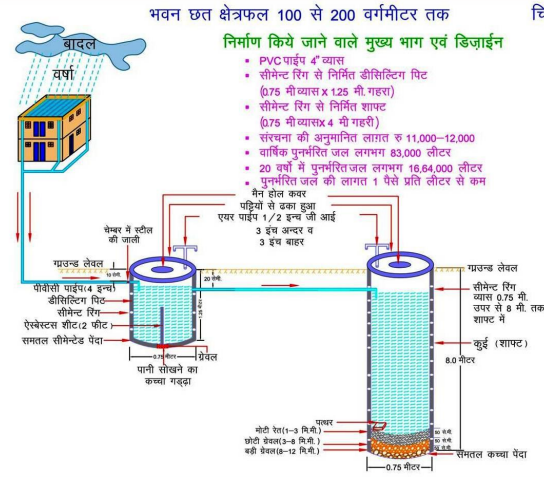


चित्र–2

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

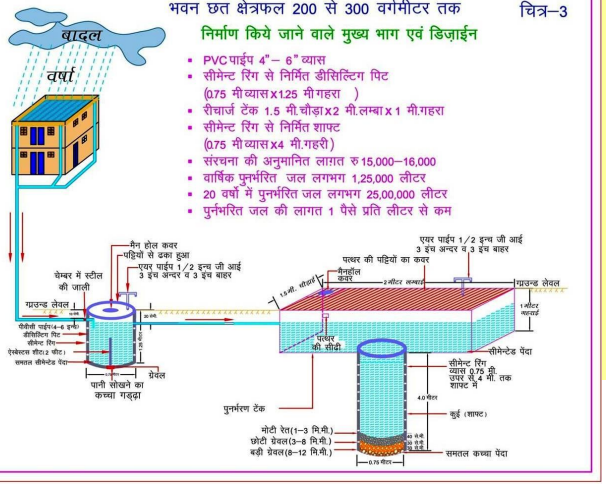


चित्र–3

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

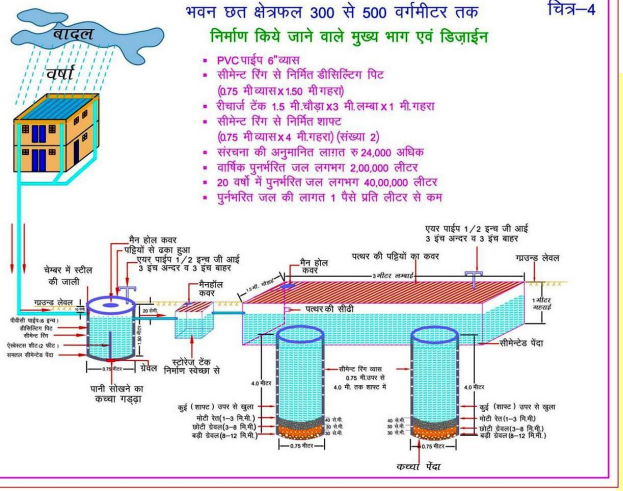


चित्र–4

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
- पुर्नभरित 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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