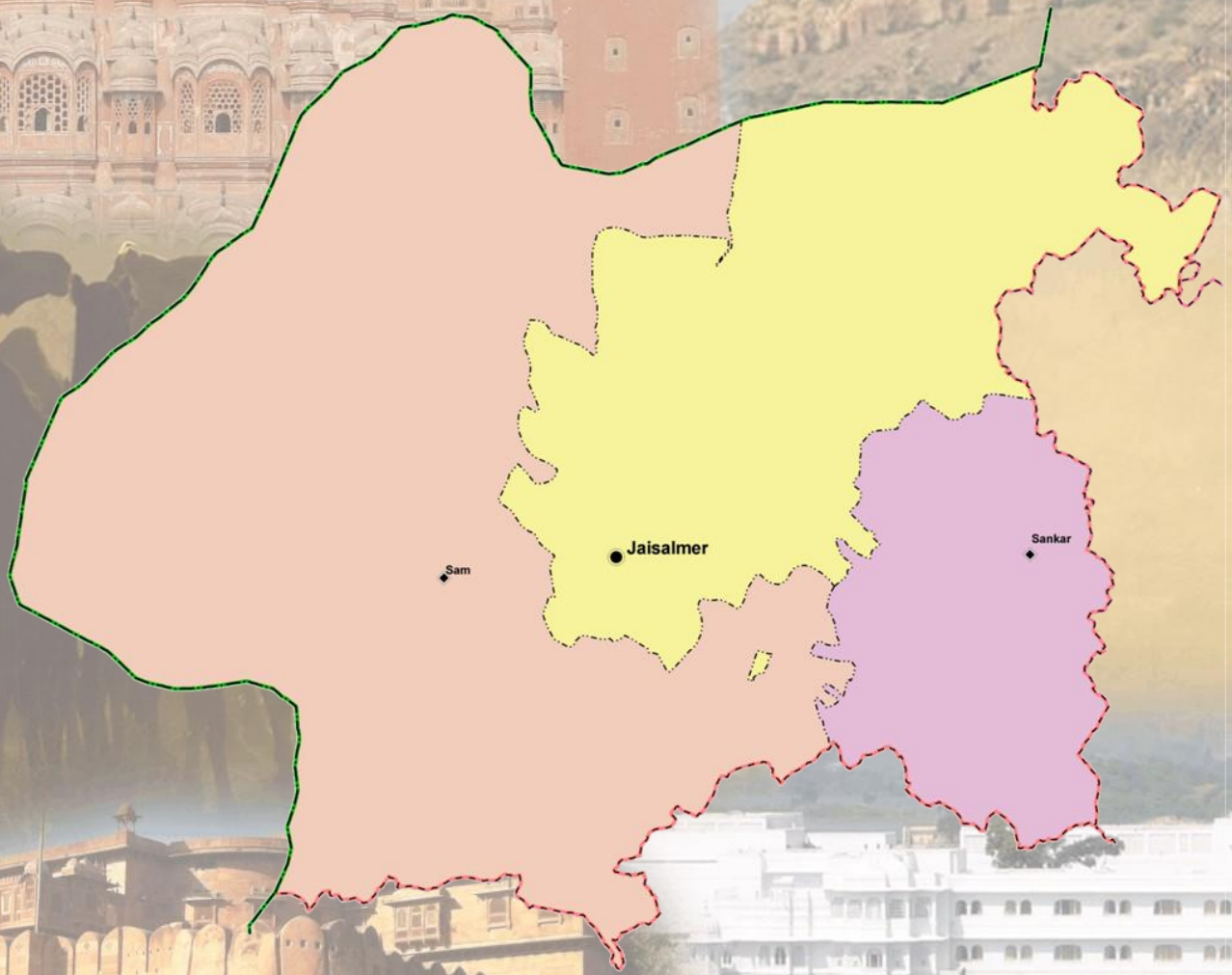
Ground Water Department,
Rajasthan

Hydrogeological Atlas of Rajasthan

Jaisalmer District

European Union
State Partnership Programme



2013

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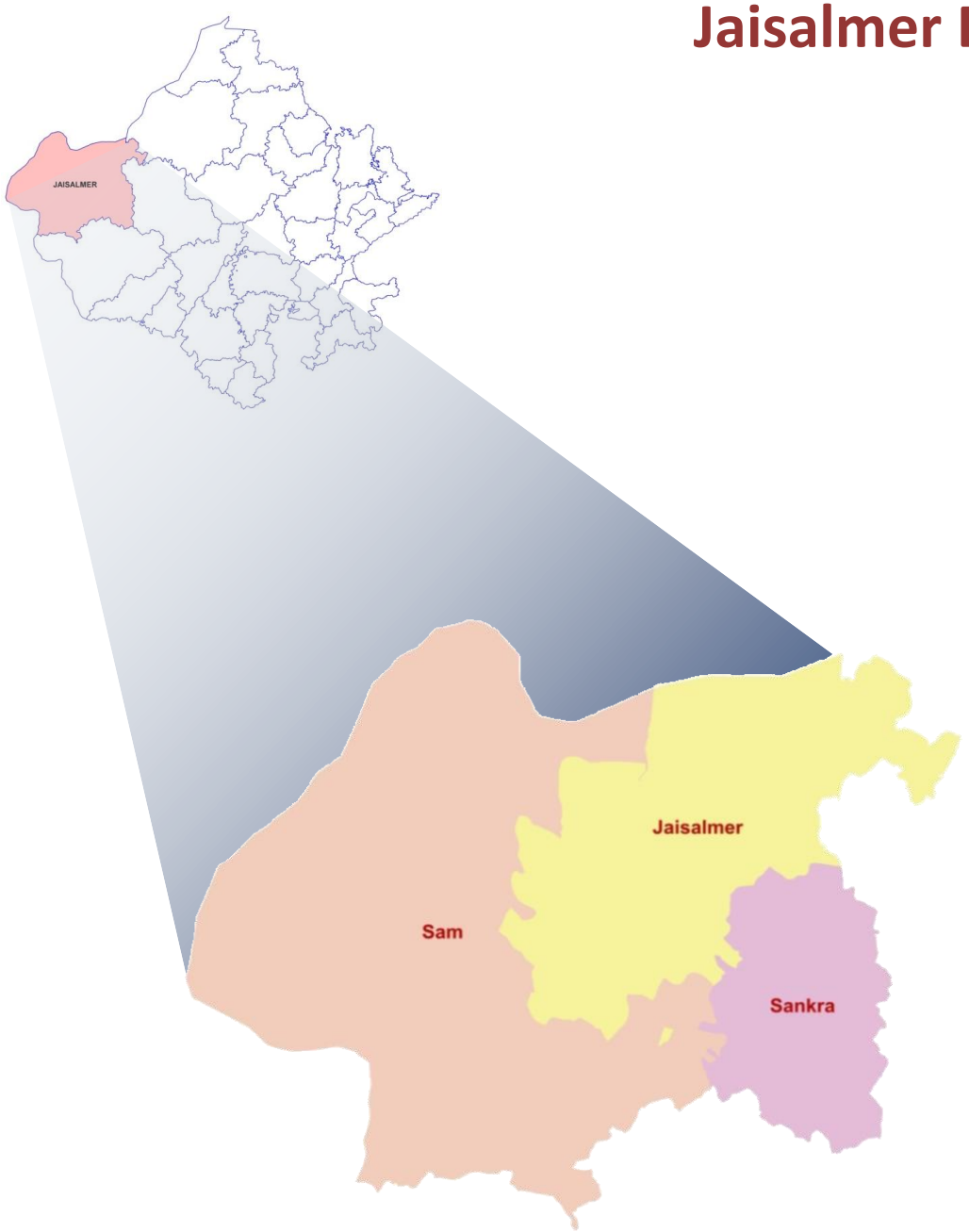
Hydrogeological Atlas of Rajasthan

Jaisalmer District



Contents:

2013

ADMINISTRATIVE SETUP

DISTRICT – JAISALMER

Location:

Jaisalmer district is located in the western part of Rajasthan. It is bounded in the north and west by Pakistan, in the east by Jodhpur district and in south by Barmer district. It stretches between 25° 58' 12.47" to 28° 04' 45.94" north latitude and 69° 25' 31.11'' to 72° 22' 35.22'' east longitude covering an approximate area of 38,487.2 sq kms. Major part of the district does not have a systematic drainage system, so whole district is part of an 'Outside' Basin.

Administrative Set-up:

Jaisalmer district is administratively divided into three 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	Jaisalmer	1,88,659	11,657.2	30.3	156
2	Sam	1,38,297	21,453.8	55.7	303
3	Sankra	1,81,291	5,376.2	14.0	180
Total		**5,08,247**	**38,487.2**	**100.0**	**639**

Jaisalmer district has 639 towns and villages, of which three are block headquarters as well.

Climate:

Jaisalmer is the most arid district of mainland India and almost entirely a sandy waste, forming a part of the Great Indian Thar desert. The general aspect of the area is that of an interminable sea of sand hills, of all shapes and sizes. The maximum summer temperature is around 41.6 °C while the minimum is 25 °C. The maximum winter temperature is usually around 23.6 °C and the minimum is 7.9 °C. The average rainfall is 176.0 mm. Highest ever recorded temperature was 48.0 °C and the lowest ever recorded temperature being −5.9 °C. Rainfall is negligible and the number of rainy days is very few during the months of July to September.

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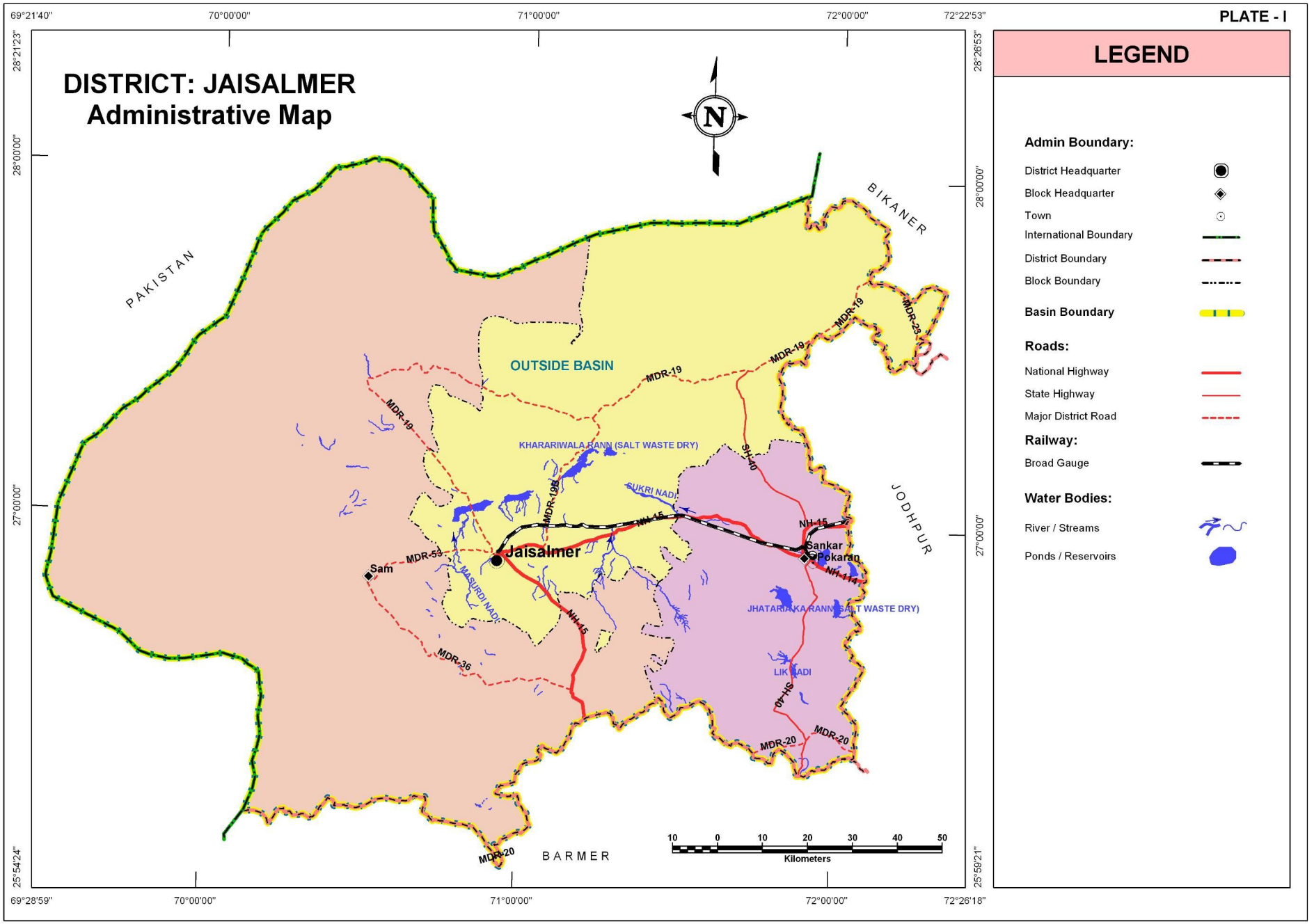
PLATE - I



LEGEND

Admin Boundary:

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

Basin Boundary

Roads:

- National Highway
- State Highway
- Major District Road

Railway:

- Broad Gauge

Water Bodies:

- River / Streams
- Ponds / Reservoirs

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TOPOGRAPHY

DISTRICT – JAISALMER

Jaisalmer district is a part of the Great Indian Thar Desert, is sandy and dry. Topographically the area is undulating with sand dunes. In general the area is a sandy plain with few rocky patches and mostly sand dunes. The ridges usually are parallel to the direction of the wind. Jaisalmer falls within 'Outside Basin'. There is no prominent drainage system, except a few streams which are purely ephemeral and are inland drainage. Masurdi River is the notable streams of the district. General elevation in sandy plain area is 100 m above mean sea level to 150 m amsl and in Center, South and Southeast direction it is 250m amsl to 300m amsl. Elevation ranges minimum of 36.7m amsl in Sam block in the western part of the district and maximum of 346.9m amsl is also within eastern part of Sam block itself.

Table: Block wise minimum and maximum elevation

S. No.	Block Name	Minimum Elevation (m amsl)	Maximum Elevation (m amsl)
1	Jaisalmer	94.7	332.0
2	Sam	36.7	346.9
3	Sankra	183.5	334.1

RAINFALL

The rainfall of the district is very scanty and erratic. The general distribution of rainfall across can be visualized from isohyets presented in the Plate – III where west parts of the district received rainfall in the range of 200 – 300 mm gradually increasing towards east per year 2010 rainfall data. The average annual rainfall was 364.8 mm based on the data of available blocks while highest average annual rainfall was 474.2 mm in Sankra block. Lowest annual rainfall was in Sam block (212.8 mm). Sankra block has received highest maximum annual rainfall of about 539.2 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)
Jaisalmer	250.1	452.7	345.1
Sam	212.8	438.4	275.1
Sankra	412.2	539.2	474.2

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Rajasthan

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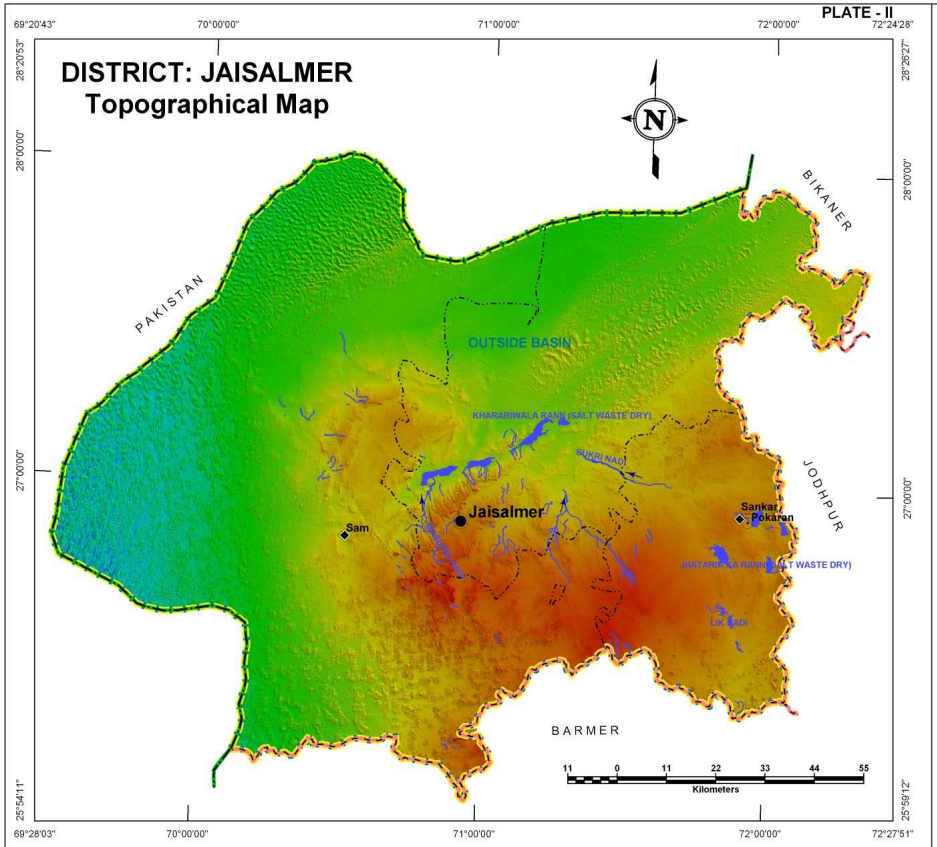
PLATE - II



LEGEND

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

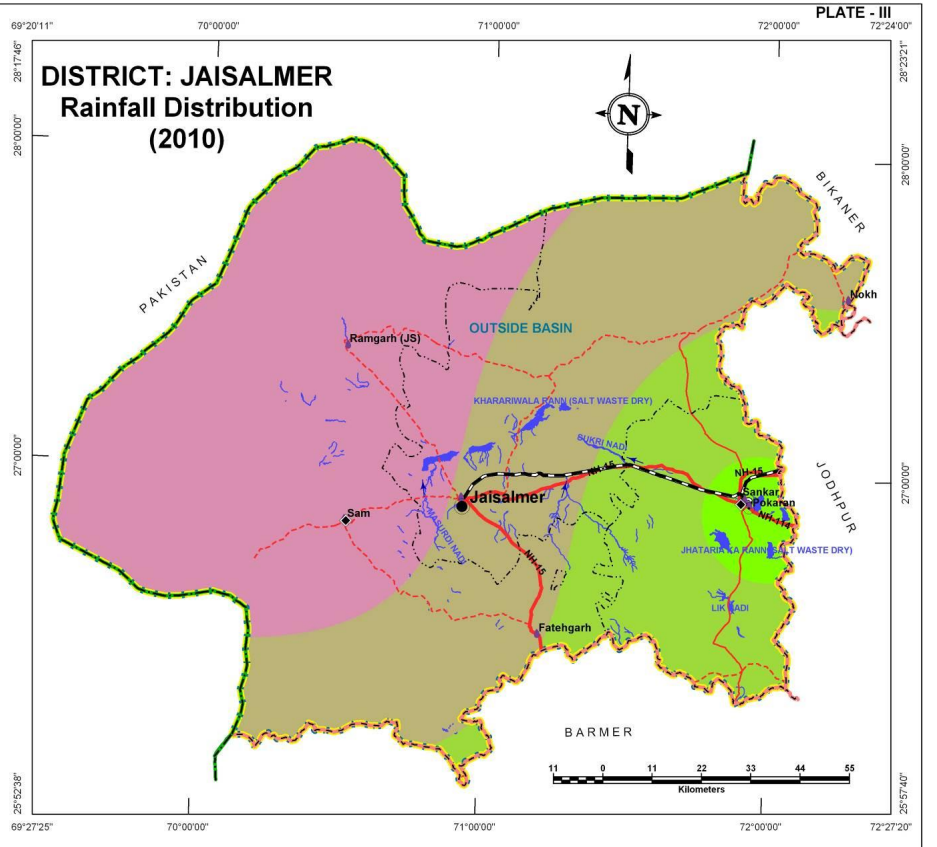
Basin Boundary

Water Bodies:
- River / Streams
- Ponds / Reservoirs

Elevation (m amsl):
347, 300, 250, 200, 150, 100, 50, 37

Source : SRTM DEM

PLATE - III



LEGEND

Admin Boundary:
- District Headquarter
- Block Headquarter
- Town
- Raingauge Stations
- International Boundary
- District Boundary
- Block Boundary

Basin Boundary

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

Railway:
- Broad Gauge

Water Bodies:
- River / Streams
- Ponds / Reservoirs

Isohyets (mm):
- 200-300
- 300-400
- 400-500
- 500-600

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GEOLOGY &GEOMORPHOLOGY

DISTRICT – JAISALMER

Geology:

Geologically, the major part of the district is covered by Alluvium and wind-blown sand. It is one of the largest districts of India. The basement rocks are the metamorphites granites and rhyolites; they are unconformably overlain by dolomitic limestone, shale and sandstone of the MarwarSuper Group. Resting over these with unconformity are the Jurassic rocks made up of the Lathi, Jaisalmer, Baisakhi and Bhadesar formation. These are followed by rocks of Parewar and Abur formation. Sumer formation consists of unconsolidated highly current bedded reddish, gluconitic sandstone and silty sandstone. Khuiala formation consists of limestone boulder bedded fossiliferous limestone and shales.

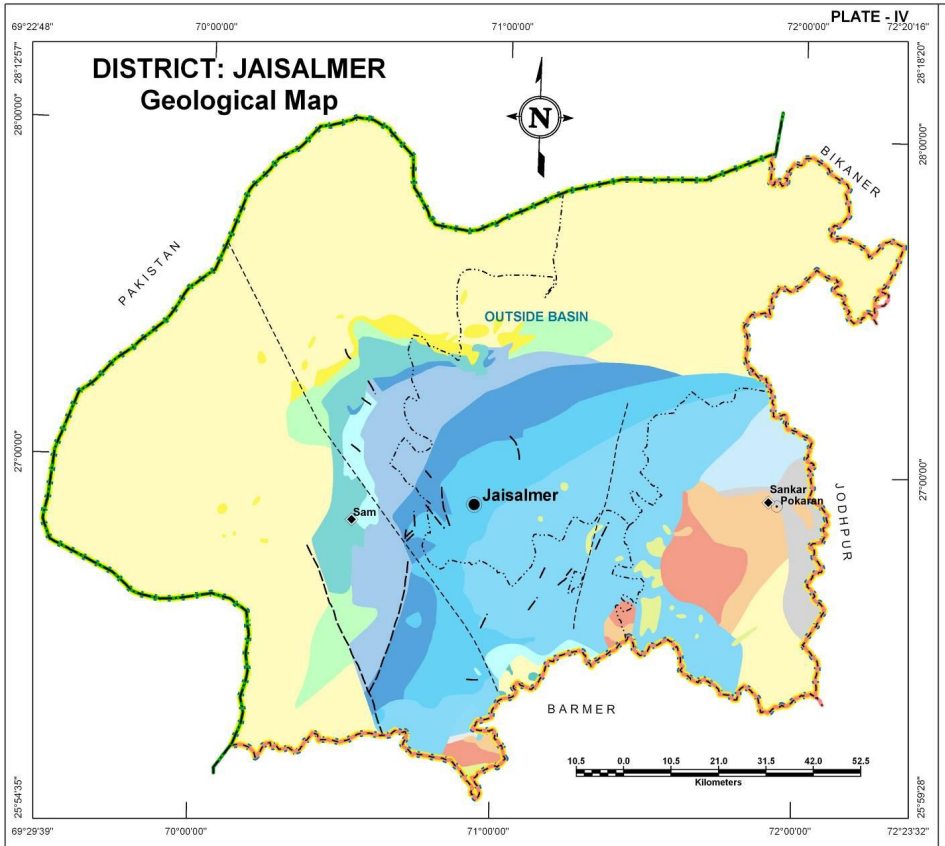
Age/Super Group	Group/Series	Formation
Recent to Sub-Recent	Alluvium and Sand dunes	Blown sand, silt, gravel
-------X--------X--------X---Unconformity---X--------X--------X-------		
Paleocene to Eocene	Sumar Series	Sandstone
	Bandha Series	Limestone, bentonitic clay, Fuller's earth and lignite seams
	Khuiala Series	
-------X--------X--------X---Unconformity---X--------X--------X-------		
Cretaceous	Abur Series	Sandstone, limestone, clay and lignite
	Parewar Series	
-------X--------X--------X---Unconformity---X--------X--------X-------		
Mesozoic	Bhadesar Series	Ferruginous sandstone
	Baisakhi formation	Calcareous sandstone
	Jaisalmer formation	Fossiliferous limestone, sandstone, etc.
	Lathi formation	Sandstone, shale, etc.
-------X--------X--------X---Unconformity---X--------X--------X-------		
		Birmania formation
-------X--------X--------X---Unconformity---X--------X--------X-------		
		Randha formation
-------X--------X--------X---Unconformity---X--------X--------X-------		
Marwar		Malanivolcanics and Jalore granite

Geomorphology:

Table: Geomorphologic units, their description and distribution

Origin	Landform Unit	Description
Aeolian	Desert Pavement	Flat barren stony desert plain having coarse, angular, wind polished gravel and small stones lying on rock cut surface.
	Dune Complex	An undulating plain composed of number of sand dunes of crescent shape.
	Dune Valley Complex	Cluster of dunes and interdunal spaces with undulating topography formed due to wind-blown activity, comprising of unconsolidated sand and silt.
	Eolian Plain	Formed by aeolian activity, with sand dunes of varying height, size, and slope. Long stretches of sand sheet. Gently sloping flat to undulating plain, comprised of fine to medium grained sand and silt. Also scattered xerophytic vegetation.
	Interdunal Flat	Flat, narrow land between dunes.
Denudat-ional	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.
	Pediplain	Coalescence and extensive occurrence of pediment.
Fluvial	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.
	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
- International Boundary
- District Boundary
- Block Boundary

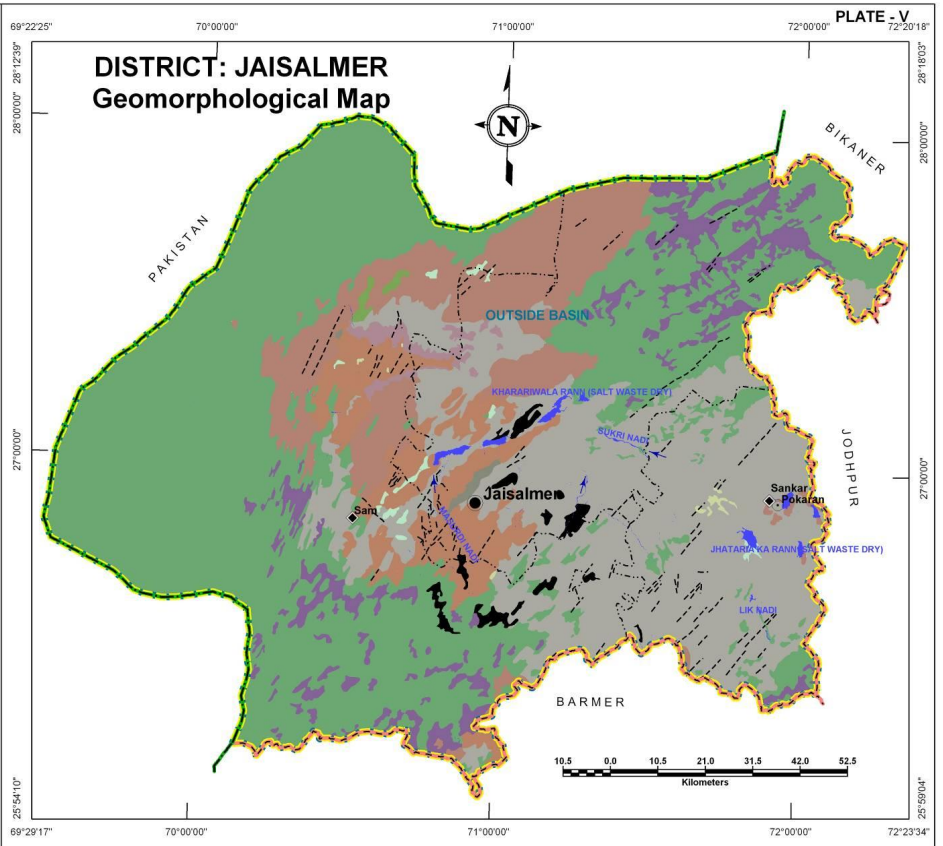
Basin Boundary

Structural Features:
- Fault
- Lineament

Geology:
- Alluvium and Wind blown sand
- Shumar Formation
- Phalsund Formation
- Bandah Formation
- Khuiala Formation
- Mandai Formation
- Sanu Formation
- Abur Formation
- Fatehgarh Formation
- Pariwar (Parihar) Formation
- Badesar Formation
- Baisakhi Formation
- Jaisalmer Formation
- Lathi Formation
- Bilara Group
- Jodhpur Group
- Birmania Formation
- Randa Formation
- Malani Plutonic
- Volcanic Suite
- Erinpura Granite & Gneiss

Source: District Resource Map of Rajasthan - GSI

PLATE - V



LEGEND

Admin Boundary:
- District Headquarter
- Block Headquarter
- Town
- International 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:
- Valley Fill
- Salt Encrustation/Playa

Denudational Origin:
- Pediment
- Pediplain

Aeolian Origin:
- Eolian Plain
- Dune Complex
- Dune Valley Complex
- Interdunal Flat
- Desert Pavement

Structural Origin:
- Plateau

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

AQUIFERS

DISTRICT – JAISALMER

Aquifers area formed in the district mainly within Alluvium and Sandstone, and partly in Rhyolite and Granite. Of all aquifer forming materials Younger alluvium is most prominent occupying about 37% of the district area forming northern and western fringes. This is followed by different sandstones accounting for about 54% area spread over most of central, southern and eastern parts of the district. Rhylites for about 7% of aquifers in the district in the eastern part and small aquifers in the east and south are formed by granites.

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	14,169.6	36.8	It is largely constituted of Aeolian and Fluvial sand, silt, clay, gravel and pebbles in varying proportions.
Tertiary Sandstone	7,410.5	19.3	Medium to coarse grained, consolidated to semi consolidated sandstone.
Nagaur& Jodhpur Sandstone	367.5	1.0	Buff to reddish brown in colour, fine to medium grained hard and compact sandstone.
Parewar Sandstone	1,285.4	3.3	It is feldspathic ferruginous sandstone.
Sandstone	11,618.9	30.2	Fine to medium grained, red colour and compact and at places.
Rhyolite	2,582.9	6.7	Rhyolite is porphyritic and has phenocryst of quartz and feldspar.
Granite	1,052.4	2.7	Light grey to pink colour, medium to coarse grained, and characteristically have porphyritic texture.
Total	**38,487.2**	**100.0**	

STAGE OF GROUND WATER DEVELOPMENT

Ground water resource assessment studies carried out in the district have helped in categorizing the different blocks based on the stage of development. In Jaisalmer district of the three blocks, the Sam block falls into 'Critical' category indicating that the development of ground water is close to 100% whereas the other two blocks are already under 'Over Exploited' category suggesting that no further development should be done to prevent depletion of this resource.

Categorization on the basis of stage of development of ground water	Block Name
Critical	Sam
Over Exploited	Sankra, Jaisalmer

Basis for categorization: Ground water development <=100% - Critical and >100% - Over-Exploited.

PLATE - VI

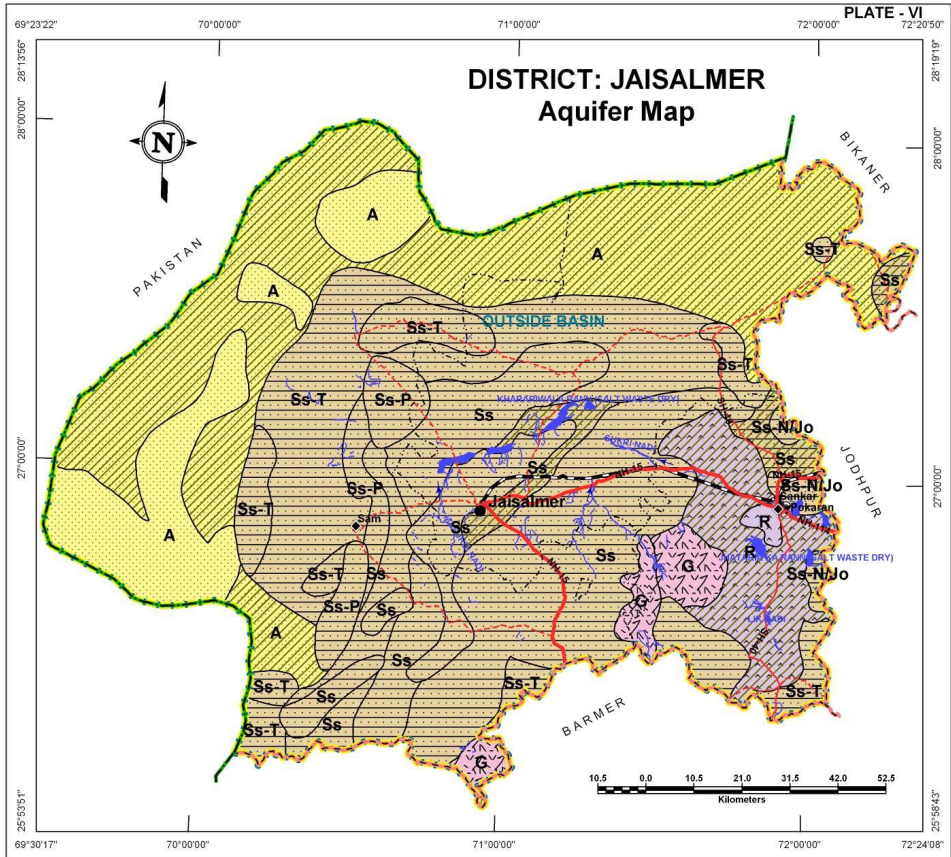
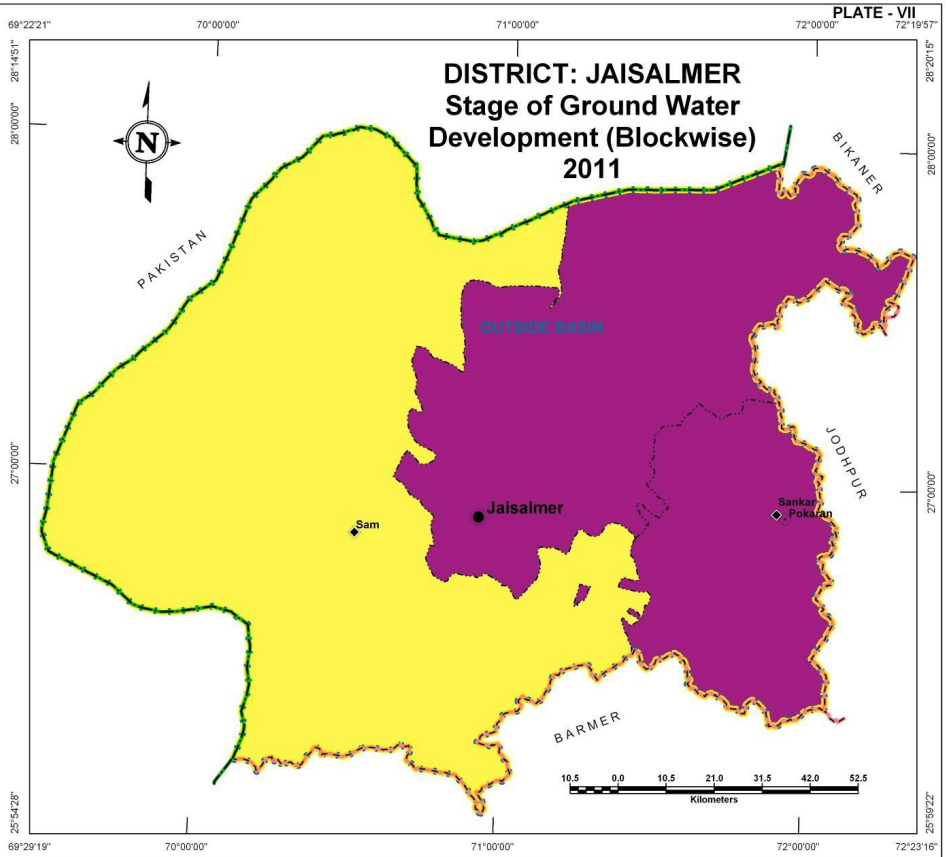


PLATE - VII



LEGEND

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

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

Railway:
- Broad Gauge

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

Aquifer:
- Younger Alluvium
- Tertiary Sandstone
- Nagaur & Jodhpur Sandstone
- Parewar Sandstone
- Sandstone
- Rhyolite
- Granite

Source: Ground Water Potential Zone Map - GWD, Rajasthan

LEGEND

Admin Boundary:
- District Headquarter
- Block Headquarter
- Town
- International 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 – JAISALMER

There is a well distributed network of exploratory wells (99) and ground water monitoring stations (319) in the district owned by RGWD (49and 223 respectively) and CGWB (50 and 96 respectively) in Jaisalmer district. The exploratory wells have formed the basis for delineation of subsurface aquifer distribution scenario in three dimensions. Benchmarking and optimization studies suggest that both ground water level and quality monitoring networks need to be strengthened by 297 and 13 additional wells respectively.

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
Jaisalmer	16	14	**30**	34	75	**109**	96	7
Sam	34	24	**58**	41	85	**126**	168	4
Sankra	-	11	**11**	21	63	**84**	33	2
Total	**50**	**49**	**99**	**96**	**223**	**319**	**297**	**13**

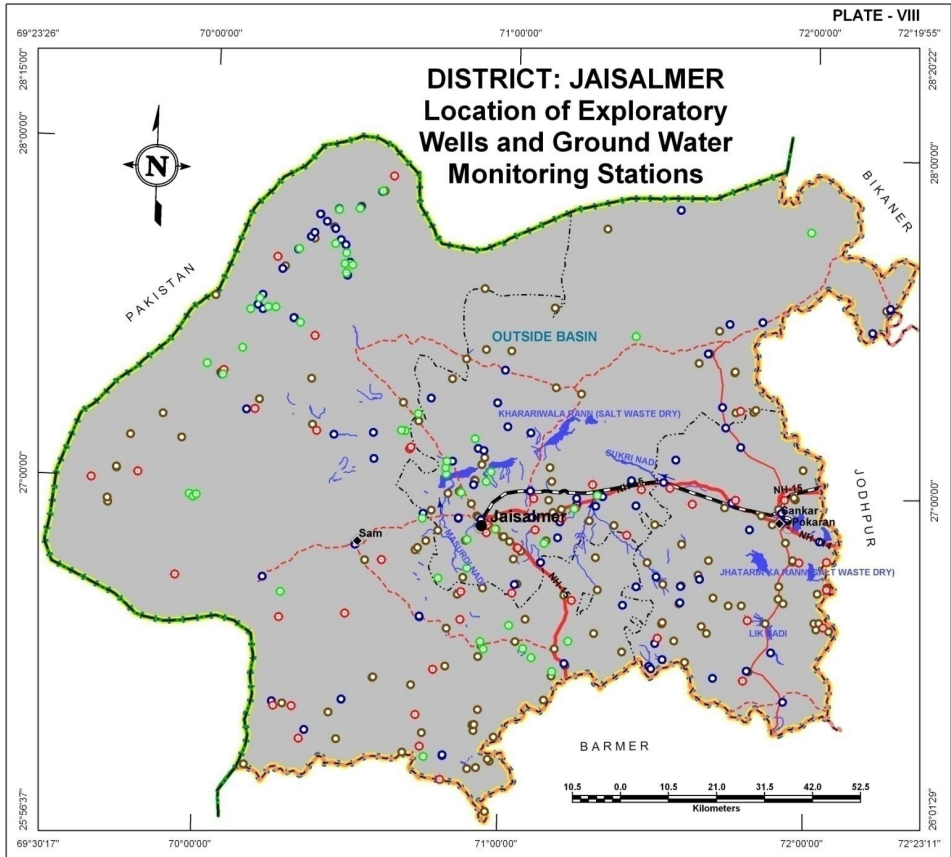
DEPTH TO WATER LEVEL (PRE MONSOON – 2010)

Depth to water level shows large variation, ranging from less than 10m below ground level to more than 130m bgl. Most of the hardrock area (granite and rhyolite) parts falling within Sankra block the ground water occur at shallow depth ranging from less than 10m bgl to around 90m bgl. There are also shallow water zones in northeastern and central parts of Jaisalmer block and in isolated patches in Sam block where the depth to water level is less (<10m bgl to about 70m bgl). In the sandstone aquifer, ground water generally occurs at deeper levels i.e., beyond 70m bgl and reaching even upto 130m bgl in major part of Sam block in southern part and central part of Jaisalmer block.

Block Name	Block wise area coverage (sq km) with depth to water level range (m gbl) *														Total Area (sq km)
	< 10	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60	60 – 70	70 – 80	80 – 90	90 – 100	100 – 110	110 – 120	120 – 130	> 130	
Jaisalmer	234.8	2,215.2	3,137.3	89.1	4,154.3	544.2	434.5	343.1	185.9	150.7	88.4	48.0	25.9	5.8	**11,657.2**
Sam	6.7	135.5	239.4	257.8	9,018.1	3,292.8	2,525.3	1,691.4	2,043.9	1,304.2	599.4	303.9	35.4	-	**21,453.8**
Sankra	235.1	1,738.4	1,252.1	474.6	654.0	549.7	375.3	94.4	2.6	-	-	-	-	-	**5,376.2**
Total	476.6	4,089.1	4,628.8	821.5	13,826.4	4,386.7	3,335.1	2,128.9	2,232.4	1,454.9	687.8	351.9	61.3	5.8	**38,487.2**

* 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
- International Boundary
- District Boundary
- Block Boundary
- **Basin Boundary**

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

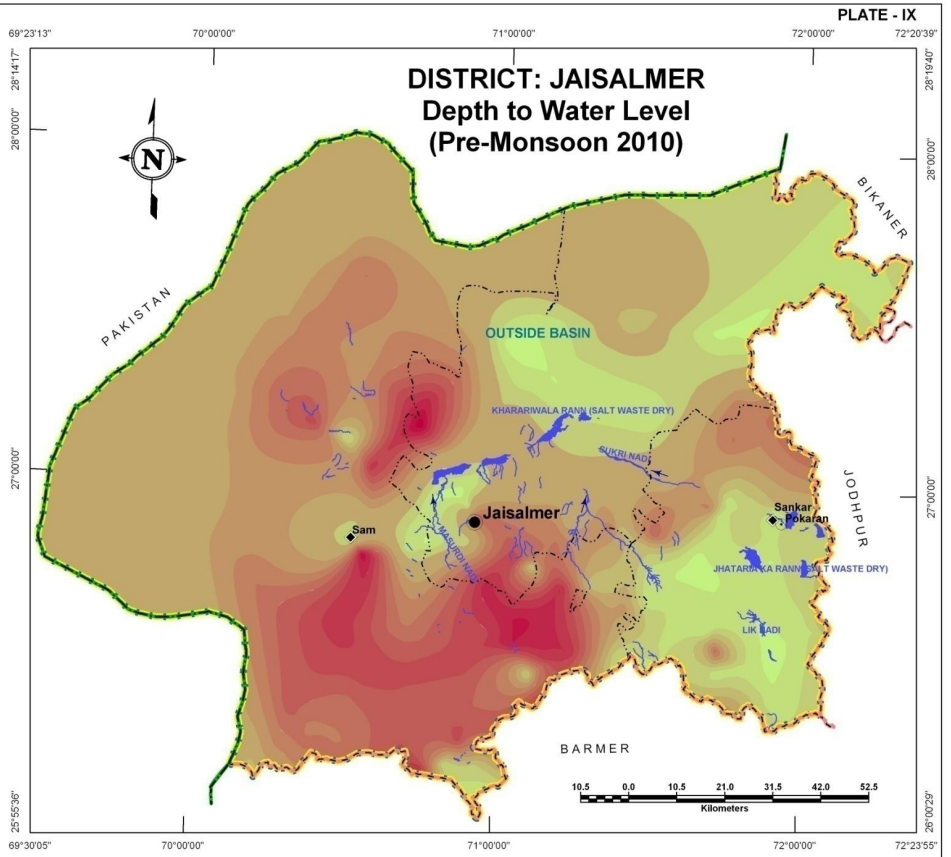
Railway:
- Broad Gauge

Water Bodies:
- River / Streams
- Ponds / Reservoirs

Exploratory Wells:
- CGWB
- RGWD

Ground Water Monitoring Stations:
- CGWB
- RGWD

PLATE - IX



LEGEND

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

Water Bodies:
- River / Streams
- Ponds / Reservoirs

Depth to Water Level(m bgl):

<10	70 - 80
10 - 20	80 - 90
20 - 30	90 - 100
30 - 40	100 - 110
40 - 50	110 - 120
50 - 60	120 - 130
60 - 70	> 130

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

The district falls within The Great Indian Thar Desert. The water table elevation range is very high. The regional flow direction thus is from east/southeast to westwards. Water table elevation highest reaching up to >280m amsl in Southeast part (Pokaran Block) of the district whereas minimum elevation (<20m amsl) in the Sam block. The flow gradient is quite steep in the high elevation areas and gradually flattens towards west.

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

Block Name	Block wise area coverage (sq km) per Water table elevation range (m amsl)															Total Area (sq km)
	< 20	20 - 40	40 - 60	60 - 80	80 - 100	100 - 120	120 - 140	140 - 160	160 - 180	180 - 200	200 - 220	220 - 240	240 - 260	260 - 280	> 280	
Jaisalmer	-	-	-	-	2,014.5	2,166.6	2,571.9	2,977.9	1,298.2	480.5	141.5	6.1	-	-	-	**11,657.2**
Sam	52.2	4,232.9	5,251.4	3,859.5	2,229.0	1,049.0	1,004.6	1,611.5	1,095.2	282.7	180.2	299.5	181.0	92.4	32.7	**21,453.8**
Sankra	-	-	-	-	-	-	-	375.1	607.6	630.1	839.7	1,582.6	608.6	451.9	280.6	**5,376.2**
Total	**52.2**	**4,232.9**	**5,251.4**	**3,859.5**	**4,243.5**	**3,215.6**	**3,576.5**	**4,964.5**	**3,001.0**	**1,393.3**	**1,161.4**	**1,888.2**	**789.6**	**544.3**	**313.3**	**38,487.2**

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 to rise of more than 12m in the district, as seen in Plate – XI. The –ve fluctuation areas (indicated by pink and red regions) are the areas where overexploitation is taking place and even after monsoon recharge water level has not risen and has actually gone down with respect to pre-monsoon levels. Such large ground water depletion areas are located in northern, central and southern part of the district. Remaining part 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 12m is noticed in the central part of the Sam block.

Table: Block wise area covered in each water fluctuation zone

Water level fluctuation range (m)	Block wise area coverage (sq km)			Total Area (sq km)
	Jaisalmer	Sam	Sankra	
< -4	-	-	64.3	**64.3**
-4 -2	20.5	327.2	77.1	**424.8**
-2 – 0	4,638.40	3,864.70	787.3	**9,290.4**
0 – 2	6,402.9	15,057.8	2,872.9	**24,333.6**
2 – 4	411.4	1,471.0	1,256.3	**3,138.7**
4 – 6	127.9	470.2	269.6	**867.7**
6 – 8	31.4	169.7	42.4	**243.5**
8 – 10	16.3	43.9	6.3	**66.5**
10 – 12	7	32.5	-	**39.5**
> 12	1.4	16.8	-	**18.2**
Total	**11,657.2**	**21,453.8**	**5,376.2**	**38,487.2**

PLATE - X

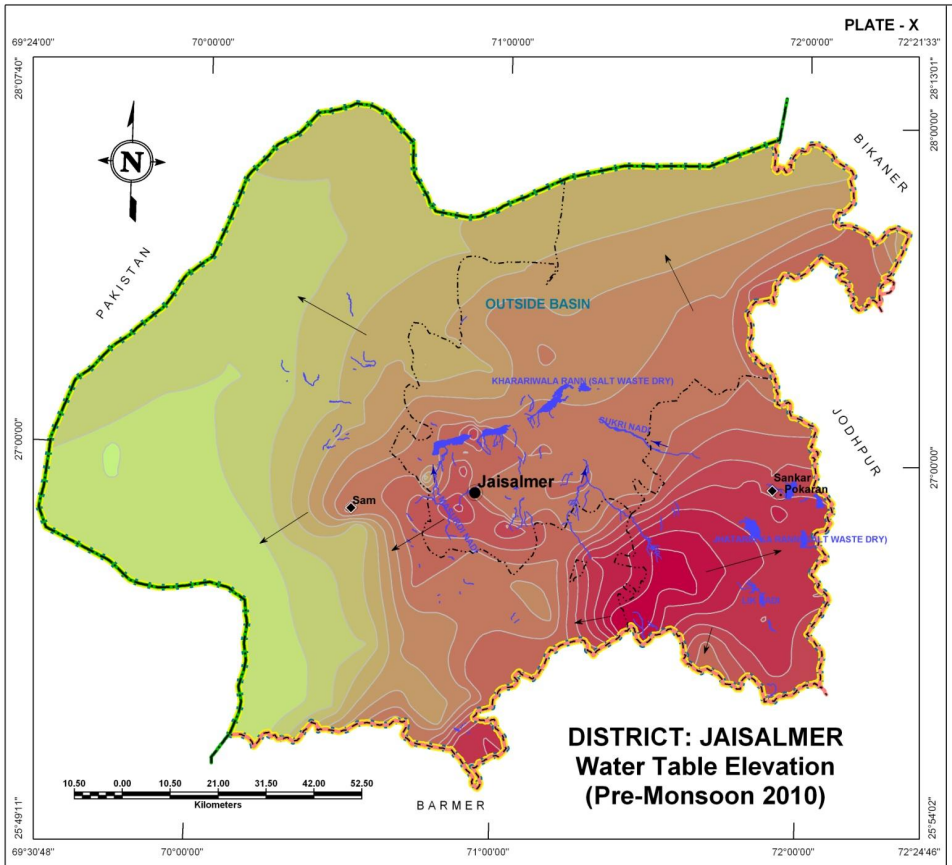
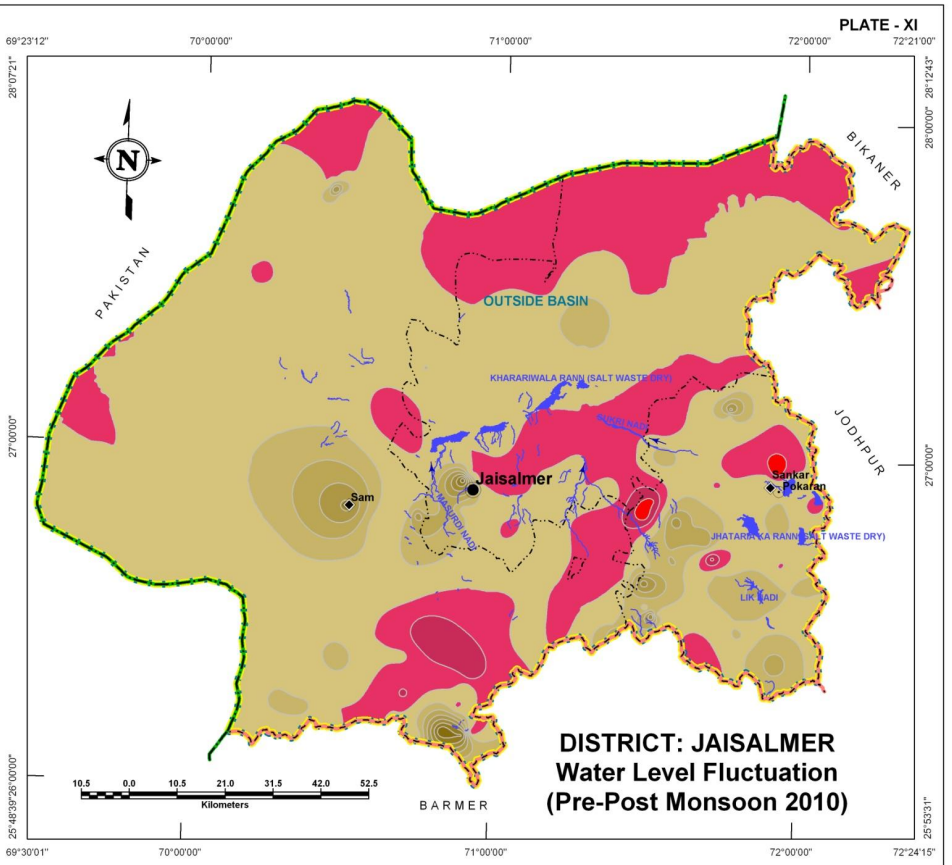


PLATE - XI



Admin Boundary:

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

Basin Boundary

Water Bodies:

- River / Streams
- Ponds / Reservoirs

Water Table Elevation

Water Table Elevation (m amsl):

< 20	160 - 180
20 - 40	180 - 200
40 - 60	200 - 220
60 - 80	220 - 240
80 - 100	240 - 260
100 - 120	260 - 280
120 - 140	>280
140 - 160	

Admin Boundary:

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

Basin Boundary

Water Bodies:

- River / Streams
- Ponds / Reservoirs

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

GROUND WATER ELECTRICAL CONDUCTIVITY DISTRIBUTION DISTRICT – JAISALMER

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 occupy approximately 47% of the district area. The areas with high EC values (>4000 µS/cm) are shown in red color and occupies 45% of the district area, which is not suitable for domestic purpose. Remaining small part of the district approximately 6% has low EC values in ground water (<2000 µS/cm) is shown in yellow color, largely eastern part of Jaisalmer where the ground water is 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)
	Jaisalmer		Sam		Sankra		
	Area	%age	Area	%age	Area	%age	
<2000	1,155.2	9.9	1,429.9	6.7	406.7	7.6	**2,991.8**
2000-4000	6,688.8	57.4	8,763.1	40.8	2,753.2	51.2	**18,205.1**
>4000	3,813.2	32.7	11,260.8	52.5	2,216.3	41.2	**17,290.3**
Total	**11,657.2**	**100.0**	**21,453.8**	**100.0**	**5,376.2**	**100.0**	**38,487.2**

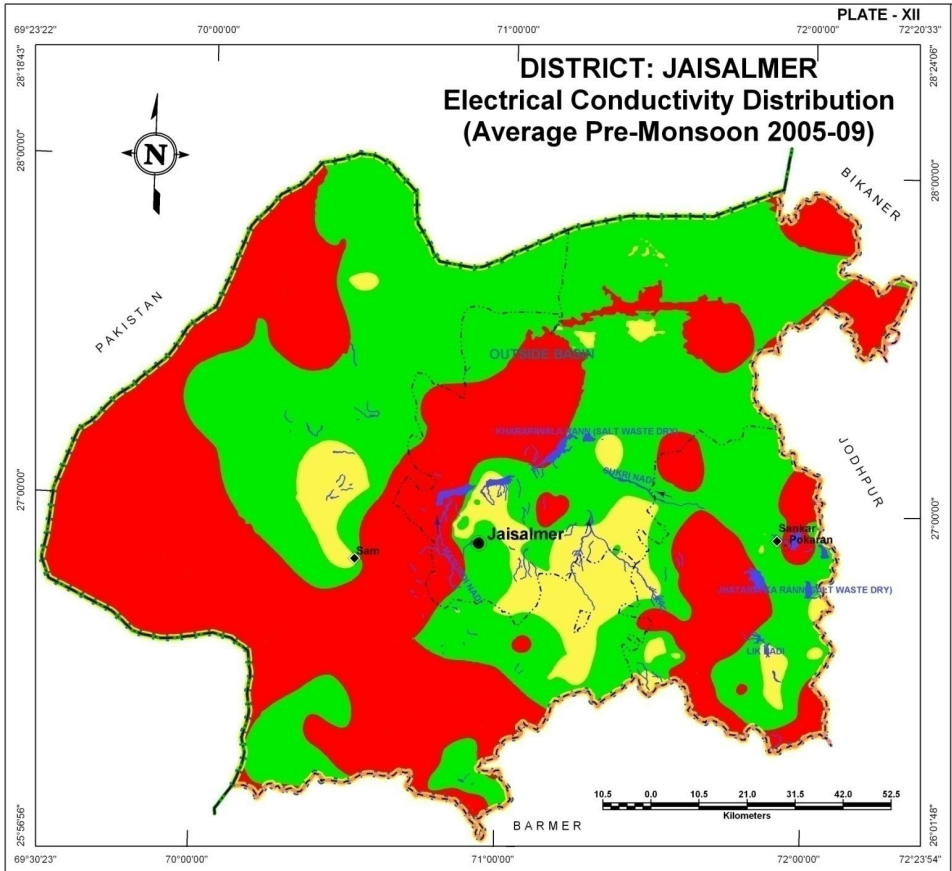
GROUND WATER CHLORIDE DISTRIBUTION

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 53% of the district area and are not suitable for domestic purpose. The areas with high chloride concentration (>1000mg/l) are shown in red color and occupies approximately 44% of the district area, which is not suitable for domestic purpose. Remaining small part of the district approximately 2% falls under low chloride concentration (<250 mg/l) is shown in yellow color, largely southeastern part of Jaisalmer where the ground water is 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)
	Jaisalmer		Sam		Sankra		
	Area	%age	Area	%age	Area	%age	
< 250	432.3	4.0	479.3	2.0	28.9	1.0	**940.5**
250-1000	6,983.9	60.0	9,556.5	45.0	3,977.5	74.0	**20,517.9**
> 1000	4,241.0	36.0	11,418.0	53.0	1,369.8	25.0	**17,028.8**
Total	**11,657.2**	**100.0**	**21,453.8**	**100.0**	**5,376.2**	**100.0**	**38,487.2**

PLATE - XII



LEGEND

Admin Boundary:

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

Basin Boundary

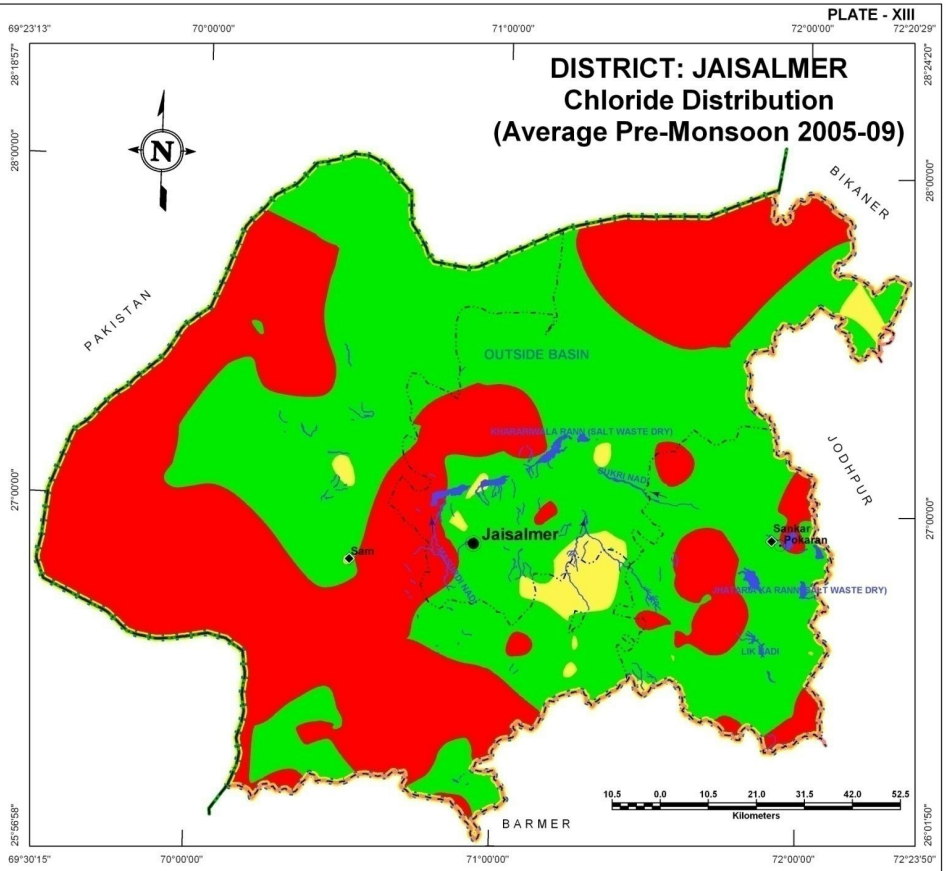
Water Bodies:

- River / Streams
- Ponds / Reservoirs

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

- < 2000
- 2000-4000
- >4000

PLATE - XIII



LEGEND

Admin Boundary:

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

Basin Boundary

Water Bodies:

- River / Streams
- Ponds / Reservoirs

Chloride Concentration (mg/l):

- < 250
- 250 - 1000
- > 1000

GROUND WATER FLUORIDE DISTRIBUTION

DISTRICT – JAISALMER

The Fluoride concentration map is presented in Plate – XIV. The areas with low concentration (<1.5 mg/l) are shown in yellow color and occupies 28% of the district area mainly in the western parts and as small isolated patches in the eastern part, which are suitable for domestic purpose. The areas with moderately high fluoride concentration (1.5-3.0 mg/l) are shown in green color and occupy about 53% of the district and also the remaining 19% of the district which has high Fluoride concentration (>3.0 mg/l, shown in red color), spread all over the Jaisalmer district are unsuitable 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)
	Jaisalmer		Sam		Sankra		
	Area	%age	Area	%age	Area	%age	
< 1.5	1,716.4	14.7	7,500.9	35.0	1,598.8	29.7	**10,816.1**
1.5-3.0	5,373.9	46.1	12,011.4	56.0	3,003.0	55.9	**20,388.3**
> 3.0	4,566.9	39.2	1,941.5	9.0	774.4	14.4	**7,282.8**
Total	**11,657.2**	**100.0**	**21,453.8**	**100.0**	**5,376.2**	**100.0**	**38,487.2**

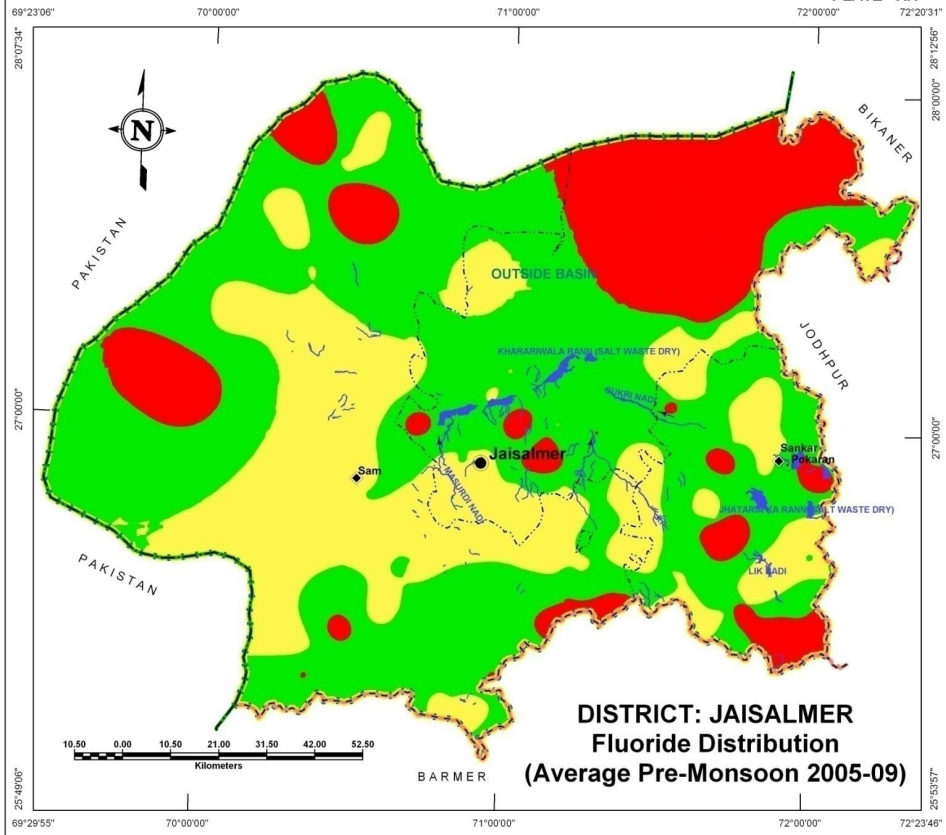
GROUND WATER NITRATE DISTRIBUTION

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 occupies approximately 41% of the district area which is suitable for agriculture purpose but significant part of it being arid, agriculture has a very limited feasibility. The areas with moderately high nitrate concentration (50-100 mg/l) are shown in green color occupy approximately 27% of the district area, largely western and northern part of the district. The eastern part of the district is slightly less arid but most of it falls within high nitrate concentration (>100 mg/l) areas shown in red colored patches. The district therefore has very limited potential for agriculture either in terms of ground water quality or soil and climatic conditions.

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)
	Jaisalmer		Sam		Sankra		
	Area	%age	Area	%age	Area	%age	
< 50	3,298.9	28.3	11,940.0	55.7	585.7	10.8	**15,824.6**
50-100	2,623.4	22.5	6,791.1	31.6	1,003.1	18.7	**10,417.6**
>100	5,734.9	49.2	2,722.7	12.7	3,787.4	70.5	**12,245.0**
Total	**11,657.2**	**100.0**	**21,453.8**	**100.0**	**5,376.2**	**100.0**	**38,487.2**

PLATE - XIV



DISTRICT: JAISALMER
Fluoride Distribution
(Average Pre-Monsoon 2005-09)

LEGEND

Admin Boundary:

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

Basin Boundary

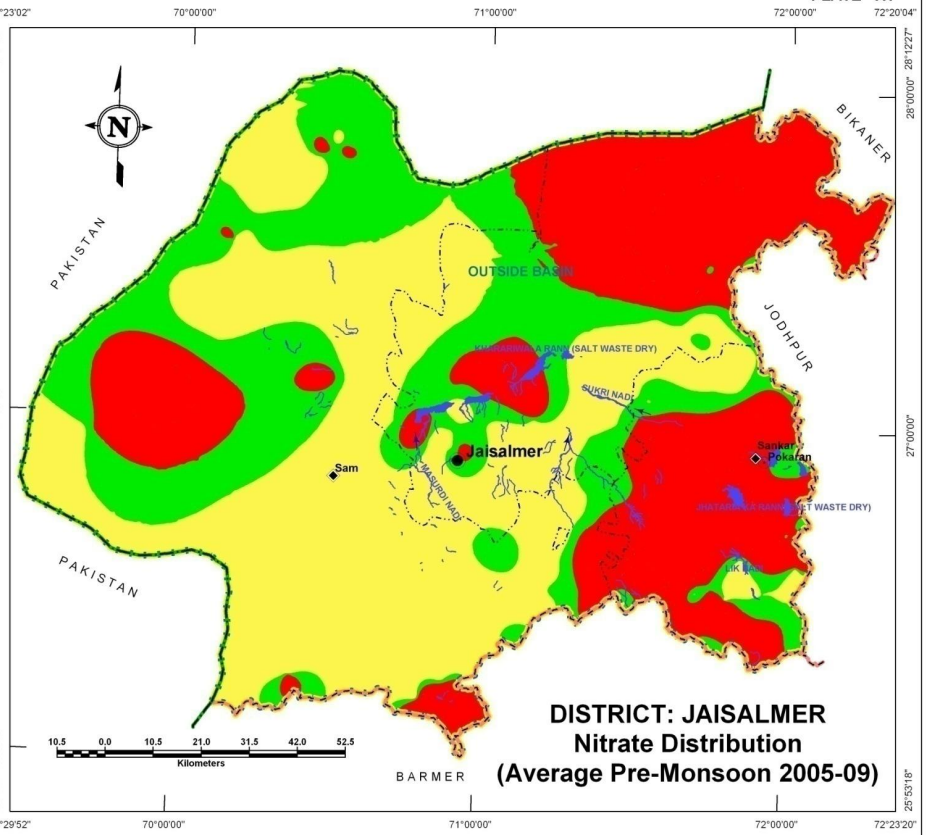
Water Bodies:

- River / Streams
- Ponds / Reservoirs

Fluoride Concentration (mg/l):

- < 1.5
- 1.5-3.0
- >3.0

PLATE - XV



DISTRICT: JAISALMER
Nitrate Distribution
(Average Pre-Monsoon 2005-09)

LEGEND

Admin Boundary:

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

Basin Boundary

Water Bodies:

- River / Streams
- Ponds / Reservoirs

Nitrate Concentration (mg/l):

- < 50
- 50-100
- >100

DEPTH TO BEDROCK & UNCONFINED AQUIFER

DISTRICT – JODHPUR

Depth to Bedrock

The thick alluvial deposits are underlain by bedrock of different lithology and age. Plate – XVI depicts the distribution of bedrock depth from ground level. The beginning of massive bedrock has been considered for defining top of bedrock surface. The major rocks types occurring in the district are Sandstones, Rhyolites and Grainites. These rocks are overlain by eolian/alluvial deposits of sand, silt and admixture of these in different proportions and thicknesses. The map of depth to bedrock in meters below ground level reveals that the bedrock surface is highly undulating in the southern part whereas is relatively even northeastwards. It varies from upto 40m bgl to more than 300m bgl. Shallow bedrock depth is found in the central most part of Jaisalmer block (less than 40 meter ground level). Deepest occurrence of bedrock (indicating high alluvial thickness) is found in south of Sam block of the order 260m bgl to more than 300m bgl. The rest area of the district are having moderately deep bedrock is less, of the order of <60 m bgl and often reaching depth of upto 260m bgl.

Depth to bedrock (m bgl)	Block wise area coverage (sq km)						Total Area (sq km)
	Jaisalmer		Sam		Sankra		
	Area	%age	Area	%age	Area	%age	
< 40	19.9	-	-	-	-	-	**19.9**
40 – 60	44.2	-	-	-	-	-	**44.2**
60 – 80	92.4	1.0	33.7	-	2,949.1	54.9	**3,075.2**
80 – 100	179.6	2.0	95.9	-	1,424.3	26.5	**1,699.8**
100 – 120	2,570.1	22.0	423.0	2.0	839.7	15.5	**3,832.8**
120 – 140	3,056.5	26.0	1,883.4	9.0	113.4	2.1	**5,053.3**
140 – 160	1,693.0	15.0	5,077.9	24.0	33.3	0.6	**6,804.2**
160 – 180	2,426.5	21.0	4,080.0	19.0	13.5	0.3	**6,520.0**
180 – 200	749.4	6.0	4,696.0	22.0	2.9	0.1	**5,448.3**
200 – 220	516.2	4.0	3,289.6	15.3	-	-	**3,805.8**
220 – 240	228.5	2.0	933.7	4.3	-	-	**1,162.2**
240 – 260	76.4	1.0	454.0	2.1	-	-	**530.4**
260 – 280	4.5	-	279.7	1.3	-	-	**284.2**
280 – 300	-	-	174.4	1.0	-	-	**174.4**
> 300	-	-	32.5	-	-	-	**32.5**
Total	**11,657.2**	**100.0**	**21,453.8**	**100.0**	**5,376.2**	**100.0**	**38,487.2**

Unconfined aquifer

Alluvial material forms aquifers in entire western half of the district mainly covering Sam and Jaisalmer blocks. The thickness of unconfined aquifer varies from less than 10 m to about 100m with the thickest parts lying to the southeast of Sam block. The general thickness is upto 40m. Perusal of Plate – XVII reveals a moderate thickness of upto 40m in the area with pockets of more thick (>80m) unconfined eolian/alluvial aquifer material in the Sam and Jaisalmer region. Weathered, fractured and jointed rock formations mainly Sandstone occurring at shallower depths constitute good unconfined aquifers. Such zones range in thickness from less than 10 meter to around 30 meter spreading around in the district. In Sam region in the southwestern part a narrow strip and isolated patch in the southeast part of Sankar block has been reported thickness of aquifer in Sandstone more than 20m.

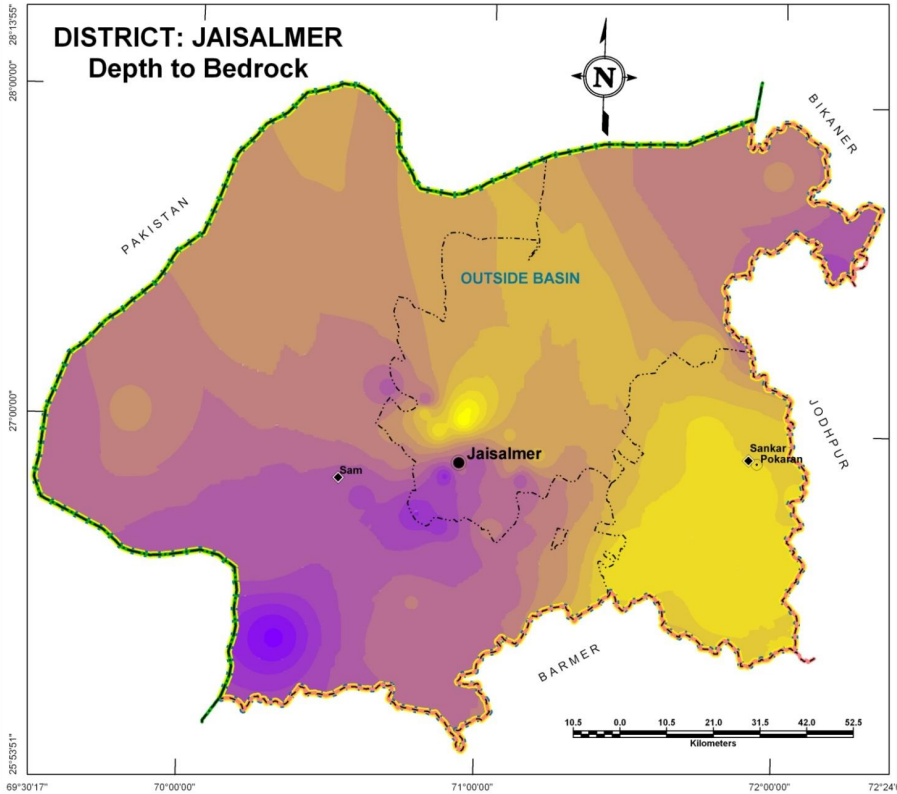
Alluvial areas

Unconfined aquifer Thickness (m)	Block wise area coverage (sq km)			Total Area (sq km)
	Jaisalmer	Sam	Sankra	
< 10	27.3	3,371.2	-	**3,398.5**
10 – 20	70.7	1,608.5	-	**1,679.2**
20 – 30	1,363.3	1,097.2	-	**2,460.5**
30 – 40	-	216.1	-	**216.1**
40 – 50	765.7	895.8	-	**1,661.5**
50 – 60	554.1	812.1	-	**1,366.2**
60 – 70	741.4	634.4	-	**1,375.8**
70 – 80	800.9	1,082.1	-	**1,883.0**
80 – 90	-	113.9	-	**113.9**
> 90	-	7.3	-	**7.3**
Total	**4,323.4**	**9,838.6**	**-**	**14,162.0**

Hardrock areas:

Unconfined aquifer Thickness (m)	Block wise area coverage (sq km)			Total Area (sq km)
	Jaisalmer	Sam	Sankra	
<10	3,871.9	8	<10	3,871.9
10 – 20	3,461.9	7,168.1	10-20	3,461.9
> 20	-	4,439.1	> 20	-
Total	**7,333.8**	**11,615.2**	**Total**	**7,333.8**

PLATE - XVI

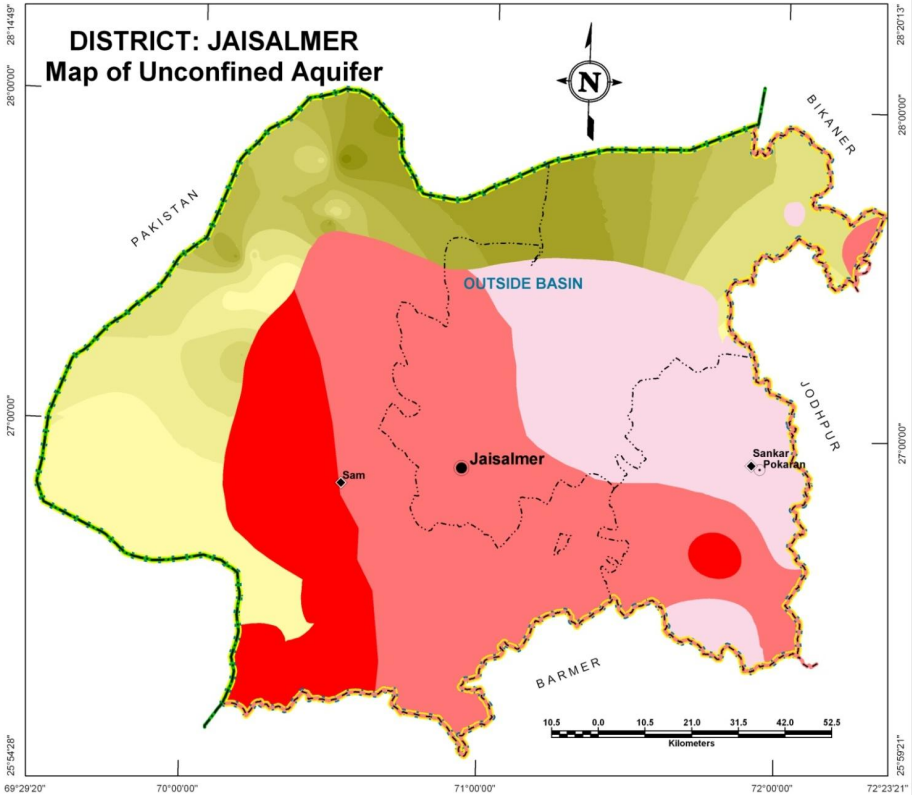


LEGEND

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

Depth to Bedrock (m bgl):
- <40
- 40-60
- 60-80
- 80-100
- 100-120
- 120-140
- 140-160
- 160-180
- 180-200
- 200-220
- 220-240
- 240-260
- 260-280
- 280-300
- >300

PLATE - XVII



LEGEND

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

Aquifer Thickness (m):

Alluvial Area:
- <10
- 10-20
- 20-30
- 30-40
- 40-50
- 50-60
- 60-70
- 70-80
- 80-90
- >90

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

Glossary of terms

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

(Contd…)

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

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

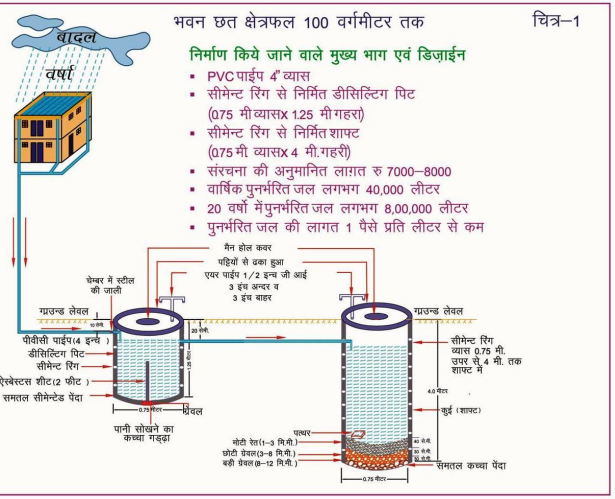
भूजल अमूल्य है इसे प्रदूषित न करें।

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

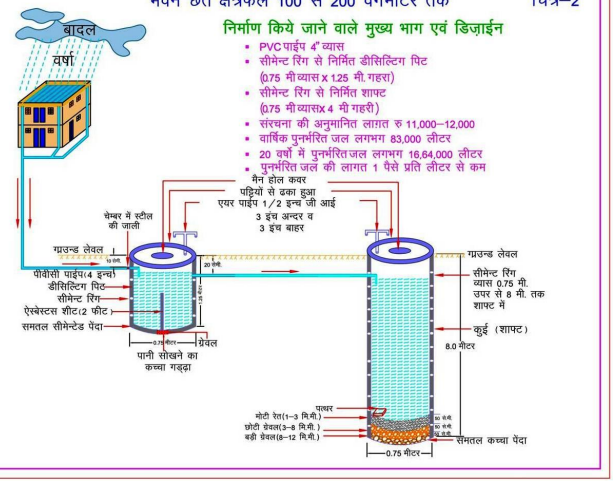


चित्र–2

भवन छत क्षेत्रफल 100 से 200 वर्गमीटर तक

निर्माण किये जाने वाले मुख्य भाग एवं डिज़ाईन

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

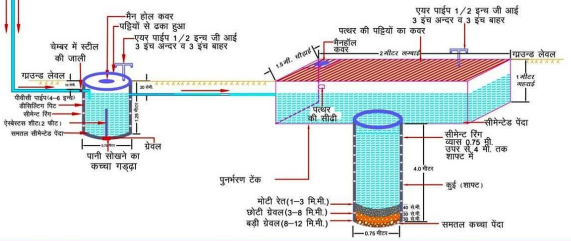


चित्र–3

भवन छत क्षेत्रफल 200 से 300 वर्गमीटर तक

निर्माण किये जाने वाले मुख्य भाग एवं डिज़ाईन

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

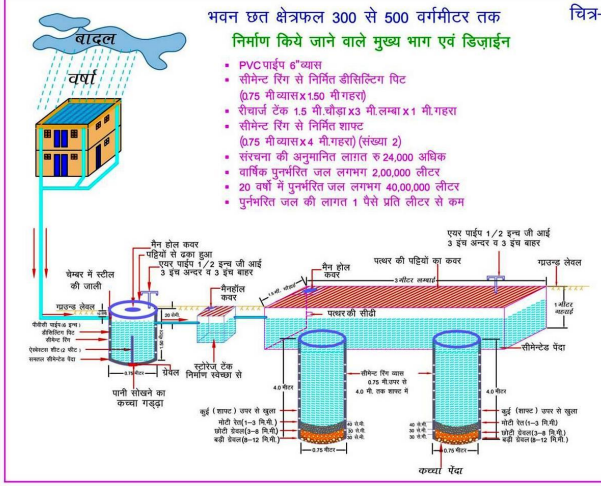


चित्र–4

भवन छत क्षेत्रफल 300 से 500 वर्गमीटर तक

निर्माण किये जाने वाले मुख्य भाग एवं डिज़ाईन

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



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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

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