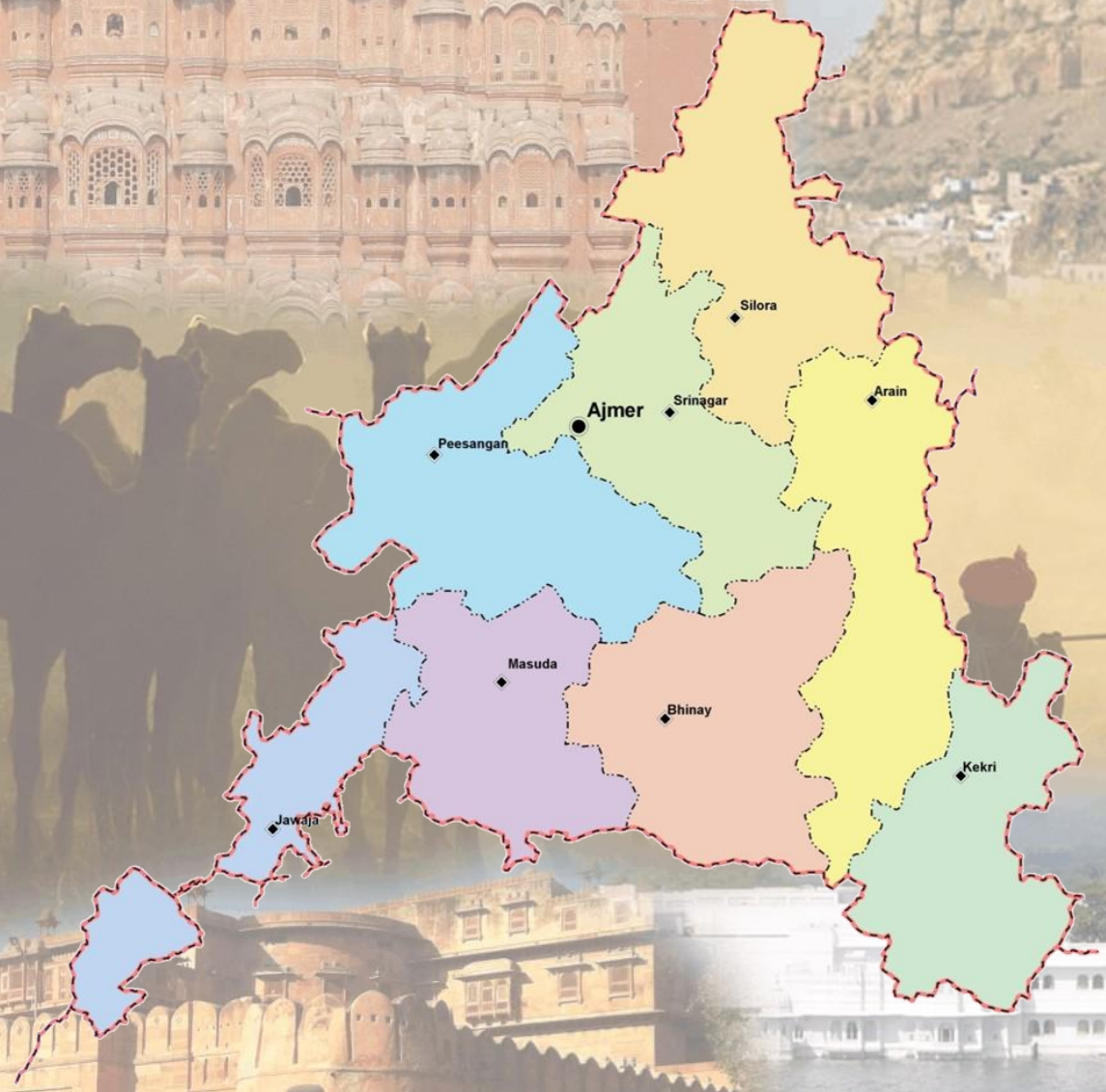
Ground Water Department,
Rajasthan

Hydrogeological Atlas of Rajasthan

Ajmer District

European Union
State Partnership Programme

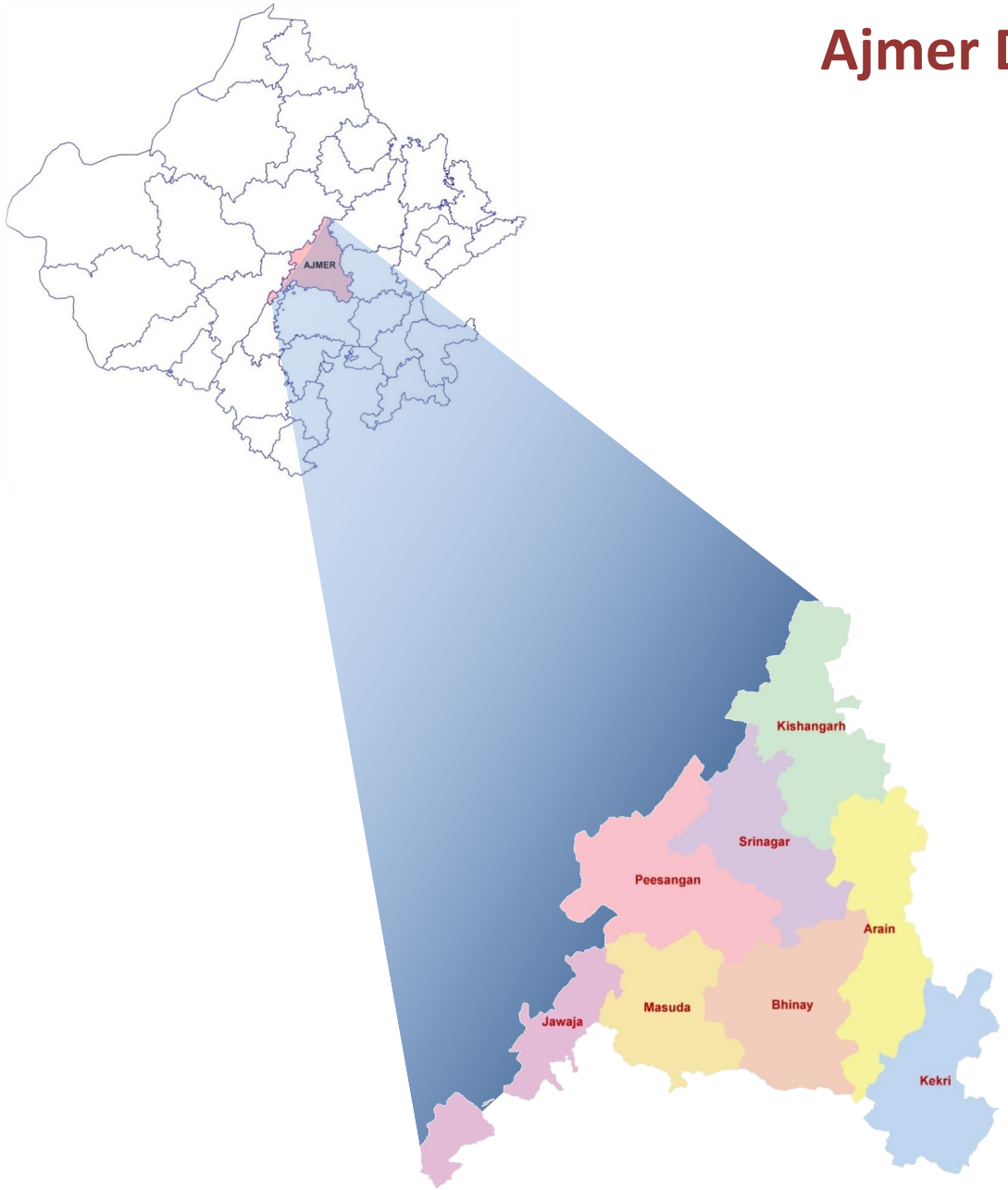


2013

ROLTA
Rolta India Limited

Hydrogeological Atlas of Rajasthan

Ajmer District



Contents:

2013

ADMINISTRATIVE SETUP

DISTRICT – AJMER

Location:

Ajmer district is located in the central part of Rajasthan. It is bounded in the northeast by Jaipur district, in the east by Tonk district, south by Bhilwara and Rajsamand districts, Pali district in the west and Nagaur in the northwest. It stretches between 25^{o} 38' 48.84" to 26^{o} 58' 42.97" North latitude and 73^{o} 53' 48.20'' to 75^{o} 21' 22.73'' East longitude covering area of 8,484.1 sq kms. Major part of the district has a systematic drainage system, being covered by parts of several basins namely 'Banas River Basin','Luni River Basin' and 'Shekhawati River Basin'.

Administrative Set-up:

Ajmer district is administratively divided into eight 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	Arain	1,49,588	1,211.0	14.3	130
2	Bhinay	1,55,111	1,193.1	14.1	128
3	Jawaja	2,81,660	696.0	8.0	201
4	Kekri	1,75,056	997.7	11.8	101
5	Kishangarh	2,69,696	1,187.1	14.0	115
6	Masuda	1,87,295	895.3	10.6	144
7	Peesangan	3,00,380	1,320.4	15.6	130
8	Srinagar	6,60,662	983.5	11.6	98
Total		**21,79,448**	**8,484.1**	**100.0**	**1,047**

Ajmer district has 1,047 towns and villages, out of which eight are block headquarters as well.

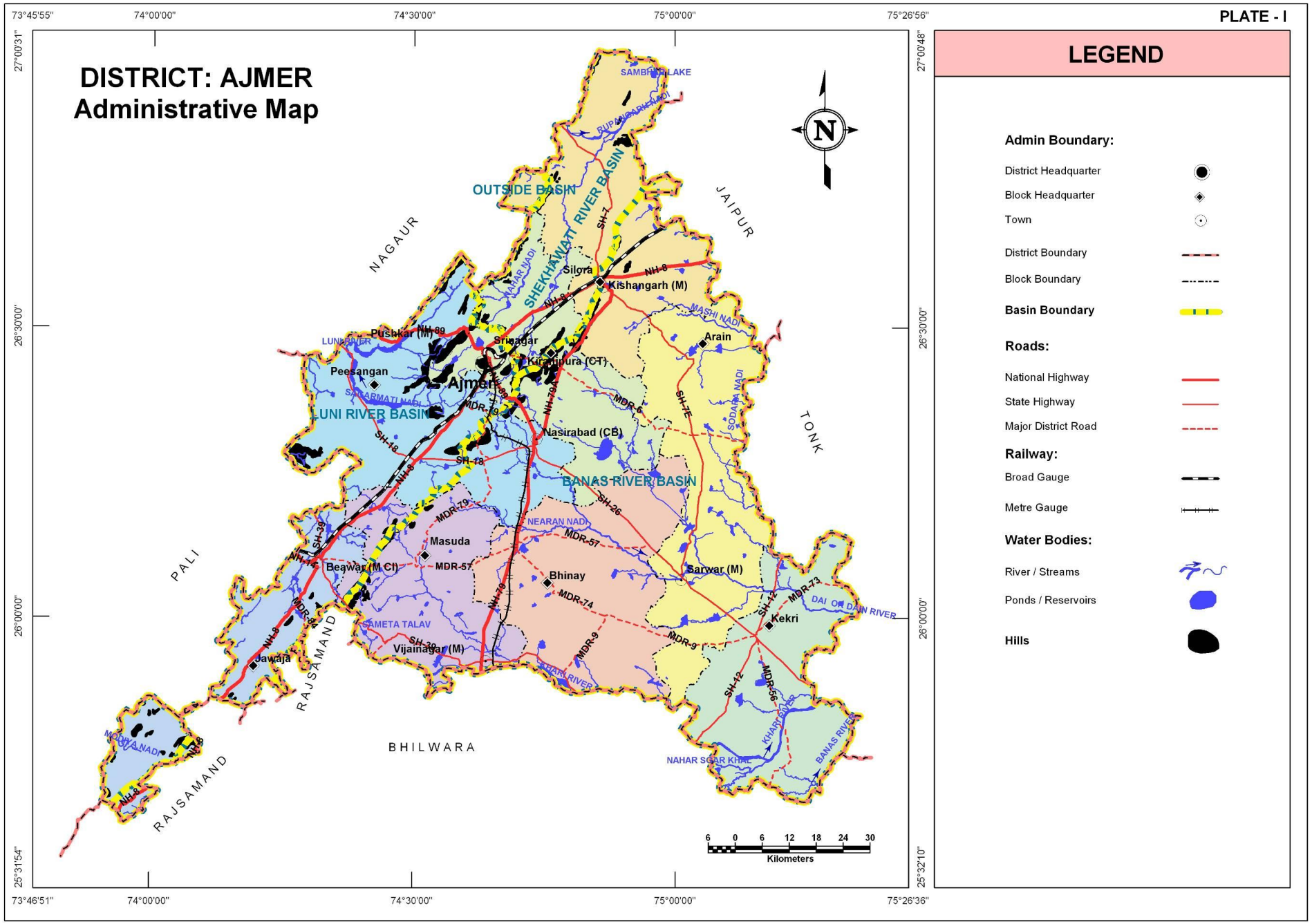
Climate:

January is the coldest month with mean maximum and minimum temperatures being lowest at 22.7 ^{o}C & 7.6 ^{o}C. Temperature in summer month June, reaches up to 39.5 ^{o}C. There is drop in temperature due to onset of monsoon and rises again in the month of September. Atmosphere is generally dry except during the monsoon period. The humidity is highest in August with mean daily relative humidity 80%. Mean annual rainfall of the district is 453.2mm.

Ground Water Department,
Rajasthan

European Union
State Partnership Programme

PLATE - I



LEGEND

Admin Boundary:

- District Headquarter
- Block Headquarter
- Town
- 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**

ROLTA
Rolta India Limited

TOPOGRAPHY

DISTRICT – AJMER

The district is broadly triangular in shape. It is generally a plain area interspersed with low hills of Aravalli range running roughly NE-SW direction and irregular terrain lying in the southwestern part of the district. The Kekri block forms the southeastern part of the district, and is a level plain; The Kishangarh block which is in the northeastern portion of the district is sandy except for a few isolated hills. The major rivers of the district are Banas, Khari, Sagarmati and Rupnagar, which developed very good drainage system of the district along with their tributaries like Nearan, Mashi, Sodara and Mahar etc. Minimum elevation (301 m) is found in Kekri block whereas highest elevation is reached (870 m) in Peesangan block.

Table: Block wise minimum and maximum elevation

S. No.	Block Name	Minimum Elevation (m amsl)	Maximum Elevation (m amsl)
1	Arain	326.4	421.9
2	Bhinay	347.3	689.0
3	Jawaja	377.6	819.8
4	Kekri	301.0	547.3
5	Kishangarh	360.8	717.5
6	Masuda	390.1	584.5
7	Peesangan	366.4	870.0
8	Srinagar	367.6	850.9

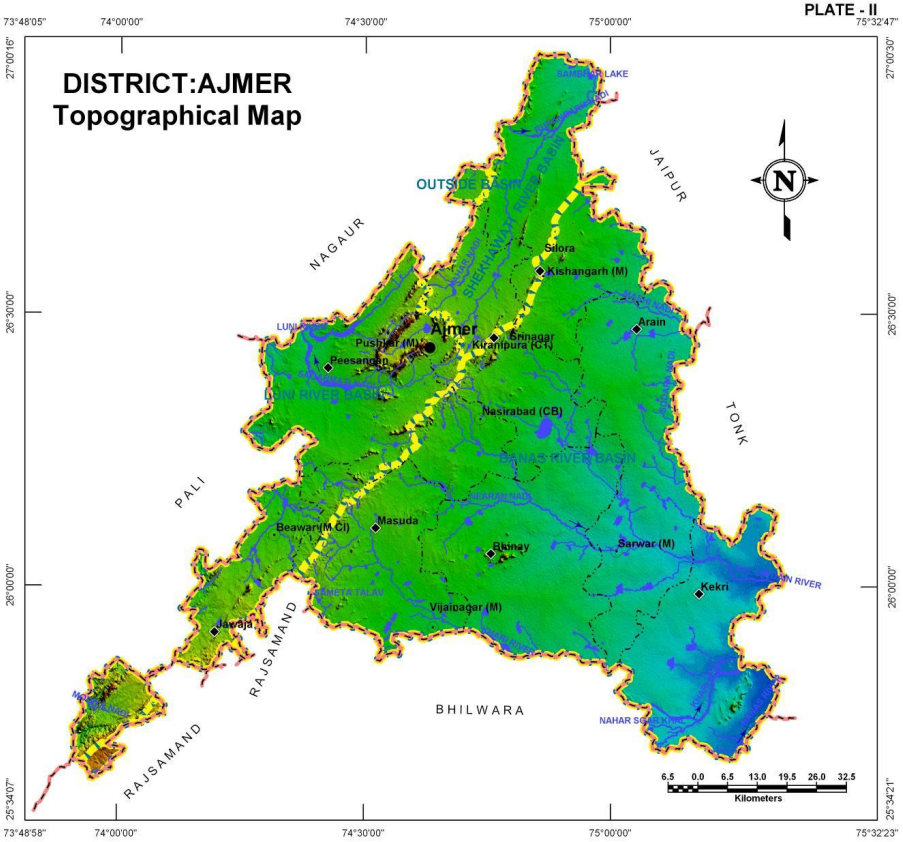
RAINFALL

The rainfall in this district is scanty and erratic. The general distribution of rainfall across can be visualized from isohyets presented in the Plate III. Interestingly, the southcentral part receives more rainfall as compared to southwest and it gradually reduces towards North. Maximum annual rainfall is noticed in Bhinay block whereas minimum in Jawaja block. Average annual rainfall in Ajmer district was about 722 mm in the year 2010.

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)
Arain	697.8	851.8	795.4
Bhinay	789.9	927.7	865.2
Jawaja	233.6	746.4	564.6
Kekri	684.9	815.3	756.6
Kishangarh	554.2	785.1	668.2
Masuda	524.6	910.9	712.8
Peesangan	630.4	830.6	699.4
Srinagar	610.3	835.8	714.0

PLATE - II



LEGEND

Admin Boundary:

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

Basin Boundary

Water Bodies:

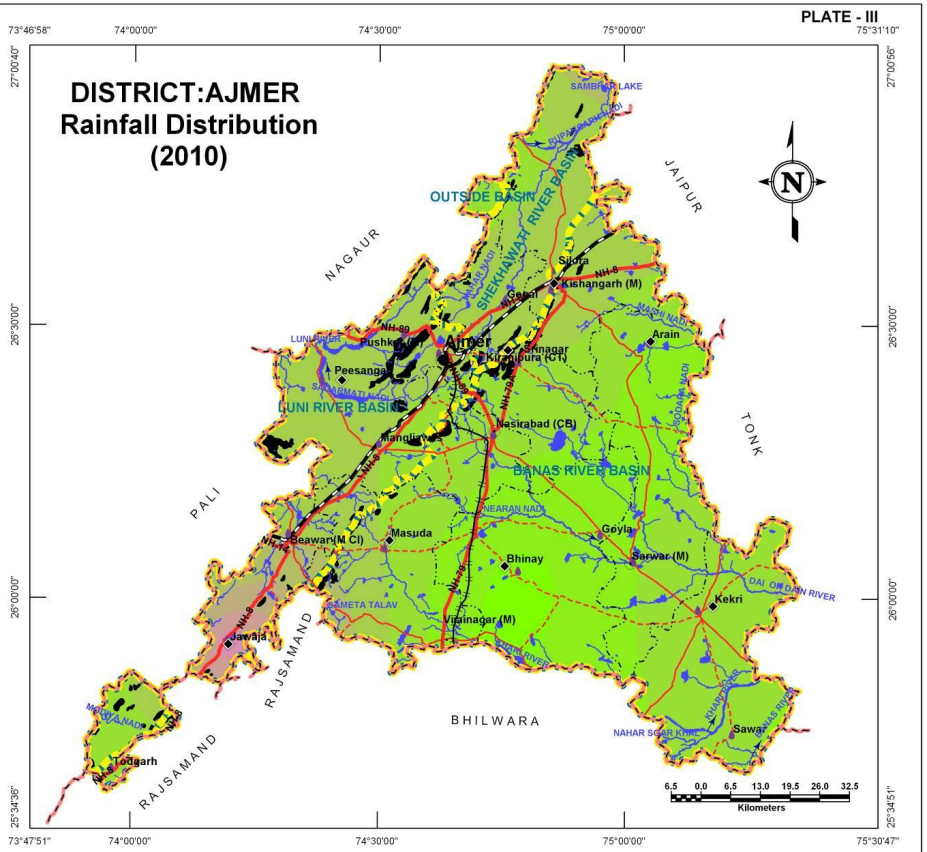
- River / Streams
- Ponds / Reservoirs

Elevation (m amsl):

871
750
625
500
375
299

Source : SRTM DEM

PLATE - III



LEGEND

Admin Boundary:

- District Headquarter
- Block Headquarter
- Town
- Raingauge Stations
- 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):

- 200-300
- 300-400
- 400-500
- 500-600
- 600-700
- 700-800
- 800-900
- 900-1000

GEOLOGY

DISTRICT – AJMER

The geological setting of the Ajmer district is represented by Bhilwara and Delhi Super Groups, which have been further divided into several Groups and Formations. The rocks of Bhilwara Super Group occur from Arain block in northeast through Bhinay up to Kekri block area, underlying the plains and comprised of metasedimentary sequences with associated magmatic complex and igneous rocks. The Aravalli range running in NNE-SSW direction is occupied by the rocks of Delhi Super Group in the southern part which comprises of calcareous, argillaceous and arenaceous metasedimentary sequences with associated volcanic and igneous rocks.

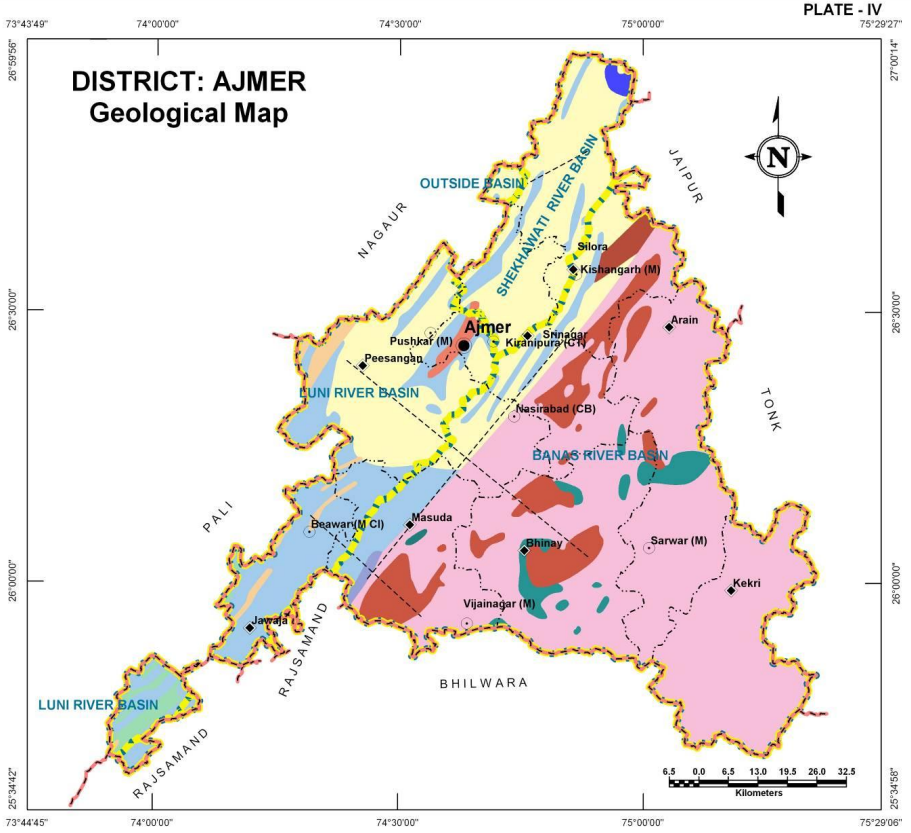
Super Group	Group	Formation
	Recent to Sub-recent	Alluvium and wind-blown sand sub-Recent
	Intrusion (Erinpura Granite)	Sendra-Ambaji granite Gneiss and Migamatite
Delhi	Kumbhalgarh	Calc-schist, calcgneiss marble, garnet, biotite schist quartzite, mica schist
	Ajabgarh	Quartzite, Calcgneiss, mica-schist and marble
	Alwar	Metaconglomerate quartzite mica-schist
--X--------X--------X--------X---Unconformity---X--------X--------X-------X--		
Bhilwara	Sawar	Dolomite, dolomitic marble, quartzite, garnetiferous mica schist.
--X--------X--------X--------X---Unconformity---X--------X--------X-------X--		
	Mangalwar complex	Migmatite, gneisses, mica-schist sillimatite, mica-schist para amphibolite impure marble
--X--------X--------X--------X---Unconformity---X--------X--------X-------X--		
	Sandmata complex	Para-gneisses, migmatite, pyroxene granulite, marble, ultramafics

GEOMORPHOLOGY

Table: Geomorphologic units, their description and distribution

Origin	Landform Unit	Description
Aeolian	Dissected Sandy Plain	Sandy plain highly dissected by stream and drainage.
	Obstacle Dune	Formed on windward/leeward sides of obstacle like isolated hills or continuous chain of hills, dune to obstruction in path of sand laden winds. Badly dissected well cemented and vegetated.
	Sandy Plain	Formed of aeolian activity, wind-blown sand with gentle sloping to undulating plain, comprising of coarse sand, fine sand, silt and clay.
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.
	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.
Fluvial	Flood Plain	Thesurfaceorstripofrelativelysmoothlandadjacenttoariverchannelformedbyriverandcoveredwithwaterwhenriveroverflowsitsbank.Normallysubjecttoperiodicflooding.
	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.
	Salt Encrustation/Playa	Topographical depression comprising of clay, silt, sand and soluble salts, usually undrained and devoid of vegetation.
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
- District Boundary
- Block Boundary

Basin Boundary

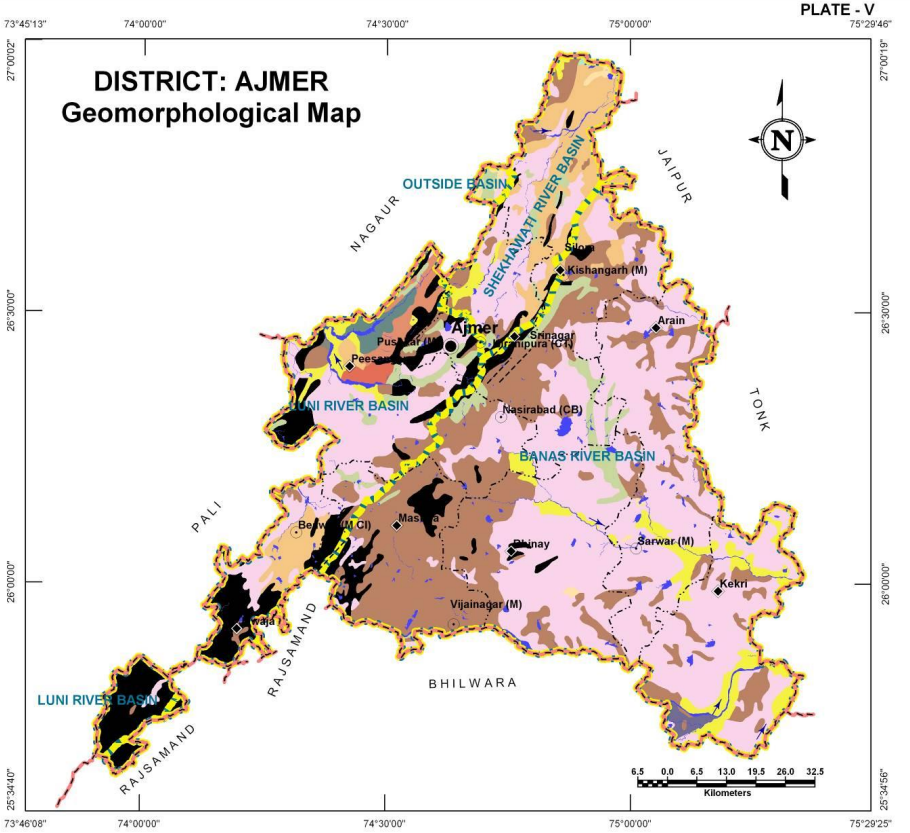
Water Bodies

Structural Features:
- Lineament

Geology:
- Alluvium and Wind blown sand
- Sirohi Group
- Kumbhalgarh Group
- Ajabgarh Group
- Gogunda Group
- Sawar Group
- Mangalwar Complex
- Sand Mata Complex
- Sendra-Ambaji Granite & Gneiss
- Phulad Ophiolite Suite
- Kishangarh Syenite
- Bairath/Dadikar/Harsora/Chapoli/Ajitgarh/Ajmer Granite etc.
- Acidic Rocks
- Mafic Rocks
- Ultramafic rocks

Source: District Resource Map of Rajasthan - GSI

PLATE - V



LEGEND

Admin Boundary:
- District Headquarter
- Block Headquarter
- Town
- 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 (Sandy)
- Alluvial Plain
- Valley Fill
- Flood Plain
- Ravine
- Salt Encrustation/Playa

Denudational Origin:
- Pediment
- Burried Pediment

Aeolian Origin:
- Sandy Plain
- Dissected Sandy Plain
- Obstacle Dune

Structural Origin:
- Plateau

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

AQUIFERS

DISTRICT – AJMER

In Ajmer district, aquifers are formed in Gneiss, Schist and Younger alluvium. Weathered and fractured parts of the massive gneiss and schist contribute to aquifer formation whereas the sandy, gravelly and other granular parts of alluvium constitute aquifers. Gneiss is the most predominant aquifer type with more than 64% spatial coverage and is present in the eastern part of the district. The schistose aquifers are formed around the hilly areas of Aravalli range and alluvium, primarily wind-blown sand is found in the northwestern part of the district around Ajmer city.

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	392.2	4.6	It is largely constituted of Aeolian and Fluvial sand, silt, clay, gravel and pebbles in varying proportions.
Schist	2,357.4	27.8	Medium to fine grained compact rock. The litho units are soft, friable and have closely spaced cleavage.
Gneiss	5,464.1	64.4	Comprises of porphyritic and non-porphyritic gneissic complex.
Non Potential Zone (Hills)	270.4	3.2	-
Total	**8484.1**	**100.0**	

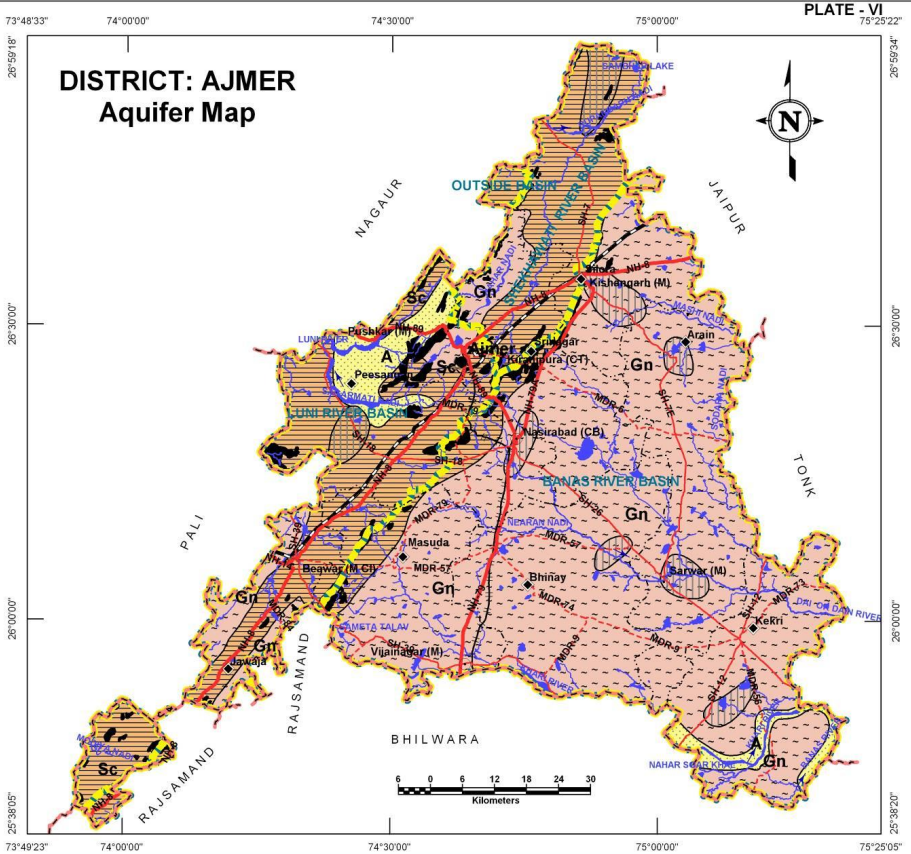
STAGE OF GROUND WATER DEVELOPMENT

Most of the blocks in the district fall under the 'Over Exploited' category indicating that the ground water is under stress and exploitation exceeding recharge. One of the blocks is in 'notified' category suggests severely stressed ground water situation.

Categorization on the basis of stage of development of ground water	Block Name
Over Exploited	Bhinay, Kishangarh, Kekri, Arain, Masuda, Jawaja, Srinagar
Notified	Peesangan

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

PLATE - VI



LEGEND

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

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

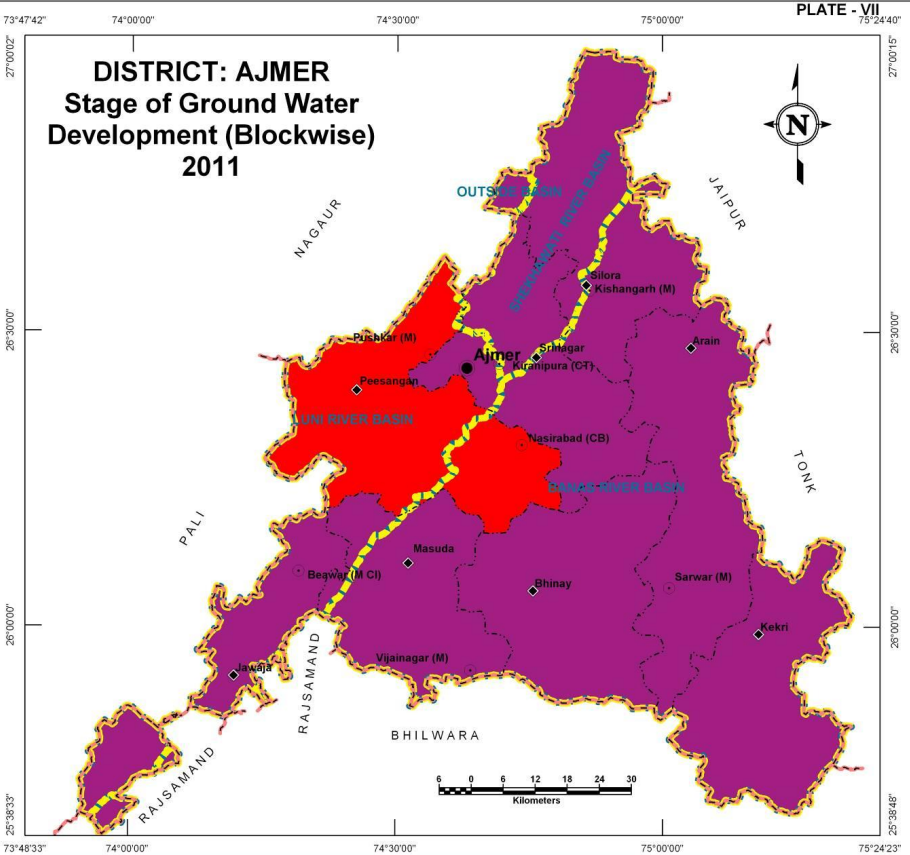
Railway:
- Broad Gauge
- Metre Gauge

Water Bodies:
- River / Streams
- Ponds / Reservoirs
- **Hills**
- **Chemically Unsuitable Area**

Aquifer:
- Younger Alluvium
- Schist
- Gneiss

Source: Ground Water Potential Zone Map - GWD, Rajasthan

PLATE - VII



LEGEND

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

The district has a well distributed network of large number of exploratory wells (117) and ground water monitoring stations (386) in the district owned by RGWD (88 and 352 respectively) and CGWB (29 and 34 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 levels are being well monitored through existing network and for better monitoring of ground water quality only one well needs to be added to existing network in Kekri block.

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
Arain	-	9	**9**	6	42	**48**	-	-
Bhinay	-	12	**12**	2	48	**50**	-	-
Jawaja	2	11	**13**	7	36	**43**	-	-
Kekri	-	8	**8**	2	46	**48**	-	1
Kishangarh	10	12	**22**	3	41	**44**	-	-
Masuda	-	8	**8**	4	38	**42**	-	-
Peesangan	12	15	**27**	7	51	**58**	-	-
Srinagar	5	13	**18**	3	50	**53**	-	-
Total	**29**	**88**	**117**	**34**	**352**	**386**	**0**	**1**

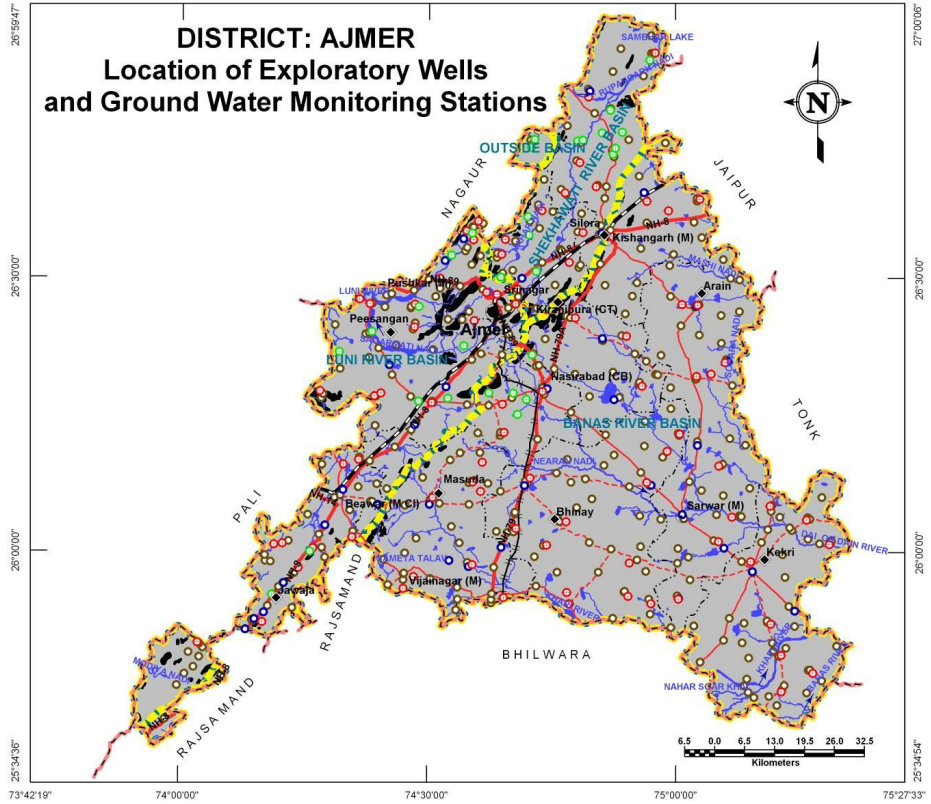
DEPTH TO WATER LEVEL (PRE MONSOON – 2010)

Depth to water level shows variation from less than 10m below ground level to >40m below ground level. The central and southeastern parts of the district including in the southern fringe have shown a generally not so deep ground water occurrence (i.e., within a depth range of 30m) whereas the northern parts (north of Kishangarh) have shown deep water levels reaching up to more than 40m below ground level. The shallow occurrence less than 10m bgl water level have reported in south eastern parts of the district around Sarwar and kekri.

Depth to water level (m bgl)	Block wise area coverage (sq km) *								Total Area (sq km)
	Arain	Bhinay	Jawaja	Kekri	Kishangarh	Masuda	Peesangan	Srinagar	
<10	178.4	7.0	2.0	175.4	-	-	9.5	26.0	**398.3**
10-20	994.9	1,093.0	597.0	817.9	213.4	623.6	384.8	493.9	**5,218.5**
20-30	37.7	77.0	74.2	4.4	576.4	228.6	812.3	356.1	**2,166.7**
30-40	-	16.1	-	-	350.3	6.5	23.8	21.7	**418.4**
>40	-	-	-	-	11.8	-	-	-	**11.8**
Total	**1,211.0**	**1,193.1**	**673.2**	**997.7**	**1,151.9**	**858.7**	**1,230.4**	**897.7**	**8,213.7**

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

PLATE - VIII



LEGEND

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

Basin Boundary

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

Railway:
- Broad Gauge
- Metre Gauge

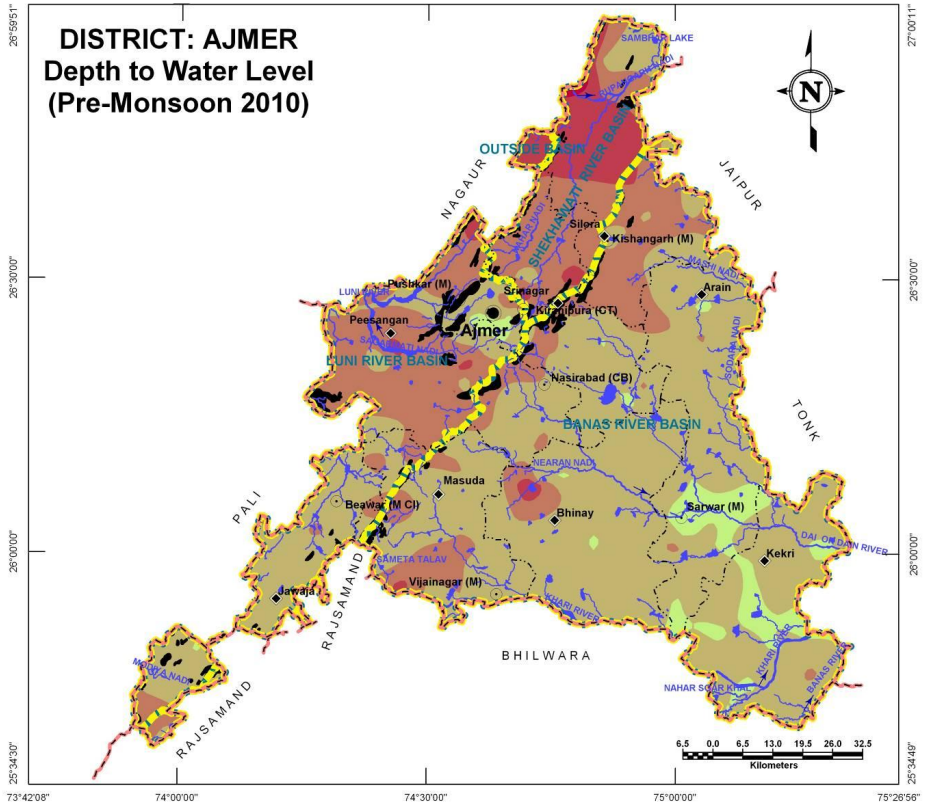
Water Bodies:
- River / Streams
- Ponds / Reservoirs

Hills

Exploratory Wells:
- CGWB
- RGWD

Ground Water Monitoring Stations:
- CGWB
- RGWD

PLATE - IX



LEGEND

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

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

General flow direction of ground water is from northwest to southeast in the district. The western part near Peesangan) it assumes a flow direction towards west and in the north of Ajmer, a northeasterly direction. The minimum water table elevation (<320m amsl) is seen in the southeastern part of the district in Kekri block, the maximum elevation (>680m amsl) is observed in the southwestern part of the district in Jawja Block in the hilly area of Aravalli range.

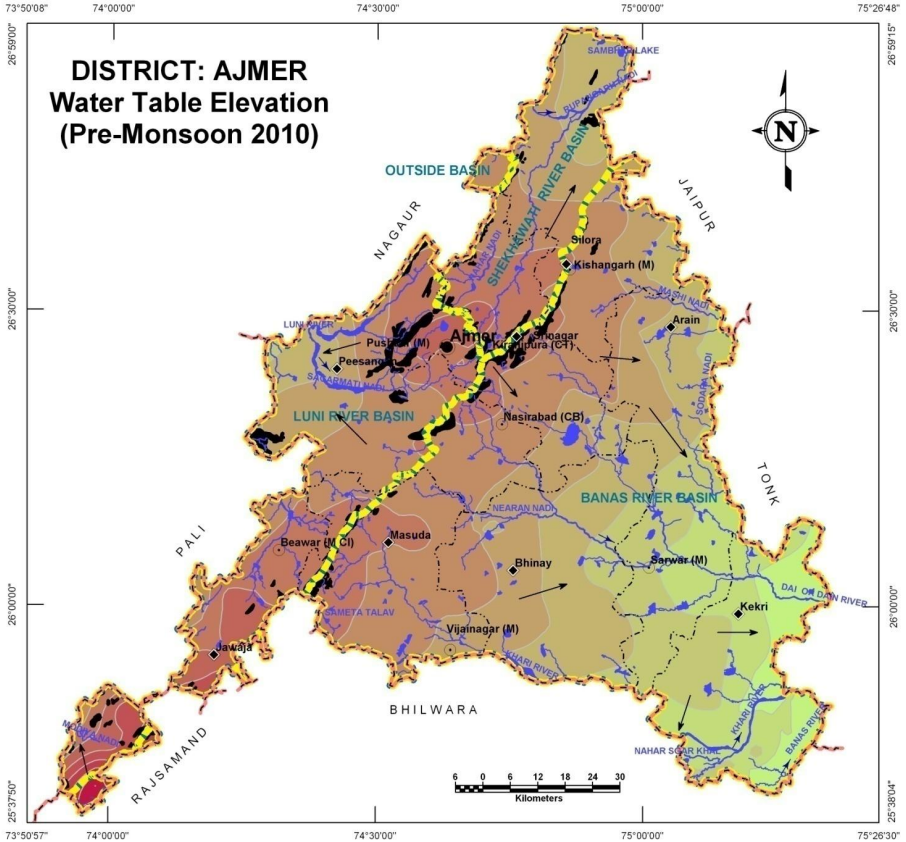
Block Name	Block wise area (sq km) within water table elevation (m amsl) range													Total Area (sq km)
	< 320	320 - 340	340 - 360	360 - 380	380 - 400	400 - 440	440 - 480	480 - 520	520 - 560	560 - 600	600 - 640	640 - 680	> 680	
Arain	-	227.7	451.0	310.6	178.6	43.1	-	-	-	-	-	-	-	**1,211.0**
Bhinay	-	-	137.1	588.0	338.1	129.9	-	-	-	-	-	-	-	**1,193.1**
Jawaja	-	-	-	-	1.9	79.7	266.1	184.2	83.1	21.3	18.8	18.1	-	**673.2**
Kekri	336.9	465.4	195.4	-	-	-	-	-	-	-	-	-	-	**997.7**
Kishangarh	-	-	0.4	299.5	368.5	433.5	50.0	-	-	-	-	-	-	**1,151.9**
Masuda	-	-	-	-	82.5	502.4	272.8	1.0	-	-	-	-	-	**858.7**
Peesangan	-	-	11.7	119.9	256.3	643.6	198.5	0.4	-	-	-	-	-	**1,230.4**
Srinagar	-	-	-	44.5	154.1	282.6	327.7	88.8	-	-	-	-	-	**897.7**
Total	**336.9**	**693.1**	**795.6**	**1,362.5**	**1,380.0**	**2,114.8**	**1,115.1**	**274.4**	**83.1**	**21.3**	**18.8**	**18.1**	**-**	**8,213.7**

WATER LEVEL FLUCTUATION (PRE TO POST MONSOON 2010)

A 2m contour interval adopted to visualize the ground water level fluctuation reveals a fall of 4 m in one area to rise in other areas reaching to more than 18m, as seen in Plate XI. The –ve fluctuation areas (indicated by red color regions) are the areas where overexploitation is taking place and even after monsoon recharge water level has not risen and has actually gone down with respect to pre-monsoon levels. Such large ground water depletion areas are located in the southeastern part of the district. 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. Maximum rise of more than 18m is noticed at eastern part of Kishangarh Block.

Water level fluctuation range (m)	Block wise area coverage (sq km)								Total Area (sq km)
	Arain	Bhinay	Jawaja	Kekri	Kishangarh	Masuda	Peesangan	Srinagar	
<-4	-	-	-	3.5	-	-	-	-	**3.5**
-4 – -2	-	-	-	16.7	-	-	-	-	**16.7**
-2 – 0	-	-	1.4	48.4	-	-	-	-	**49.8**
0 – 2	34.3	-	12.6	257.6	45.6	8.2	93.6	19.2	**471.1**
2 – 4	393.1	93.5	33.1	297.9	114.5	144.7	117.0	115.0	**1,308.8**
4 – 6	408.2	401.0	42.7	275.0	117.5	189.5	244.5	236.9	**1,915.3**
6 – 8	217.4	493.1	143.1	89.5	256.3	231.5	389.5	296.5	**2,116.9**
8 – 10	83.8	182.5	201.6	9.1	348.4	169.9	221.1	143.4	**1,359.8**
10 – 12	48.6	21.3	142.6	-	154.8	63.4	104.5	61.0	**596.2**
12 – 14	22.0	1.7	78.6	-	56.2	48.2	54.3	25.4	**286.4**
14 – 16	3.6	-	17.5	-	29.6	3.3	5.9	0.3	**60.2**
16 – 18	-	-	-	-	22.7	-	-	-	**22.7**
>18	-	-	-	-	6.3	-	-	-	**6.3**
Total	**1,211.0**	**1,193.1**	**673.2**	**997.7**	**1,151.9**	**858.7**	**1,230.4**	**897.7**	**8,213.7**

PLATE - X



LEGEND

Admin Boundary:

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

Basin Boundary

Water Bodies:

- River / Streams
- Ponds / Reservoirs

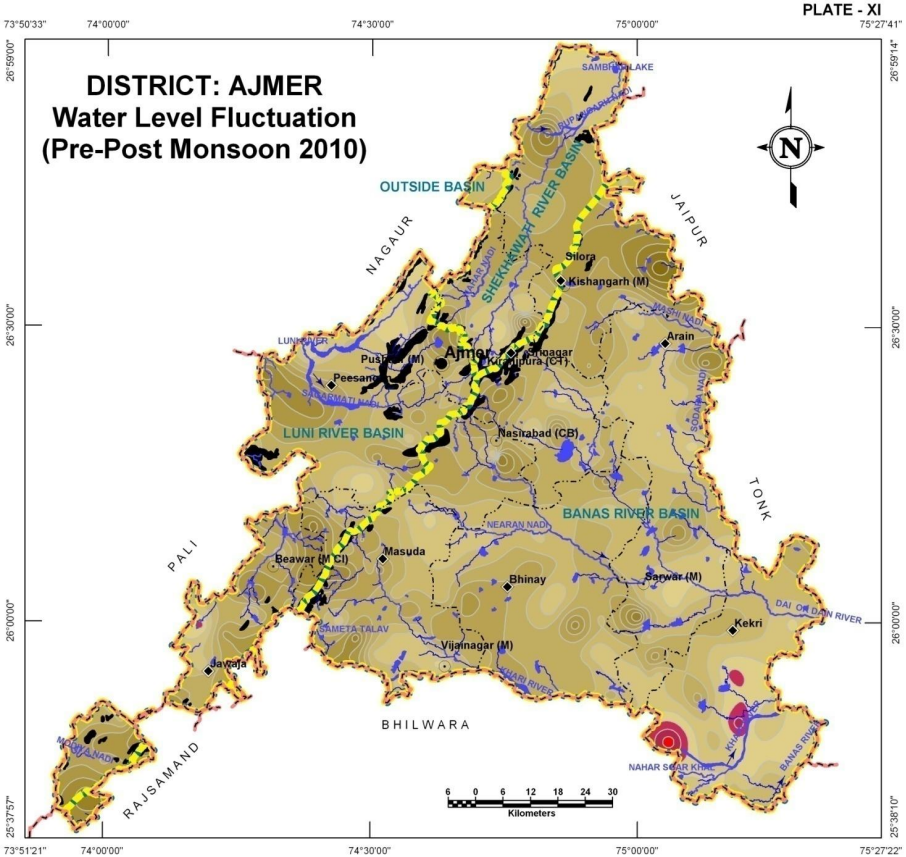
Hills

Water Table Elevation

Water Table Elevation(m amsl):

- <320
- 320 - 340
- 340 - 360
- 360 - 380
- 380 - 400
- 400 - 440
- 440 - 480
- 480 - 520
- 520 - 560
- 560 - 600
- 600 - 640
- 640 - 680
- >680

PLATE - XI



LEGEND

Admin Boundary:

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

Basin Boundary

Water Bodies:

- River / Streams
- Ponds / Reservoirs

Hills

Water Level Fluctuation(m):

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

GROUND WATER ELECTRICAL CONDUCTIVITY DISTRIBUTION — DISTRICT – AJMER

The Electrical conductivity (at 25°C) distribution map is presented in plate XII. The areas with moderately high EC values in ground water (2000-4000 µS/cm) are shown in green color and they together occupy almost 47% of the district area. The areas with low EC values (<2000 µS/cm) are shown in yellow color and occupy approximately 29% of the district area where the water is suitable for domestic purposes. Remaining part of the district (about 24%) has high EC values (>4000µS/Cm) in ground water and is shown in red color and water in this region 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)
	Arain		Bhinay		Jawaja		Kekri		Kishangarh		Masuda		Peesangan		Srinagar		
	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	
< 2000	295.4	24.4	364.5	30.6	404.3	60.1	302.5	30.3	271.6	23.6	149	17.4	358.5	29.1	241.8	26.9	**2387.6**
2000-4000	456.8	37.7	604.1	50.6	233.7	34.7	346.7	34.8	537.1	46.6	488.3	56.8	660.2	53.7	413.9	46.1	**3740.8**
>4000	458.8	37.9	224.5	18.8	35.2	5.2	348.5	34.9	343.2	29.8	221.4	25.8	211.7	17.2	242	27	**2085.3**
Total	**1211.0**	**100.0**	**1193.1**	**100.0**	**673.2**	**100.0**	**997.7**	**100.0**	**1151.9**	**100.0**	**858.7**	**100.0**	**1230.4**	**100.0**	**897.7**	**100.0**	**8213.7**

GROUND WATER CHLORIDE DISTRIBUTION

The green colored regions in plate XIII are such areas where chloride concentration is moderately high (250 – 1000 mg/l) and these areas occupy approximately 62% of the district area. The area with high chloride concentration (>1000 mg/l) which is shown in red color occupies approximately 22% of the district area. These areas are as isolated pockets scattered in different parts of the entire district. The ground water in this high chloride region is not suitable for domestic purpose. Remaining part of the district area has low chloride concentration (< 250 mg/l) which is shown in yellow color and occupies approximately 16% of the district area. These areas are presents in eastern, southwestern part of the district, southern part of Kekri and central part of the Bhinay block. The water in this region is suitable for domestic purpose. Overall, the district seems to have very limited areas where freshwater is available.

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)
	Arain		Bhinay		Jawaja		Kekri		Kishangarh		Masuda		Peesangan		Srinagar		
	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	
<250	162.7	13.4	219.3	18.4	304.8	45.3	202.7	20.3	85.8	7.5	61.4	7.2	172.6	14.0	92.3	10.3	**1,301.6**
250-1000	655.0	54.1	777.1	65.1	337.8	50.2	554.7	55.6	726.5	63.1	606.6	70.6	862.8	70.1	579.1	64.5	**5,099.6**
>1000	393.3	32.5	196.7	16.5	30.6	4.5	240.3	24.1	339.6	29.4	190.7	22.2	195.0	15.9	226.3	25.2	**1,812.5**
Total	**1,211.0**	**100.0**	**1,193.1**	**100.0**	**673.2**	**100.0**	**997.7**	**100.0**	**1,151.9**	**100.0**	**858.7**	**100.0**	**1,230.4**	**100.0**	**897.7**	**100.0**	**8,213.7**

PLATE - XII

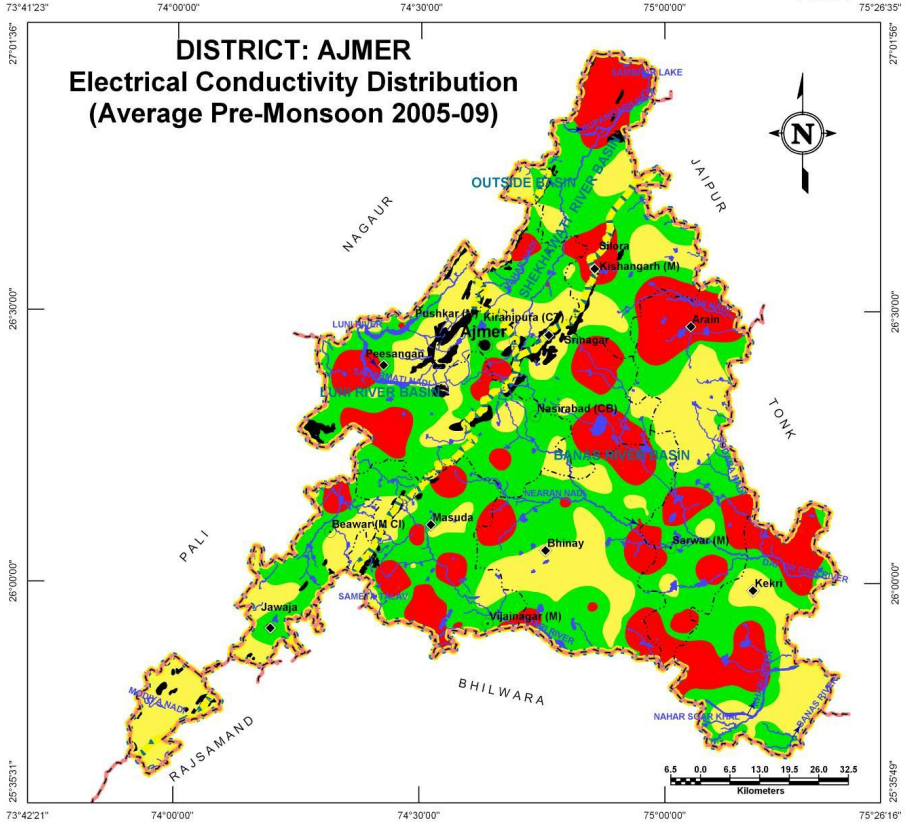
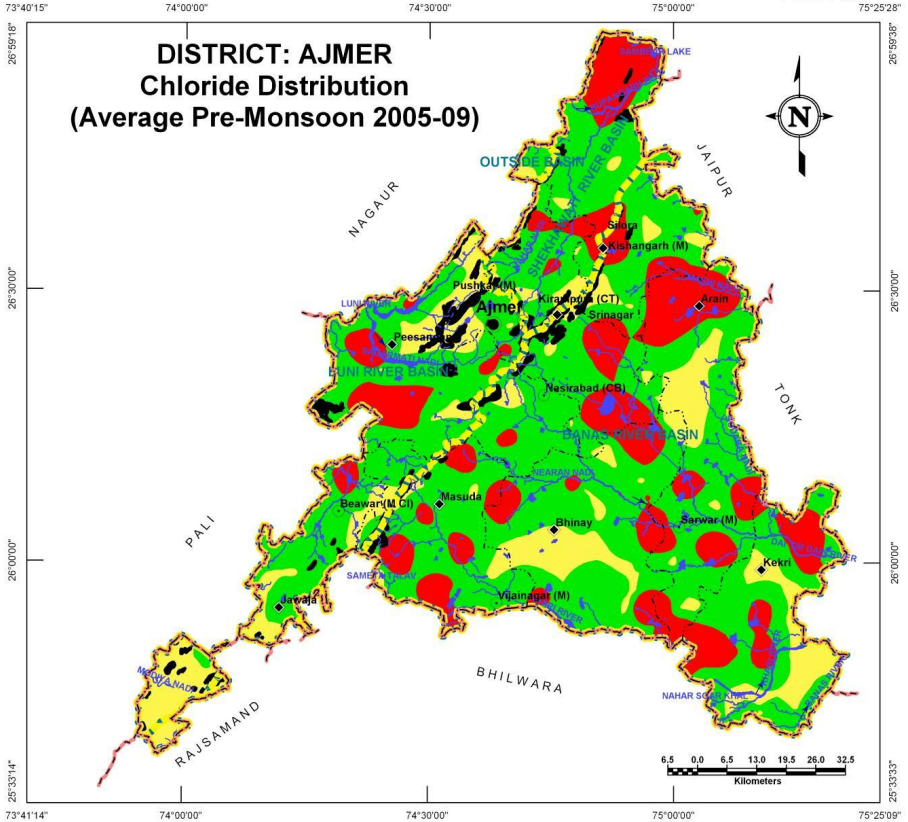


PLATE - XIII



LEGEND

Admin Boundary:

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

Basin Boundary

Water Bodies:

- River / Streams
- Ponds / Reservoirs

Hills

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

- < 2000
- 2000-4000
- >4000

LEGEND

Admin Boundary:

- District Headquarter
- Block Headquarter
- Town
- 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 – AJMER

The Fluoride concentration map is presented in Plate – XIV. In general, the district has moderate to high fluoride concentration in ground water. The areas with moderately high concentration (1.5 – 3.0 mg/l) are shown in green color and occupy approximately 57% of the district area. The areas with high fluoride concentration (>3.0 mg/l) seen as red color patches, are scattered in eastern and southeastern part of the district. The water in this region is not suitable for domestic purpose. Low fluoride concentration (i.e., >1.5 mg/l) area is shown with yellow color scattered, largely in western, northwestern and southwestern part of the district. Interestingly, the moderate and high fluoride concentration areas directly correlate with areas where aquifers are formed in Gneisses.

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)
	Arain		Bhinay		Jawaja		Kekri		Kishangarh		Masuda		Peesangan		Srinagar		
	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	
<1.5	158.6	13.1	99.3	8.3	440.6	65.4	45.7	4.6	225.5	19.6	94.1	11.0	449.5	36.5	221.9	24.7	**1,735.2**
1.5-3.0	544.9	45.0	617.6	51.8	232.0	34.5	568.6	57.0	770.9	66.9	651.5	75.8	726.0	59.0	536.6	59.8	**4,648.1**
>3.0	507.5	41.9	476.2	39.9	0.6	0.1	383.4	38.4	155.5	13.5	113.1	13.2	54.9	4.5	139.2	15.5	**1,830.4**
Total	**1,211.0**	**100.0**	**1,193.1**	**100.0**	**673.2**	**100.0**	**997.7**	**100.0**	**1,151.9**	**100.0**	**858.7**	**100.0**	**1,230.4**	**100.0**	**897.7**	**100.0**	**8,213.7**

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. The moderately high nitrate concentration (50-100 mg/l) is shown in green color and occupies approximately 41% of the district area. The areas with high nitrate concentration (>100 mg/l) are shown in red color is seen largely major parts central areas in the district and partly in the north and southeast. The water in such areas is not suitable for agriculture purpose. The Area with low concentration (<50 mg/l) in yellow color patches scattered largely southern, southwestern and northeastern parts of the district. The water in this region is suitable for agriculture purpose.

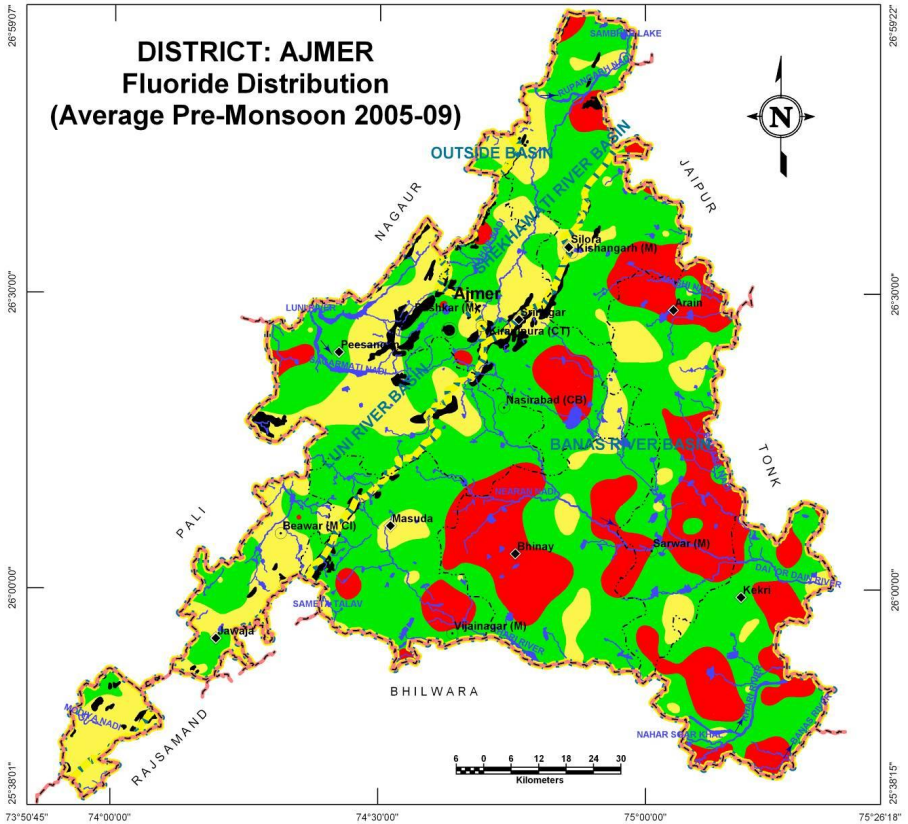
Table: Block wise area of Nitrate distribution

Nitrate concentration Range (mg/l) (Ave. of years 2005-09)	Block wise area coverage (sq km)																Total Area (sq km)
	Arain		Bhinay		Jawaja		Kekri		Kishangarh		Masuda		Peesangan		Srinagar		
	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	
<50	433.5	35.8	745.1	62.4	457.3	67.9	277.8	27.8	312.9	27.2	210.0	24.5	378.4	30.8	178.8	19.9	**2,993.8**
50-100	342.8	28.3	419.3	35.2	137.2	20.4	556.1	55.8	513.5	44.5	283.9	33.1	629.0	51.1	455.3	50.7	**3,337.1**
>100	434.7	35.9	28.7	2.4	78.7	11.7	163.8	16.4	325.5	28.3	364.8	42.4	223.0	18.1	263.6	29.4	**1,882.8**
Total	**1,211.0**	**100.0**	**1,193.1**	**100.0**	**673.2**	**100.0**	**997.7**	**100.0**	**1,151.9**	**100.0**	**858.7**	**100.0**	**1,230.4**	**100.0**	**897.7**	**100.0**	**8,213.7**

Ground Water Department,
Rajasthan

European Union
State Partnership Programme

PLATE - XIV



LEGEND

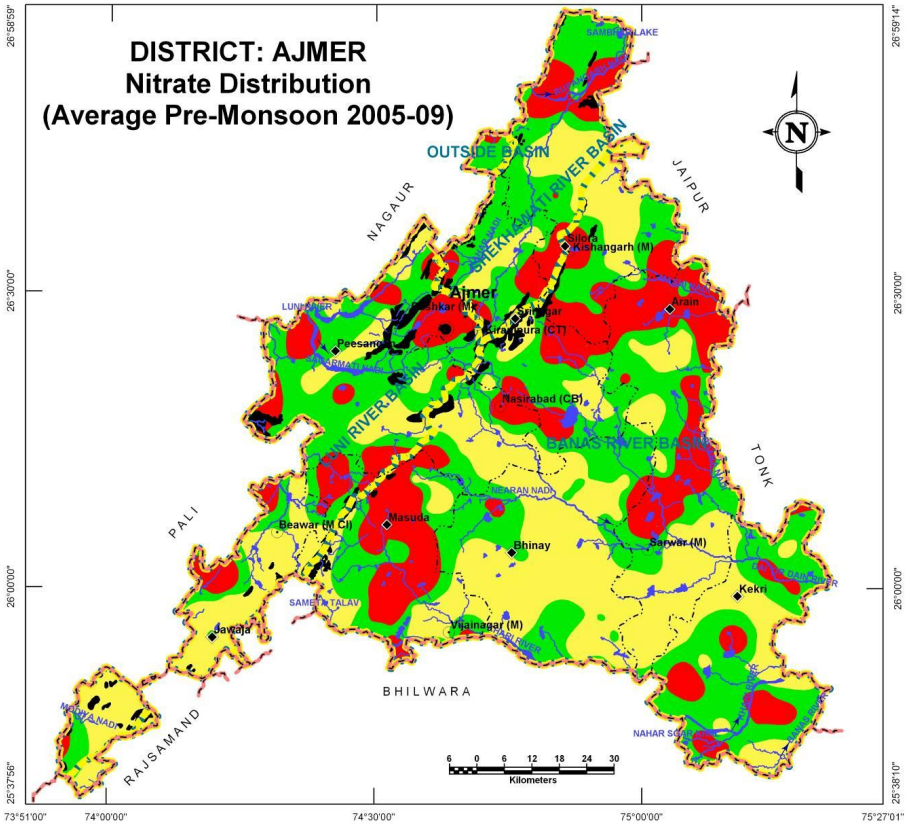
Admin Boundary:

- District Headquarter
- Block Headquarter
- Town
- 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
- 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 – AJMER

Depth to bedrock map of Ajmer district (Plate – XVI) reveals wide variation from less than 20m below ground level to reaching a maximum depth of more than 60m below ground level. The majority of the areas are covered by Gneiss and Schist. These rocks are overlain by alluvial deposits of sand, clay, silt and admixture of these in different proportions and thicknesses. On perusal of the map it can be interpreted that the bedrock is less in the entire eastern parts and as we move to central part of the district bedrock becomes deeper to about 20m bgl to 60m bgl. The maximum depth of bedrock encountered in the northern part (in Kishangarh block, >60m bgl) and southern part (in Jawja block, 40-60m bgl).

Depth to bedrock (m bgl)	Block wise area coverage (sq km)																Total Area (sq km)
	Arain		Bhinay		Jawaja		Kekri		Kishangarh		Masuda		Peesangan		Srinagar		
	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	
<20	922.3	76.2	827.6	69.4	15.5	2.3	830.8	83.3	274.2	23.7	213.4	24.8	0.9	0.1	90.8	10.1	**3,175.5**
20 - 40	288.7	23.8	365.5	30.6	539.1	80.1	166.9	16.7	371.6	32.3	645.3	75.2	996.7	81.0	528.3	58.9	**3,902.1**
40 - 60	-	-	-	-	118.6	17.6	-	-	363.6	31.6	-	-	229.6	18.6	278.6	31.0	**990.4**
>60	-	-	-	-	-	-	-	-	142.5	12.4	-	-	3.2	0.3	-	-	**145.7**
Total	**1,211.0**	**100.0**	**1,193.1**	**100.0**	**673.2**	**100.0**	**997.7**	**100.0**	**1,151.9**	**100.0**	**858.7**	**100.0**	**1,230.4**	**100.0**	**897.7**	**100.0**	**8,213.7**

UNCONFINED AQUIFER

Aquifer formed from alluvial materials covers very small area (approximately 393 sq km) of the district. The saturated thickness of alluvial formation varies less than 10m to about 20m and largely found in northeastern part of Peesangan block.

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 more than 80 meter, whereas the general thickness in the district is less than 30m. Southwestern part of the district in Jawaja block and northwestern part of Peesangan block have zones of very high thickness of aquifers in weathered/fractured hardrock (more than 80m), Kishangarh and Srinagar blocks have moderate thicknesses of up to 60m and shallow thickness has been reported in Arain, Bhinay, Kekri and Masuda blocks (less than 40m thickness).

Alluvial areas:

Unconfined Aquifer Thickness (m)	Block wise area coverage (sq km)								Total Area (sq km)
	Arain	Bhinay	Jawaja	Kekri	Kishangarh	Masuda	Peesangaon	Srinagar	
< 10	-	-	-	134.7	-	-	257.2	0.5	**392.5**
> 10	-	-	-	-	-	-	0.1	-	**0.0**
Total	**-**	**-**	**-**	**134.7**	**-**	**-**	**257.3**	**0.5**	**392.5**

Hard rock areas:

Unconfined Aquifer Thickness (m)	Block wise area coverage (sq km)								Total Area (sq km)
	Arain	Bhinay	Jawaja	Kekri	Kishangarh	Masuda	Peesangan	Srinagar	
<10	983.3	1065.4	111.8	612	466.3	704.9	744.9	516.7	**5,205.3**
10-20	227.7	127.7	243.2	247.6	460.7	140.5	61.4	246.7	**1,755.5**
20-30	-	-	168.1	3.4	147.7	13.3	49.5	85.8	**467.8**
30-40	-	-	62.6	-	48.6	-	41.9	32.5	**185.6**
40-50	-	-	31.6	-	24.7	-	29.6	13	**98.9**
50-60	-	-	28.1	-	3.9	-	20.7	2.5	**55.2**
60-70	-	-	16	-	-	-	13.8	-	**29.8**
70-80	-	-	9.5	-	-	-	9	-	**18.5**
> 80	-	-	2.3	-	-	-	2.3	-	**4.6**
Total	**1211.0**	**1193.1**	**673.2**	**863.0**	**1151.9**	**858.7**	**973.1**	**897.2**	**7,821.2**

PLATE - XVI

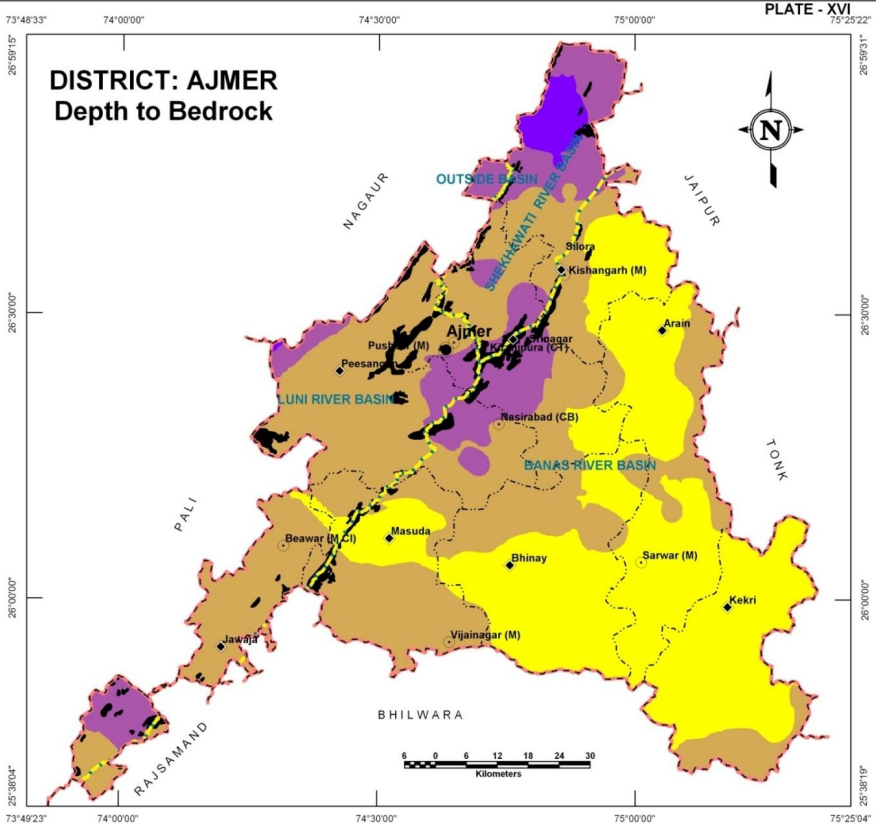
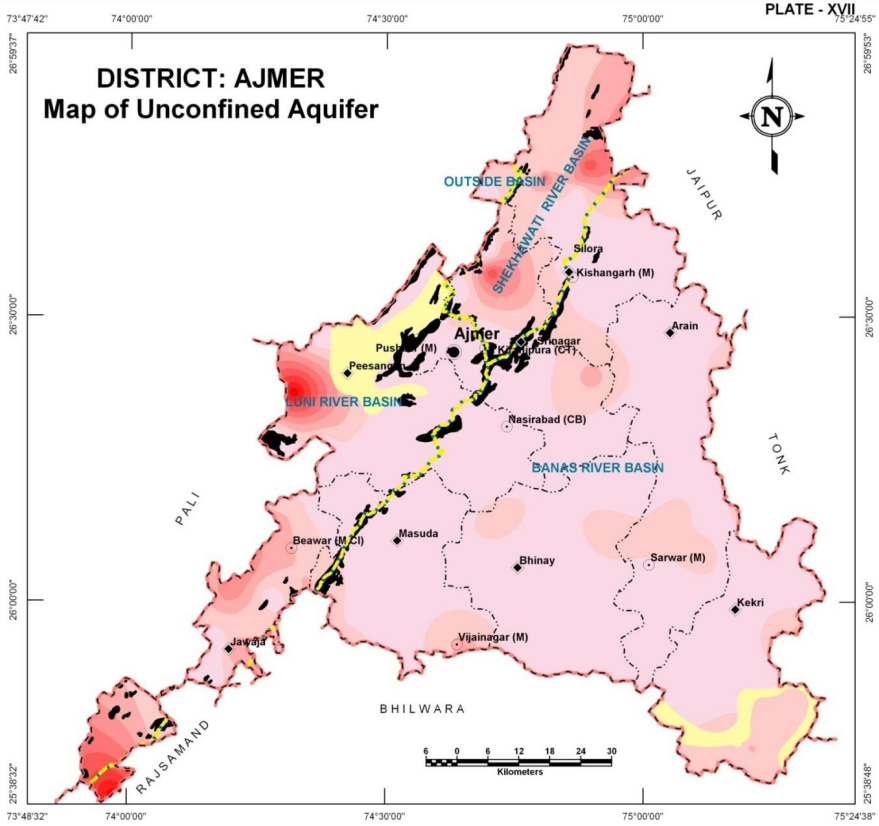


PLATE - XVII



LEGEND

Admin Boundary:

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

Depth to Bedrock(m bgl):

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

LEGEND

Admin Boundary:

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

Aquifer Thickness(m):

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

Glossary of terms

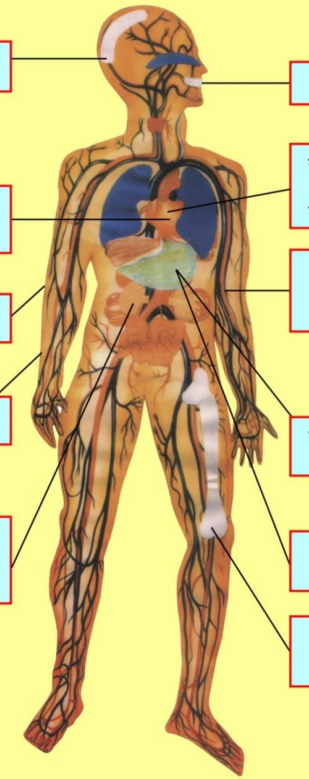
S. No.	Technical Terms	Definition
1	AQUIFER	A saturated geological formation which has good permeability to supply sufficient quantity of water to a Tube well, well or spring.
2	ARID CLIMATE	Climate characterized by high evaporation and low precipitation.
3	ARTIFICIAL RECHARGE	Addition of water to a 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 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	Windblown 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
- फ्लोराइड - दंत क्षरण
- सोडियम-हृदय, गुर्दा व रक्त परिसंचरण रोगों से ग्रसित लोगों को हानिकारक
- क्लोराइड-सोडियम के साथ मिलकर उच्च रक्त चाप
- नाइट्रेट-नवजात शिशुओं में ब्लू बेबी बीमारी (मेथमोग्लोबिनिमिया)
- कैल्शियम-जोड़ों में कड़ापन
- सल्फेट-अधिकता में मैग्नेशियम के साथ मिलकर दस्तावर
- आर्सेनिक-त्वचा रोग, कैंसर
- आयरन-आयरन जीवाणु से आमाशय संबंधी रोग
- लेड-बच्चों के शारीरिक व मानसिक विकास में बाधा वयस्कों में गुर्दे के 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

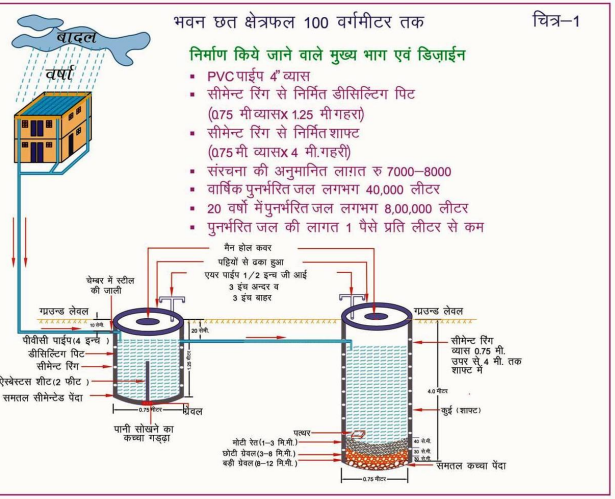
भूजल अमूल्य है इसे प्रदूषित न करें।

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 वर्षों में पुनर्भरित जल लगभग 8,00,000 लीटर
- पुनर्भरित जल की लागत 1 पैसे प्रति लीटर से कम

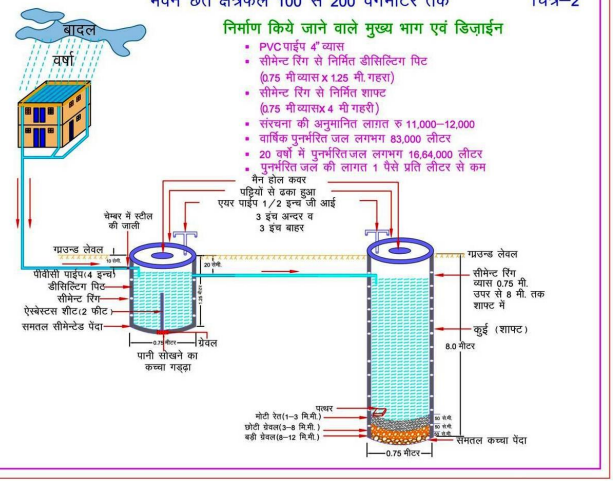


चित्र–2

भवन छत क्षेत्रफल 100 से 200 वर्गमीटर तक

निर्माण किये जाने वाले मुख्य भाग एवं डिज़ाईन

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

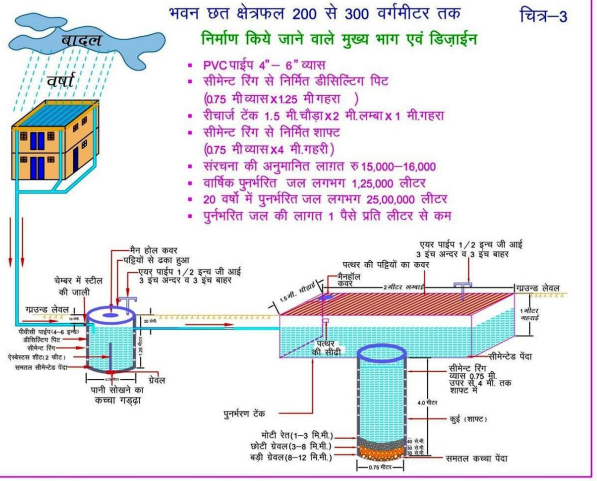


चित्र–3

भवन छत क्षेत्रफल 200 से 300 वर्गमीटर तक

निर्माण किये जाने वाले मुख्य भाग एवं डिज़ाईन

- PVC पाईप 4" – 6" व्यास
- सीमेन्ट रिंग से निर्मित डीसिल्टिंग पिट (0.75 मी.व्यास x 1.25 मी.गहरा)
- रीचार्ज 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 वर्षों में पुनर्भरित जल लगभग 25,00,000 लीटर
- पुनर्भरित जल की लागत 1 पैसे प्रति लीटर से कम

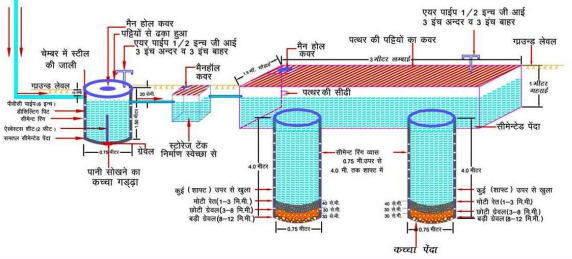


चित्र–4

भवन छत क्षेत्रफल 300 से 500 वर्गमीटर तक

निर्माण किये जाने वाले मुख्य भाग एवं डिज़ाईन

- PVC पाईप 6" व्यास
- सीमेन्ट रिंग से निर्मित डीसिल्टिंग पिट (0.75 मी.व्यास x 1.50 मी.गहरा)
- रीचार्ज 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 वर्षों में पुनर्भरित जल लगभग 40,00,000 लीटर
- पुर्नभरित जल की लागत 1 पैसे प्रति लीटर से कम



ROLTA
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

Rolta India Limited

Central & Registered Office
Rolta Tower A,
Rolta Technology Park,
MIDC, Andheri (East),
Mumbai - 400 093
Tel : +91 (22) 2926 6666, 3087 6543
Fax : +91 (22) 2836 5992
Email : indsales@rolta.com

www.rolta.com