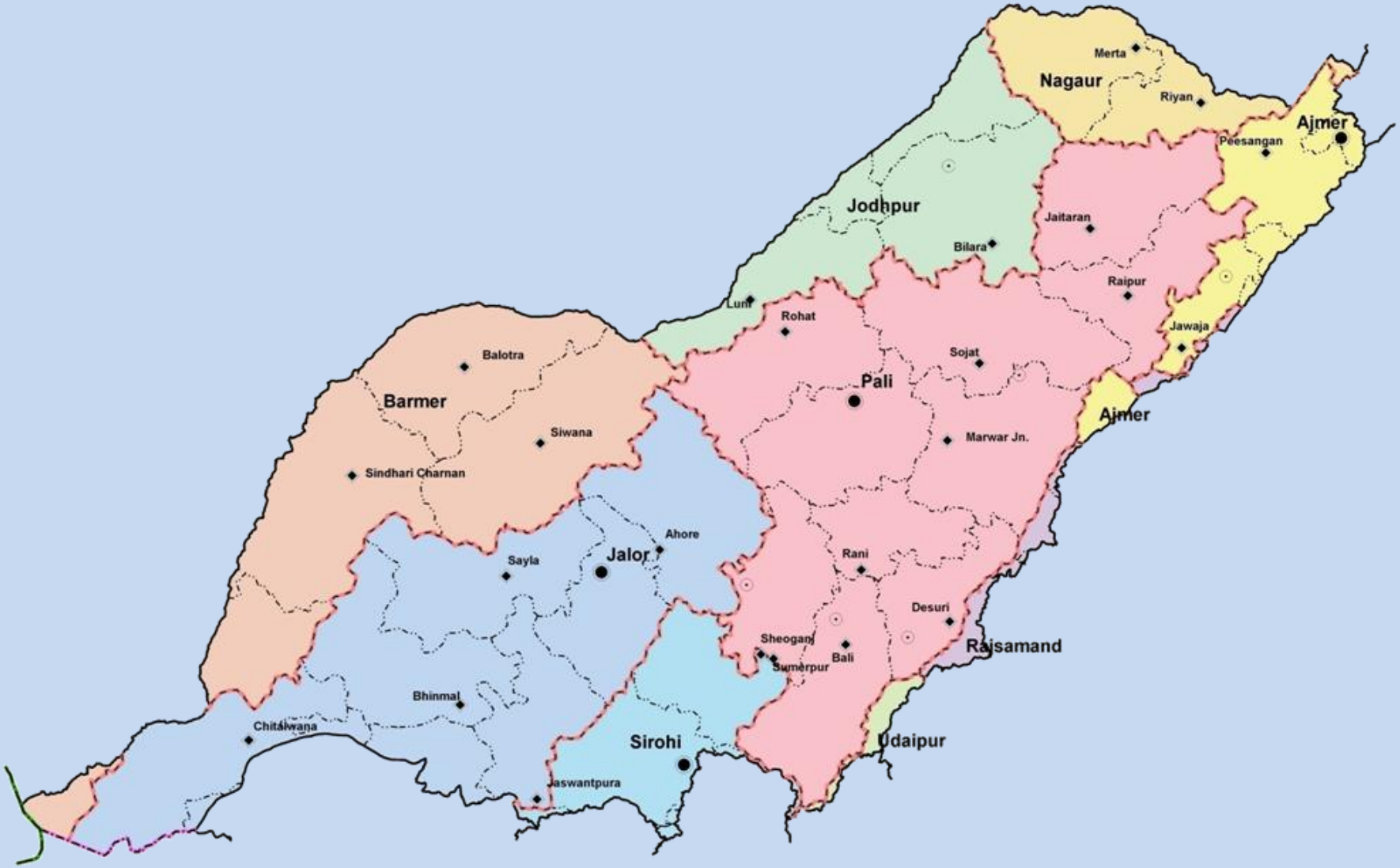
Ground Water Department,
Rajasthan

European Union
State Partnership Programme

Hydrogeological Atlas of Rajasthan

Luni River Basin



2013

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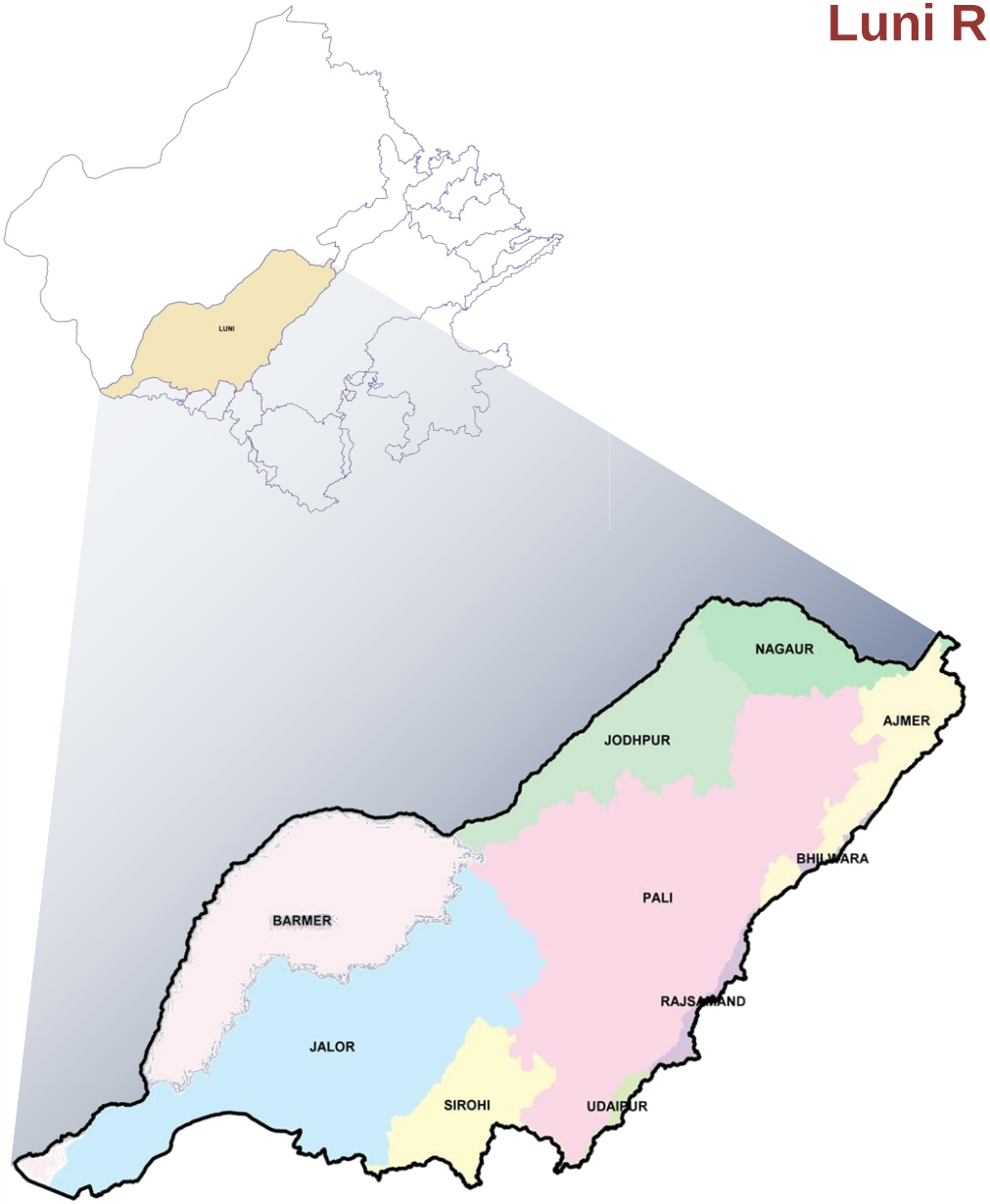
Hydrogeological Atlas of Rajasthan

Luni River Basin



Contents:

2013

ADMINISTRATIVE SETUP

LUNI RIVER BASIN

Location:

Luni River Basin is located in south-western part of Rajasthan. It stretches between 24° 36' 35.67" to 26° 46' 07.31" North latitude and 70° 59' 33.03'' to 74° 42' 18.45'' East longitudes. It is bounded by the Outside Basin in the west, by Banas River Basin in the east, Shekhawati River Basin in the north, and Sukli, West Banas, Other Nallahs and Sabarmati River Basins in the south. The Luni Basin extends over parts of Ajmer, Barmer, Jalore, Jodhpur, Nagaur, Pali, Rajsamand, Sirohi and Udaipur Districts. The total catchment area of the Basin is 37,796.37 km^2. Luni River Basin lies to the west of the Aravali hills and forms part of the mid-west alluvial plain.

Luni River originates in the western slopes of Aravalli Range at an elevation of 550 meters above mean sea level (m amsl) near Ajmer in Ajmer district and flows to the Rann of Kutch in Gujarat State. After flowing for about 495 km in a south-westerly direction in Rajasthan, the river disappears in the marshy land of Rann of Kutch. The water of River Luni is sweet up to Balotra and becomes more and more saline further downstream. The main tributaries of Luni on the left are Sukri, Mithri, Bandi, Khari, Jawai, Guhiya and Sagi, whereas only Jojari River joins it from the right side.

Administrative Set-up:

Administratively, Luni River Basin extends over parts of Ajmer, Barmer, Bhilwara, Jalor, Jodhpur, Nagaur, Pali, Rajsamand, Sirohi and Udaipur encompassing 2,855 towns and villages.

S. No.	District Name	Area (sq km)	% of Basin Area	Total Number of Blocks	Total Number of Towns and Villages
1	Ajmer	1,903.5	5.0	4	310
2	Barmer	6,623.3	17.5	5	422
3	Bhilwara	2.9	-	1	1
4	Jalor	8,824.2	23.3	8	566
5	Jodhpur	3,496.6	9.3	4	206
6	Nagaur	1,892.5	5.0	4	182
7	Pali	12,375.0	32.8	10	960
8	Rajsamand	420.7	1.1	3	42
9	Sirohi	2,075.1	5.5	5	156
10	Udaipur	182.7	0.5	2	10
Total		**37,796.4**	**100.0**	**46**	**2,855**

Climate:

Luni River basin is very large and therefore climatic variations in the basin are also quite varied with Ajmer being part of sub-humid climate whereas the climate of Barmer is closer to being arid (desertic). It is extremely cold from October to February while turning hot from March to September. Areas adjoining Aravalli range receive good rainfall and area east of Barmer receives very less to negligible rainfall. The mean annual rainfall over Luni River Basin was 643 mm, of which most of the rainfall is received during the four Monsoon months (June-September).

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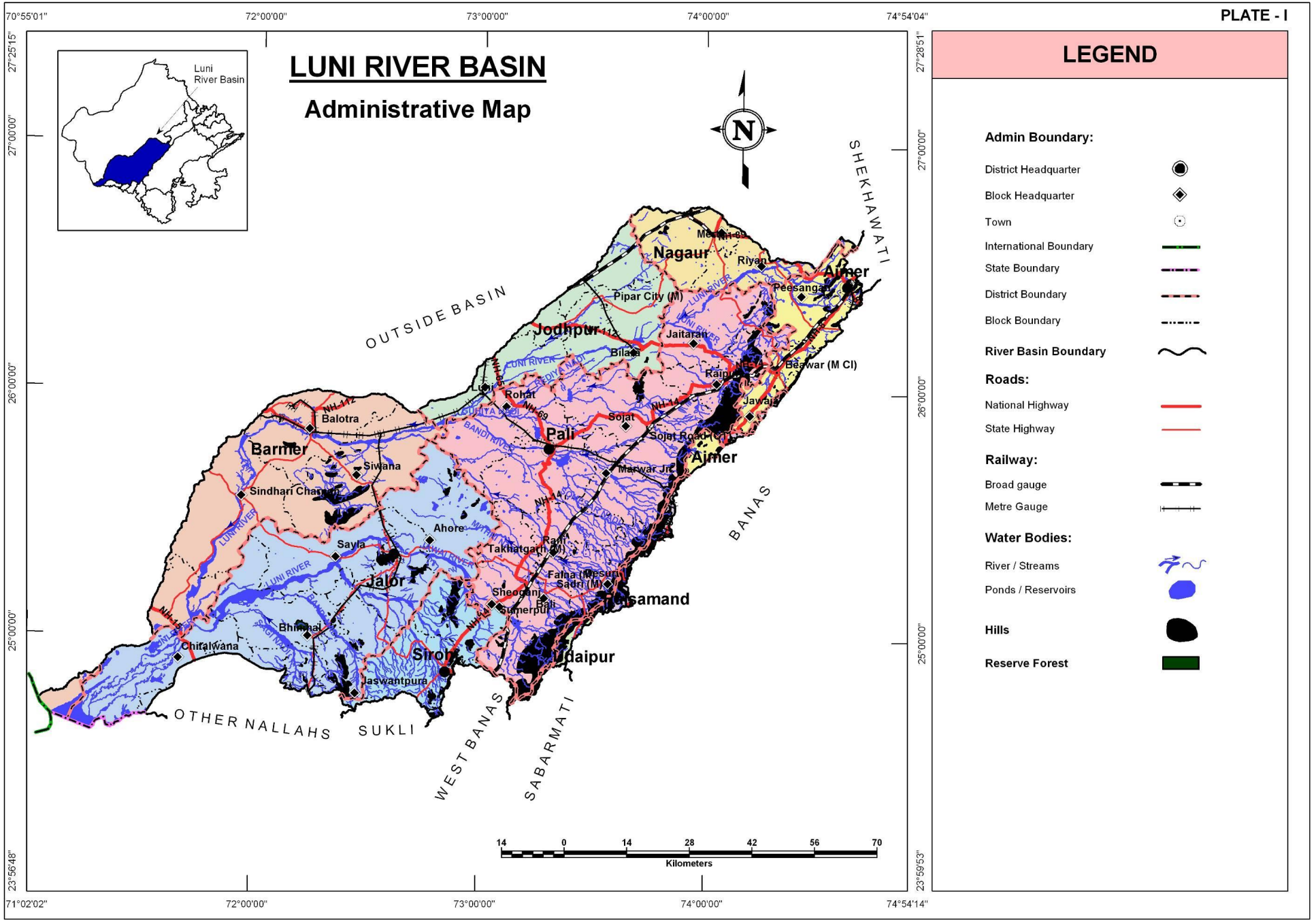
PLATE - I



LEGEND

Admin Boundary:

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

Roads:

- National Highway
- State Highway

Railway:

- Broad gauge
- Metre Gauge

Water Bodies:

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

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TOPOGRAPHY

LUNI RIVER BASIN

The Luni river flows from northeast to southwest following the general slope of the terrain within the basin,. Aravali ridges have a northwesterly slopes and thus the river following the trend initially flow NW and then turn in SW direction draining into Rann of Kutch. In Pali, Rajsamand, Sirohi and Udaipur districts the presence of hills leads to maximum elevation reaching more than 1,000m (maximum being 1,614m in Sirohi district) whereas the lower elevations are generally seen in Barmer, Jodhpur, Jalor, Nagaur and western parts of Pali district reaching upto 150 – 300m in general. IN Barmer and Jalor the topography approaches that of mean sea levels i.e., 0m amsl.

Table: District wise minimum and maximum elevation

District Name	Min. Elevation (m amsl)	Max. Elevation (m amsl)
Ajmer	366.3	870.8
Barmer	-	946.3
Bhilwara	628.4	700.3
Jalor	-	969.0
Jodhpur	148.3	450.4
Nagaur	278.6	791.9
Pali	150.6	1,066.5
Rajsamand	374.1	1,173.4
Sirohi	183.3	1,614.8
Udaipur	475.8	1,126.0

RAINFALL

The general distribution of rainfall across the Luni River Basin can be visualized from isohyets presented in the Plate III where most of the southern, southeastern and eastern parts receive higher rainfalls (in the range of 800-1000mm of total annual rainfall) whereas; the west and northwestern parts receive very low rainfall (between 300 to 500mm). The average annual rainfall computed based on available station data is about 643mm. The rainfall data for available rain gauge stations is presented below.

Table: District wise total annual rainfall (based on year 2010 meteorological station recordings) (http://waterresources.rajasthan.gov.in)

S. No	Rain gauge Stations	Total Monsoon Rainfall (mm)	Total Non-Monsoon Rainfall (mm)	Total Annual Rainfall (mm)
1	Ahore	373.8	175.0	548.8
2	Bagoda	442.0	56.0	498.0
3	Bali	796.0	141.0	937.0
4	Bhinmal	605.0	128.0	733.0
5	Bilara	302.0	37.0	339.0
6	Desuri	525.0	121.0	646.0
7	Gudhamalani	571.0	28.0	599.0
8	Jaitaran	470.0	101.0	571.0
9	Jalore	459.0	75.8	534.8
10	Jaswantpura	819.0	216.0	1,035.0
11	Jawaja	199.0	33.0	232.0
12	Kharchi(Marwar J.)	543.0	158.0	701.0
13	Kumbhalgarh	899.0	178.0	1,077.0

S. No	Rain gauge Stations	Total Monsoon Rainfall (mm)	Total Non-Monsoon Rainfall (mm)	Total Annual Rainfall (mm)
14	Luni	405.5	60.5	466.0
15	Merta City	540.0	8.0	548.0
16	Pachpadra	441.0	60.0	501.0
17	Pali	404.0	61.0	465.0
18	Raipur	790.0	177.0	967.0
19	Rohat	394.0	120.0	514.0
20	Sayala	684.8	70.0	754.8
21	Sheoganj	450.1	168.2	618.3
22	Sirohi	612.7	188.6	801.3
23	Siwana	658.0	64.0	722.0
24	Sojat	533.0	107.0	640.0
25	Sumerpur	509.0	121.0	630.0

Ground Water Department,
Rajasthan

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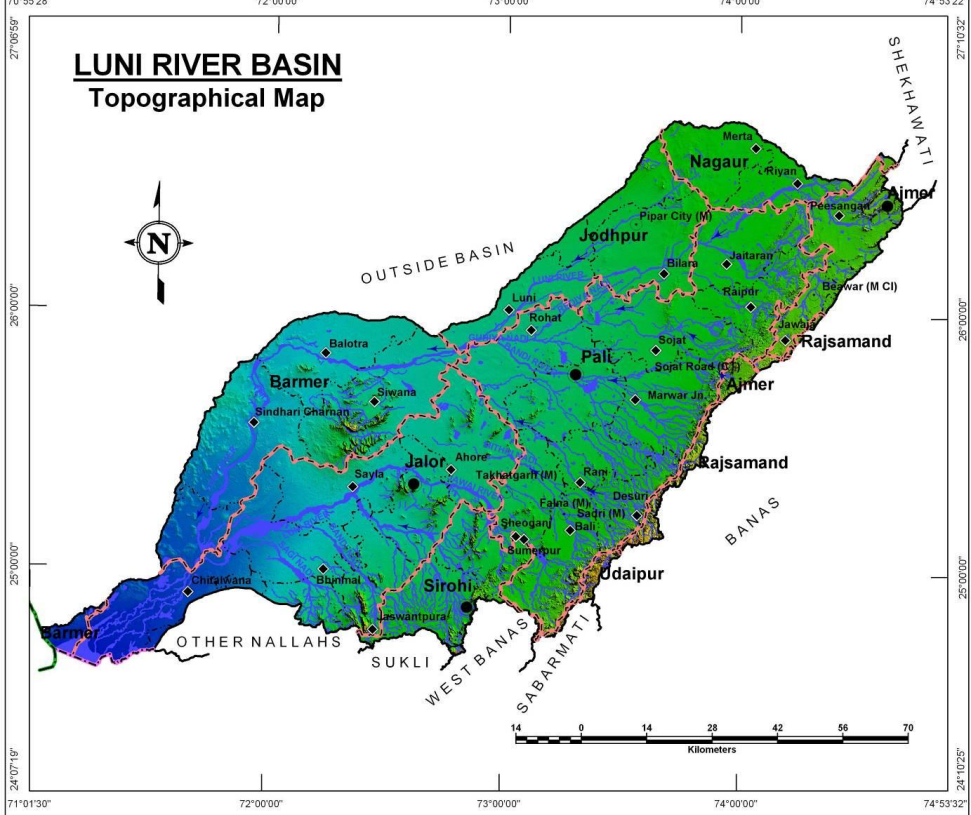
PLATE - II

LUNI RIVER BASIN
Topographical Map



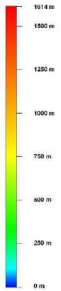
LEGEND

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

River Basin Boundary

Water Bodies:
- River / Streams
- Ponds / Reservoirs

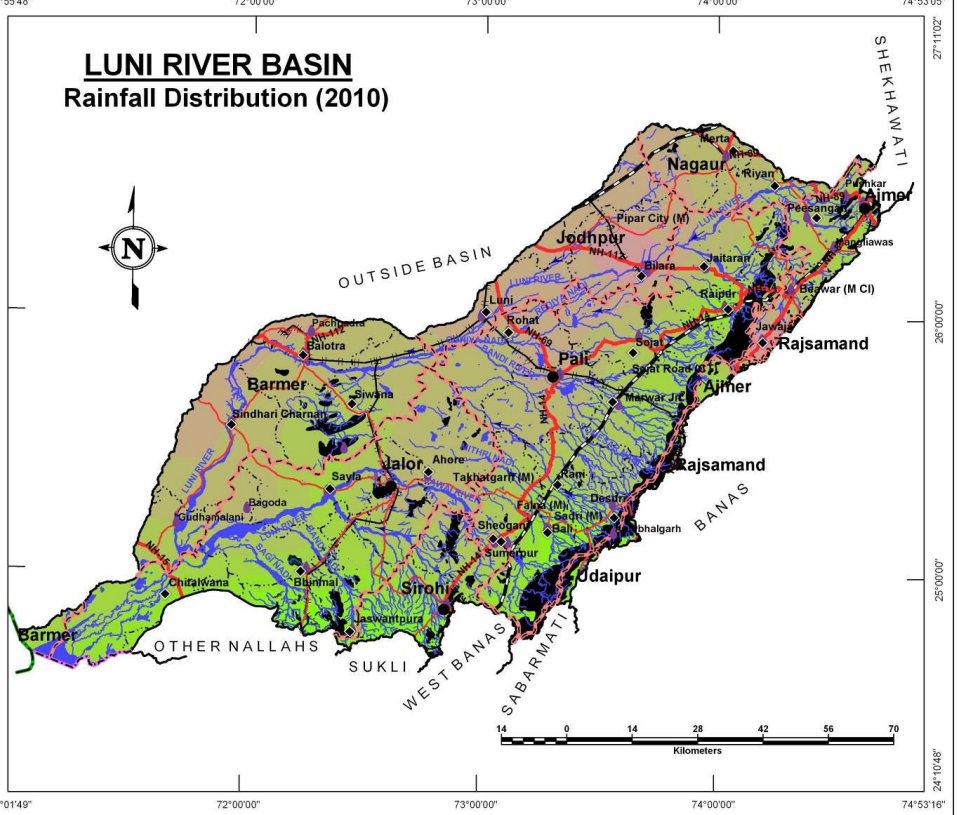
Elevation(m amsl):



Source : SRTM DEM

PLATE - III

LUNI RIVER BASIN
Rainfall Distribution (2010)



LEGEND

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

River Basin Boundary

Roads:
- National Highway
- State Highway

Railway:
- Broad Gauge
- Metre Gauge

Water Bodies:
- River / Streams
- Ponds / Reservoirs

Hills

Reserve Forest

Isohyets (mm):
- 200-300
- 300-400
- 400-500
- 500-600
- 600-700
- 700-800
- 800-900
- 900-1000
- > 1000

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GEOLOGY

LUNI RIVER BASIN

The Luni River Basin is covered mainly by rocks belonging to the Pre-Cambrian rocks (Delhi Super-Group) to Aeolian and Fluvial deposits of Recent to Sub-Recent age. Vindhyans are represented here by Jodhpur, Bilara and Nagaur Group of rocks.

Age	Super-Group	Group/Formation	Rock Types
Recent to Sub-Recent	-	Aeolian and Fluvial deposits	Wind-blown sands, Sand dunes,alluvialSands, clays,gravels, Etc.
---------x ---------x ---------x --------- Unconformity ---------x ---------x ---------x ---------			
Lower Eocene	-	Palana	Sandstone, bentonitic Clays, Fuller's earth And lignite seams
---------x ---------x ---------x --------- Unconformity ---------x ---------x ---------x ---------			
Upper Precambrian to Lower Precambrian	Vindhyan (Marwar Super-Group)	Nagaur group	Sandstone& Evaporite siltstones & Limestone
		Bilara Group	Limestones mainly with Cherty dolomite
		Jodhpur Group	Sandstone & Shales, Limestone, Shales, Conglomerates,Grits etc.
	---------x ---------x ---------x --------- Unconformity ---------x ---------x ---------x ---------		
		(Semri Group)	Limestones,Shales, Conglomerates, Grits
Upper Precambrian to Lower Precambrian	(Post-Delhi) Intrusives	Jalore-Granite, Malani Rhyolites Idar Granites, Erinpura Granites	Granites, Rhyolites, Porphyries and Tuffs, etc.
Middle Precambrian	Delhi	Ajabgarh	Dolomitic marbles, Quartzites, Metabasites, Schists and gneisses
		Alwar	Quartzites, Mica-schists and phyllites

GEOMORPHOLOGY

Origin	Landform Unit	Description
Aeolian	Dissected Sandy Plain	Sandy plain highly dissected by stream and drainage
	Dune Complex	An undulating plain composed of number of sand dunes of cressent 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, 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 Depression	Slightly depressed area in between the dunal complex showing moisture and fine sediments.
	Interdunal Flat	Flat, narrow land between dunes.
	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.
	Intermontane Valley	Depression between mountains, generally broad & linear, filled with colluvial deposits.
	Pediment	Broad gently sloping rock flooring, erosional surface of low relief between hill and plain, comprised of varied lithology, criss-crossed by fractures and faults.
	Pediplain	Coalescence and extensive occurrence of pediment.
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.
	Flood Plain	The surface or strip of relatively smooth land adjacent to a river channel formed by river and covered with water when river over flows its bank. Normally subject to periodic flooding.
	Paleochannel	Mainly buried on abandoned stream/river courses, comprising of coarse textured material of variable sizes.
	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.

PLATE - IV

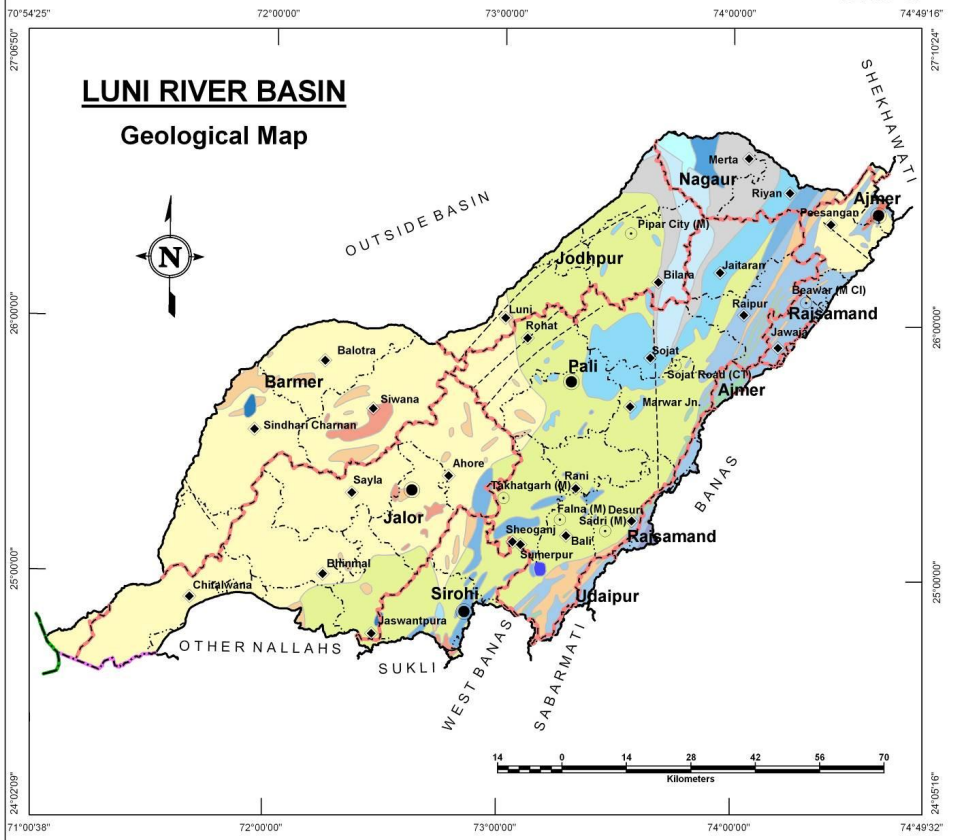
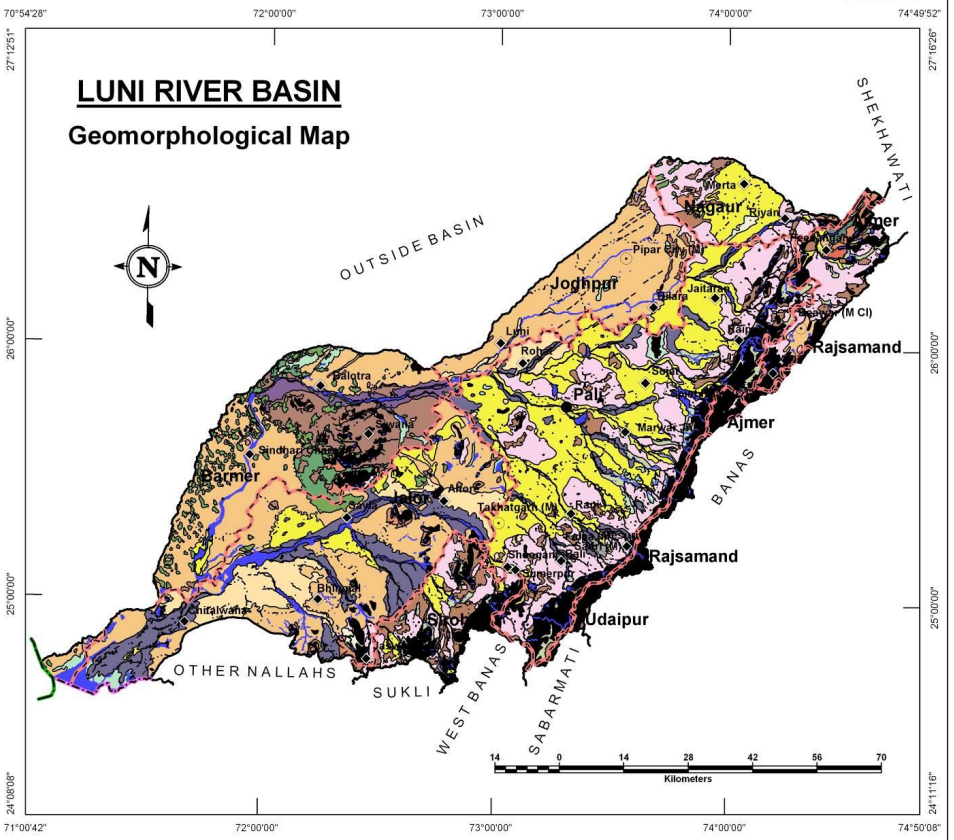


PLATE - V



LEGEND

Admin Boundary:

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

River Basin Boundary

Water Bodies

Structural Features:

- Fault
- Lineament

Geology:

- Alluvium and Wind blown sand
- Palana Formation
- Nagaur Group
- Bilara Group
- Jodhpur Group
- Punagarh Group
- Sindreth Group
- Sirohi Group
- Kumbhalgarh Group
- Ajabgarh Group
- Gogunda Group
- Sarnu-Dandali Complex
- Mundwara Alkaline Complex
- Malani Plutonic
- Volcanic Suite
- Erinpura Granite & Gneiss
- Sendra-Ambaji Granite & Gneiss
- Phulad Ophiolite Suite
- Bairath/Dadikar/Harsora/Chapoli/Ajitgarh/Ajmer Granite etc.

Source : District Resource Map of Rajasthan - GSI

LEGEND

Admin Boundary:

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

River Basin Boundary

Water Bodies:

- River/Ponds / Reservoirs

Structural Features:

- Fault/Fractures/Lineament

Hills:

- Structural/Denudational/Linear Ridge

Landforms Units:

Fluvial Origin:

- Alluvial plain
- Palaeochannel
- Alluvial Plain (Sandy)
- Ravine
- Flood Plain
- Valley Fill
- Salt Encrustation/Playa

Denudational Origin:

- Burried Pediment
- Pediment
- Intermontane Valley
- Pediplain

AeolianOrigin:

- Sandy Plain
- Eolian Plain
- Dissected Sandy Plain
- Obstacle Dune
- Interdunal Depression
- Interdunal Flat
- Dune Complex
- Dune Valley Complex

Structural Origin:

- Plateau

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

AQUIFERS

LUNI RIVER BASIN

Spatially, the alluvium forms the predominant aquifer type in the Basin and also among this Older alluvium is more prominent, together the Older and Younger alluvium occupy nearly half of the area of the basin. Most of the central and western part of the basin shows the presence of alluvial aquifers along with a small part in north. Among the other remaining aquifer types, the next most predominant is Granite aquifer present in the south and southeastern parts of the basin. Phyllite, Schist, Jalore granite and Gneiss also constitute important aquifers in Luni basin. The Aravalli ranges constitute the eastern limit of the basin in the form of Hills.

Aquifer in Potential Zone	Area (sq km)	Description of the unit/Occurrence
Younger Alluvium	4,886.2	It is largely constituted of Aeolian and Fluvial sand, silt, clay, gravel and pebbles in varying proportions.
Older Alluvium	15,440.1	This litho unit comprises of mixture of heterogeneous fine to medium grained sand, silt and kankar.
Limestone	319.7	In general, it is fine to medium grained, grey, red yellowish, pink or buff in colour.
Bilara Limestone	858.8	It is grey to buff coloured hard and compact.
Tertiary Sandstone	331.9	Medium to coarse grained, consolidated to semi consolidated sandstone.
Nagaur & Jodhpur Sandstone	601.9	Buff to reddish brown in colour, fine to medium grained hard and compact sandstone.
Phyllite	2,437.5	These include meta sediments and represented by carbonaceous phyllite.
Schist	1,831.1	Medium to fine grained compact rock. The ltho units are soft, friable and have closely spaced cleavage.
Rhyolite	460.8	Rhyolite is porphyritic and has phenocryst of quartz and feldspar.
Granite Jalore	1,143.2	Grey to pink in colour, medium to coarse grained, and non porphyritic.
Granite	6,191.9	Light gey to pink colour, medium to coarse grained, and characteristically have porphyritic texture.
Gneiss	1,072.2	Comprises of porphyritic and non porphyritic gneissic complex.
Non Potential Zone (Hills)	2,221.6	Hills and reserve forests
TOTAL	**37,796.9**	

LOCATION OF GROUNDWATER MONITORING WELLS

The basin has a well distributed network of large number of groundwater monitoring stations (935) in the basin owned by RGWD and CGWB; and 197 wells have been recommended to be added to network to effectively monitor ground water quality in the basin.

District Name	Existing Ground Water Monitoring Stations			Recommended Additional Ground Water Monitoring Stations	
	CGWB	RGWD	Total	Water Level	Water quality
Ajmer	13	93	106	-	-
Barmer	20	83	103	-	49
Bhilwara	-	-	-	-	-
Jalor	12	199	211	-	98
Jodhpur	7	95	102	-	-
Nagaur	-	34	34	-	15
Pali	-	264	264	-	34
Rajsamand	1	9	10	-	-
Sirohi	-	104	104	-	1
Udaipur	-	1	1	-	-
Grand Total	**53**	**882**	**935**	**0**	**197**

PLATE - VI

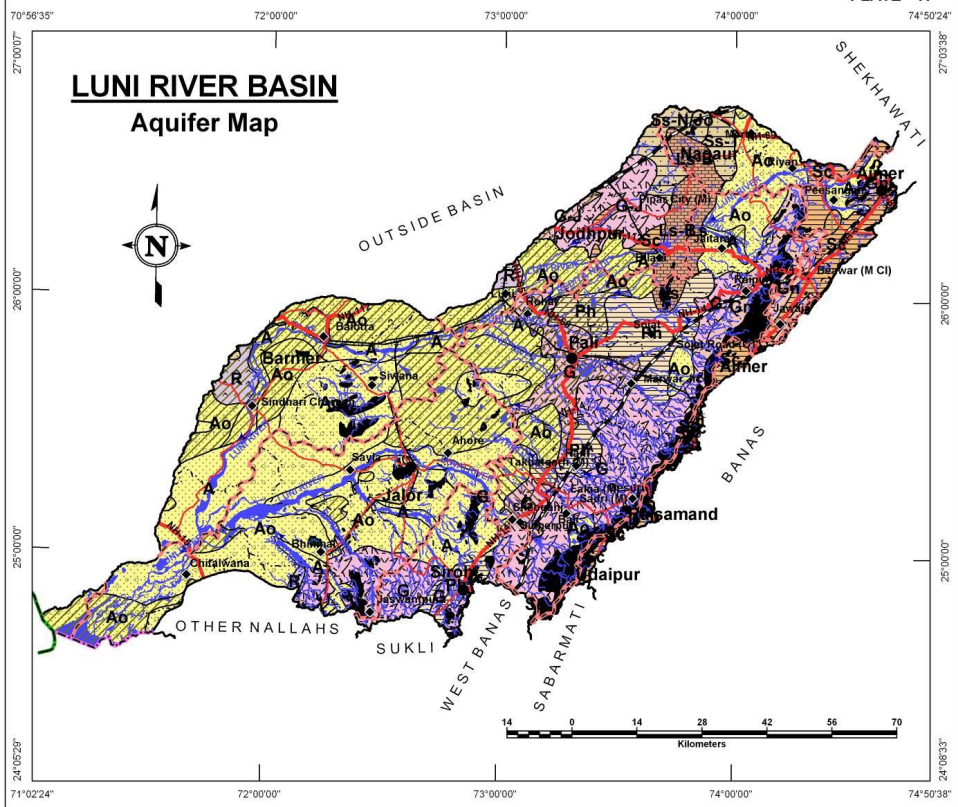
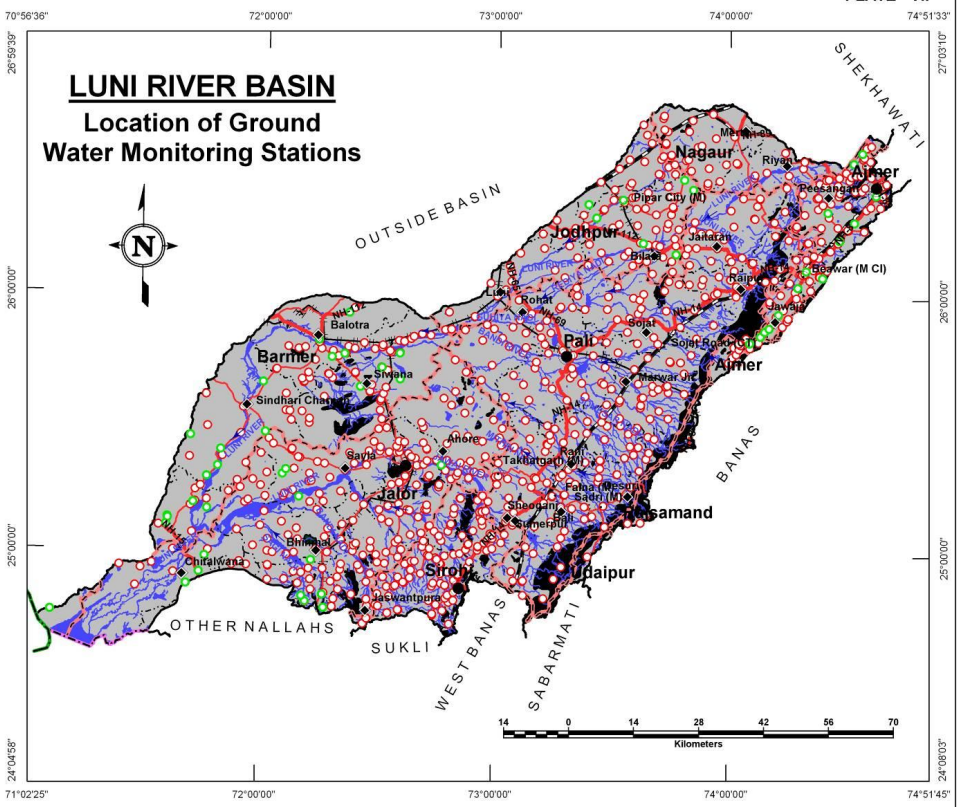


PLATE - VII



LEGEND

Admin Boundary:
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- District Boundary
- Block Boundary

River Basin Boundary

Roads:
- National Highway
- State Highway

Railway:
- Broad gauge
- Metre Gauge

Water Bodies:
- River / Streams
- Ponds / Reservoirs

Hills

Chemically Unsutiable Area

Command Area

Saline Area

Reserve Forest

Aquifer:
- Younger Alluvium
- Older Alluvium
- Limestone
- Bilara Limestone
- Tertiary Sandstone
- Nagaur & Jodhpur Sandstone
- Phyllite
- Schist
- Rhyolite
- Granite Jalore
- Granite
- Gneiss

Source: Ground Water Potential Zone Map - GWD,Rajasthan

LEGEND

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

River Basin Boundary

Roads:
- National Highway
- State Highway

Railway:
- Broad gauge
- Metre Gauge

Water Bodies:
- River / Streams
- Ponds / Reservoirs

Hills

Reserve Forest

Ground Water Monitoring Stations:
- CGWB
- RGWD

LOCATION OF EXPLORATORY WELLS

LUNI RIVER BASIN

In all there are 642 exploratory wells present in the basin drilled in the past by RGWD and CGWB that form good basis for delineation of sub-surface aquifer distribution.

District Name	Exploratory Wells		
	CGWB	RGWD	Total
Ajmer	10	27	37
Barmer	10	37	47
Bhilwara	-	-	-
Jalor	17	249	266
Jodhpur	5	20	25
Nagaur	15	32	47
Pali	51	117	168
Rajsamand	1	2	3
Sirohi	1	48	49
Udaipur	-	-	-
Total	**110**	**532**	**642**

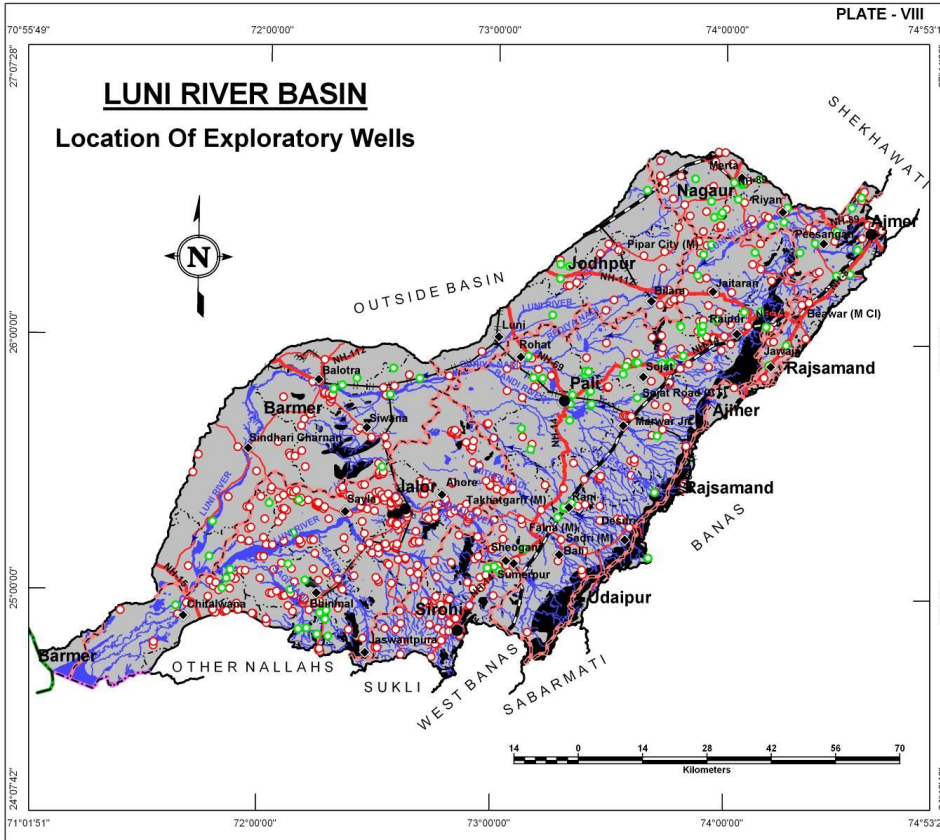
DEPTH TO WATER LEVEL (PRE MONSOON – 2010)

The general depth to water level in the basin ranges from 10 to 40 meters below ground level, as seen on northeastern, central, western and southwestern parts of the basin. There are however, three pockets; one in the north (around Merta) and in the western part in Balotra-Siwana-Sayla-Bhinmal region where water levels are quite deep, varying between 70-100mbgl and occasionally reaching upto 130m bgl.

Depth to water level (m bgl) Pre Monsoon - 2010	District wise area (sq km)*										Total Area (sq km)
	Ajmer	Barmer	Bhilwara	Jalor	Jodhpur	Nagaur	Pali	Rajsamand	Sirohi	Udaipur	
< 10	31.1	537.5	-	1,162.5	645.0	-	1,440.5	-	-	-	**3,816.6**
10 - 20	882.0	1,005.3	-	1,073.2	1,078.5	34.4	3,889.0	150.6	588.2	56.9	**8,758.1**
20 - 30	842.8	2,647.0	-	2,487.2	764.0	333.9	3,572.7	3.1	877.9	3.9	**11,532.5**
30 - 40	23.8	698.9	-	1,156.5	437.6	396.0	1,564.1	-	365.7	-	**4,642.6**
40 - 50	-	358.1	-	1,230.9	347.9	366.0	562.4	-	70.4	-	**2,935.7**
50 - 60	-	333.3	-	882.5	141.8	167.4	233.4	-	-	-	**1,758.4**
60 - 70	-	549.7	-	422.6	52.8	132.1	0.6	-	-	-	**1,157.8**
70 - 80	-	224.6	-	165.3	23.6	140.9	-	-	-	-	**554.4**
80 - 90	-	73.4	-	28.3	3.4	122.3	-	-	-	-	**227.4**
90 - 100	-	-	-	4.4	0.2	66.2	-	-	-	-	**70.8**
110 - 120	-	-	-	-	-	57.5	-	-	-	-	**57.5**
100 - 110	-	-	-	-	-	45.6	-	-	-	-	**45.6**
120 - 130	-	-	-	-	-	17.1	-	-	-	-	**17.1**
> 130	-	-	-	-	-	0.1	-	-	-	-	**0.1**
Total	**1,779.7**	**6,427.8**	**-**	**8,613.4**	**3,494.8**	**1,879.5**	**11,262.7**	**153.7**	**1,902.2**	**60.8**	**35,574.6**

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

PLATE - VIII



LEGEND

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

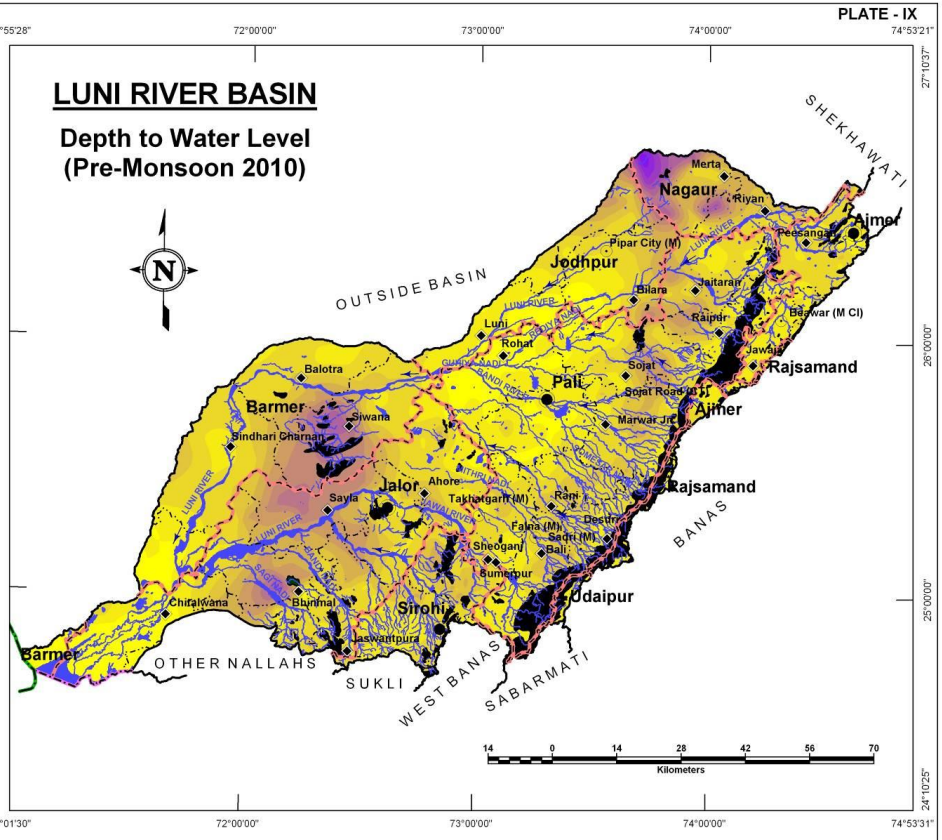
Roads:
- National Highway
- State Highway

Railway:
- Broad Gauge
- Metre Gauge

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

Exploratory Wells:
- CGWB
- RGWD

PLATE - IX



LEGEND

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

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

Depth to Water Level(m bgl):
- < 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

WATER TABLE ELEVATION (PRE MONSOON 2010)

LUNI RIVER BASIN

Water table elevation shows large variation since the topography in the basin reaches a high of >1300m amsl and low of 0m amsl. Since the water table generally follows the topography, such variations are not exception. A perusal of Plate X reveals that although WT is very high in places but the spatial distribution of the same is limited in extent to the vicinity of Aravalli range, whereas, most part of the basin has water table elevations from less than 20m amsl to around 200m amsl in the non-hilly parts of the basin in Barmer, Jalor, Jodhpur and Pali districts.

District Name	District wise area coverage (sq km) within 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 - 300	300 - 320	320 - 340	340 - 360	360 - 380	380 - 400	400 - 440	440 - 480	480 - 520	520 - 560	560 - 600	600 - >920	
Ajmer	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11.7	119.9	222.0	537.8	549.0	241.4	76.2	16.0	5.8	**1,779.8**
Barmer	116.2	581.9	1,073.2	1,385.1	975.0	1,499.8	729.8	66.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**6,427.9**
Bhilwara	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
Jalor	0.1	2,289.9	1,031.2	698.3	419.5	436.8	650.4	969.5	996.3	738.1	225.3	76.8	53.4	27.6	-	-	-	-	-	-	-	-	-	-	-	-	**8,613.2**
Jodhpur	-	-	-	-	-	-	10.9	140.5	225.7	356.4	552.0	957.3	1,170.7	81.3	-	-	-	-	-	-	-	-	-	-	-	-	**3,494.8**
Nagaur	-	-	-	-	-	-	-	-	-	-	67.2	621.5	289.2	234.2	243.1	173.4	104.1	50.3	29.3	22.2	29.8	15.1	-	-	-	-	**1,879.4**
Pali	-	-	-	-	-	-	-	113.2	730.7	948.1	1,769.2	1,905.0	1,494.5	1,162.5	835.8	648.8	515.3	412.8	282.7	173.2	190.4	61.6	14.9	4.1	-	-	**11,262.8**
Rajsamand	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.6	26.3	40.0	16.5	69.3	**153.7**
Sirohi	-	-	-	-	-	-	-	-	92.3	201.2	220.1	326.8	294.0	289.6	278.7	89.1	55.8	32.3	20.3	0.2	1.9	-	-	-	-	-	**1,902.3**
Udaipur	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.5	1.3	0.9	2.3	3.0	4.2	5.3	5.9	36.3	**60.7**
Total	**116.3**	**2,871.8**	**2,104.4**	**2,083.4**	**1,394.5**	**1,936.6**	**1,391.1**	**1,290.1**	**2,045.0**	**2,243.8**	**2,833.8**	**3,887.4**	**3,301.8**	**1,795.2**	**1,357.6**	**911.3**	**675.2**	**508.6**	**453.5**	**418.5**	**762.2**	**630.3**	**286.8**	**125.6**	**38.4**	**111.4**	**35,574.6**

WATER LEVEL FLUCTUATION (PRE TO POST MONSOON 2010)

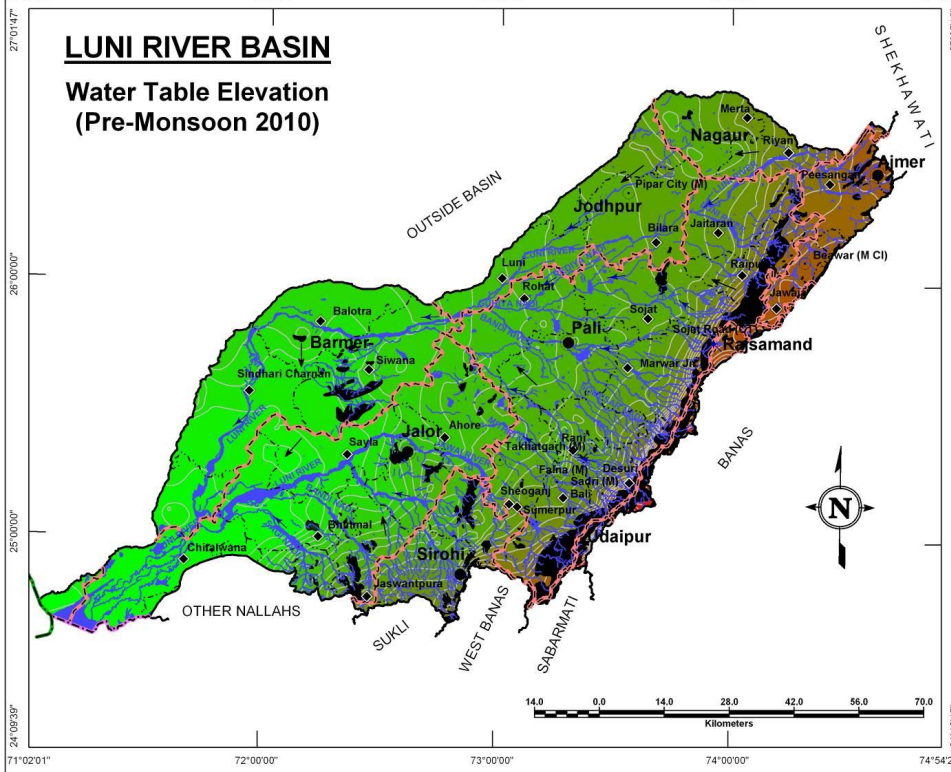
The Basin area is a mixture of hardrock aquifers and those formed within thick cover of alluvium. Therefore, wide fluctuations in water levels are seen which ranges broadly from -8m to +18m. In Sirohi district and in the hilly parts of other districts, the water level fluctuation map shows rise from nominal to significantly high whereas in alluvial areas of Nagaur Jalor and Barmer, the fluctuation is in the range of ±2m. High negative fluctuation, i.e., fall in water levels is localized phenomenon and possibly due to high exploitation.

District Name	District wise area coverage (sq km) within fluctuation range (m)															Total Area (sq km)
	< -8	-8 to -6	-6 to -4	-4 to -2	-2 to 0	0 to 2	2 to 4	4 to 6	6 to 8	8 to 10	10 to 12	12 to 14	14 to 16	16 to 18	> 18	
Ajmer	-	-	-	-	1.4	106.4	161.3	301.1	460.1	345.1	253.1	142.0	9.3	-	-	**1,779.8**
Barmer	-	-	-	-	284.9	3,062.5	1,713.0	890.2	262.6	111.6	58.6	32.4	12.1	-	-	**6,427.9**
Bhilwara	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
Jalor	-	1.2	12.9	55.0	693.6	4,183.5	1,954.0	821.2	415.9	233.3	100.9	68.7	73.3	-	-	**8,613.5**
Jodhpur	-	-	-	-	33.0	831.7	1,408.6	723.9	290.5	139.3	63.1	4.7	-	-	-	**3,494.8**
Nagaur	-	-	-	-	524.7	1,193.6	105.4	45.6	8.3	1.8	-	-	-	-	-	**1,879.5**
Pali	0.1	2.9	8.6	23.7	92.0	1,722.4	3,360.2	2,366.3	1,519.2	1,056.8	598.0	410.9	88.0	13.6	0.1	**11,262.7**
Rajsamand	-	-	-	-	-	-	-	20.9	26.3	35.4	17.4	39.7	14.0	-	-	**153.6**
Sirohi	-	-	-	-	-	88.0	204.1	382.2	621.8	393.5	94.0	68.9	28.2	19.0	2.6	**1,902.2**
Udaipur	-	-	-	-	-	-	-	0.2	22.4	38.0	-	-	-	-	-	**60.6**
Total	**0.1**	**4.0**	**21.5**	**78.7**	**1,629.6**	**11,188.2**	**8,906.6**	**5,551.6**	**3,627.2**	**2,354.8**	**1,185.2**	**767.2**	**224.8**	**32.6**	**2.7**	**35,574.6**

PLATE - X

LUNI RIVER BASIN

Water Table Elevation (Pre-Monsoon 2010)



LEGEND

Admin Boundary:

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

River Basin Boundary

Water Bodies:

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

Water Table Elevation

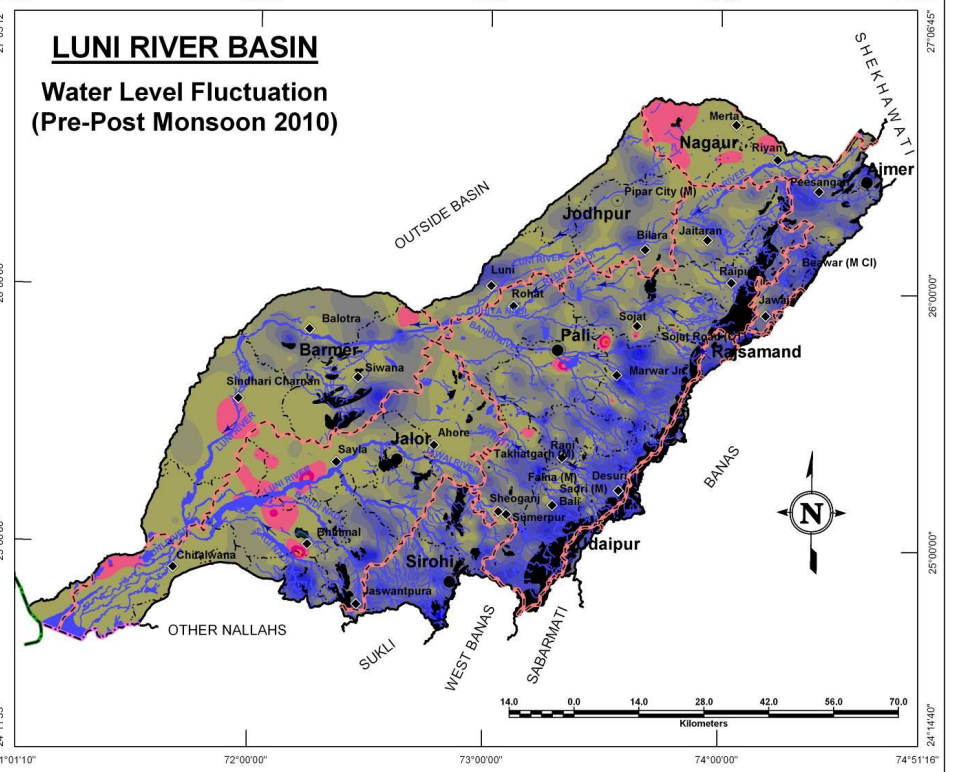
Water Table Elevation(m amsl):

< 20	240 - 260	520 - 560
20 - 40	260 - 280	560 - 600
40 - 60	280 - 300	600 - 640
60 - 80	300 - 320	640 - 680
80 - 100	320 - 340	680 - 720
100 - 120	340 - 360	720 - 760
120 - 140	360 - 380	760 - 800
140 - 160	380 - 400	800 - 840
160 - 180	400 - 440	840 - 880
180 - 200	440 - 480	880 - 920
200 - 220	480 - 520	> 920
220 - 240		

PLATE - XI

LUNI RIVER BASIN

Water Level Fluctuation (Pre-Post Monsoon 2010)



LEGEND

Admin Boundary:

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

River Basin Boundary

Water Bodies:

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

Water Level Fluctuation(m):

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

ELECTRICAL CONDUCTIVITY DISTRIBUTION

LUNI RIVER BASIN

The Electrical Conductivity (at 25°C) distribution map is presented in Plate – XII reveals an interesting pattern. The areas adjacent to hills or within hilly areas show fairly good water quality having EC < 2000 µS/cm (represented by Yellow coloured regions) whereas, significant part of the basin largely in alluvial areas in the northern, central, western and southwestern parts has high salinity (EC > 4000 µS/cm).

Electrical Conductivity Ranges (µS/cm at 25°C) (Ave. of years 2005-09)	District wise area coverage (sq km)																				Total Area (sq km)
	Ajmer		Barmer		Bhilwara		Jalor		Jodhpur		Nagaur		Pali		Rajsamand		Sirohi		Udaipur		
	Area	% age	Area	% age	Area	% age	Area	% age	Area	% age	Area	% age	Area	% age	Area	% age	Area	% age	Area	% age	
< 2000	737.3	41.4	769.1	12.0	-	100.0	1,098.0	12.8	173.7	5.0	317.5	16.9	2,651.2	23.5	123.5	80.4	715.2	37.6	60.8	100.0	**6,646.1**
2000-4000	796.7	44.8	1,337.6	20.8	-	0.0	3,291.0	38.2	514.3	14.7	872.1	46.4	3,434.6	30.5	30.0	19.6	965.9	50.8	-	0.0	**11,242.3**
> 4000	245.8	13.8	4,321.1	67.2	-	0.0	4,224.6	49.1	2,806.8	80.3	690.0	36.7	5,177.0	46.0	0.1	0.0	221.2	11.6	-	0.0	**17,686.4**
Total	**1,779.7**	**100.0**	**6,427.9**	**100.0**	**-**	**100.0**	**8,613.5**	**100.0**	**3,494.8**	**100.0**	**1,879.5**	**100.0**	**11,262.7**	**100.0**	**153.6**	**100.0**	**1,902.2**	**100.0**	**60.8**	**100.0**	**35,574.8**

CHLORIDE DISTRIBUTION

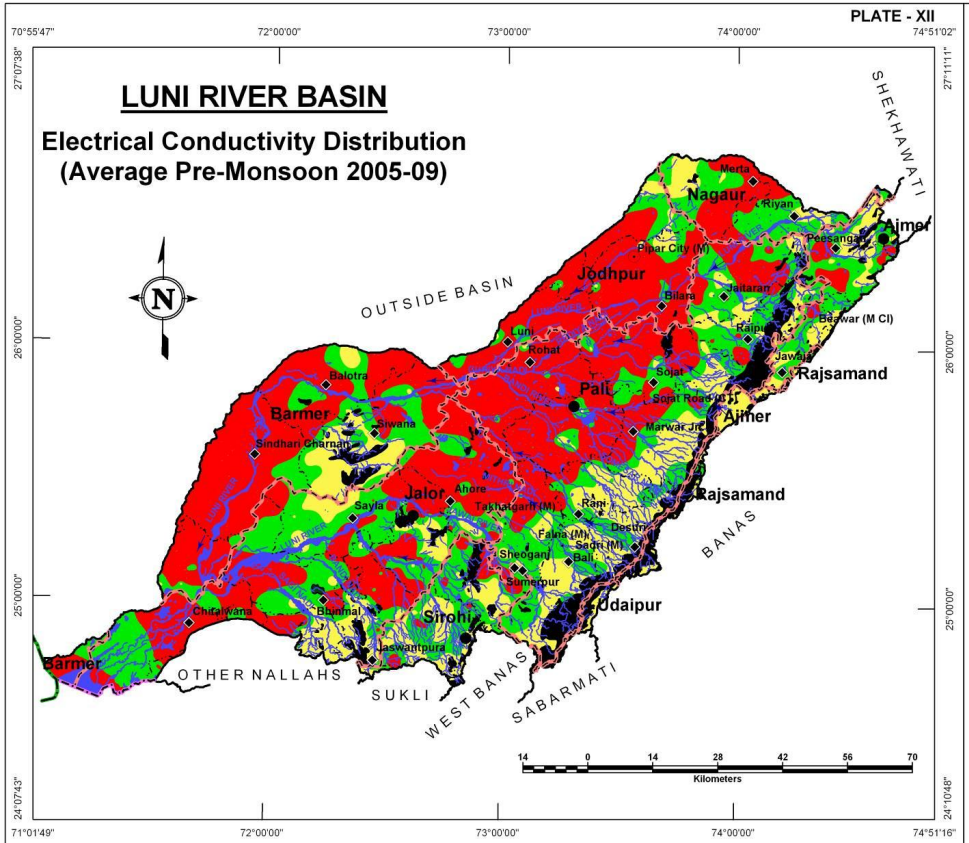
High chloride concentration in ground water also renders it unsuitable for domestic and other purposes. The red coloured regions in Plate – XIII are such areas where Chloride concentration is very high (> 1000 mg/l) which are largely found in alluvial aquifers of Barmer, Jalor, Jodhpur and Pali districts. Good quality water with low Chloride concentration (<250 mg/l) are very limited in spatial distribution and found in the close proximity of hilly areas. Significant part of the basin has moderately high Chloride concentration in ground water that ranges in between 250-1000 mg/l.

Chloride Ranges (mg/l) (Ave. of years 2005-09)	District wise area coverage (sq km)																				Total Area (sq km)
	Ajmer		Barmer		Bhilwara		Jalor		Jodhpur		Nagaur		Pali		Rajsamand		Sirohi		Udaipur		
	Area	% age	Area	% age	Area	% age	Area	% age	Area	% age	Area	% age	Area	% age	Area	% age	Area	% age	Area	% age	
< 250	469.7	26.4	225.2	3.5	-	5.8	573.2	6.7	16.3	0.5	151.5	8.1	1,586.8	14.1	111.6	72.6	318.7	16.8	60.8	100.0	**3,513.6**
250 - 1000	1,093.5	61.4	1,797.4	28.0	-	94.2	3,830.9	44.5	830.6	23.8	1,324.1	70.5	4,923.2	43.7	42.1	27.4	1,413.0	74.3	-	0.0	**15,254.8**
> 1000	216.6	12.2	4,405.3	68.5	-	0.0	4,209.4	48.9	2,647.8	75.8	403.9	21.5	4,752.8	42.2	-	0.0	170.5	9.0	-	0.0	**16,806.4**
Total	**1,779.7**	**100.0**	**6,427.9**	**100.0**	**-**	**100.0**	**8,613.5**	**100.0**	**3,494.8**	**100.0**	**1,879.5**	**100.0**	**11,262.7**	**100.0**	**153.7**	**100.0**	**1,902.2**	**100.0**	**60.8**	**100.0**	**35,574.8**

PLATE - XII

LUNI RIVER BASIN

Electrical Conductivity Distribution (Average Pre-Monsoon 2005-09)



LEGEND

Admin Boundary:

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

Water Bodies:

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

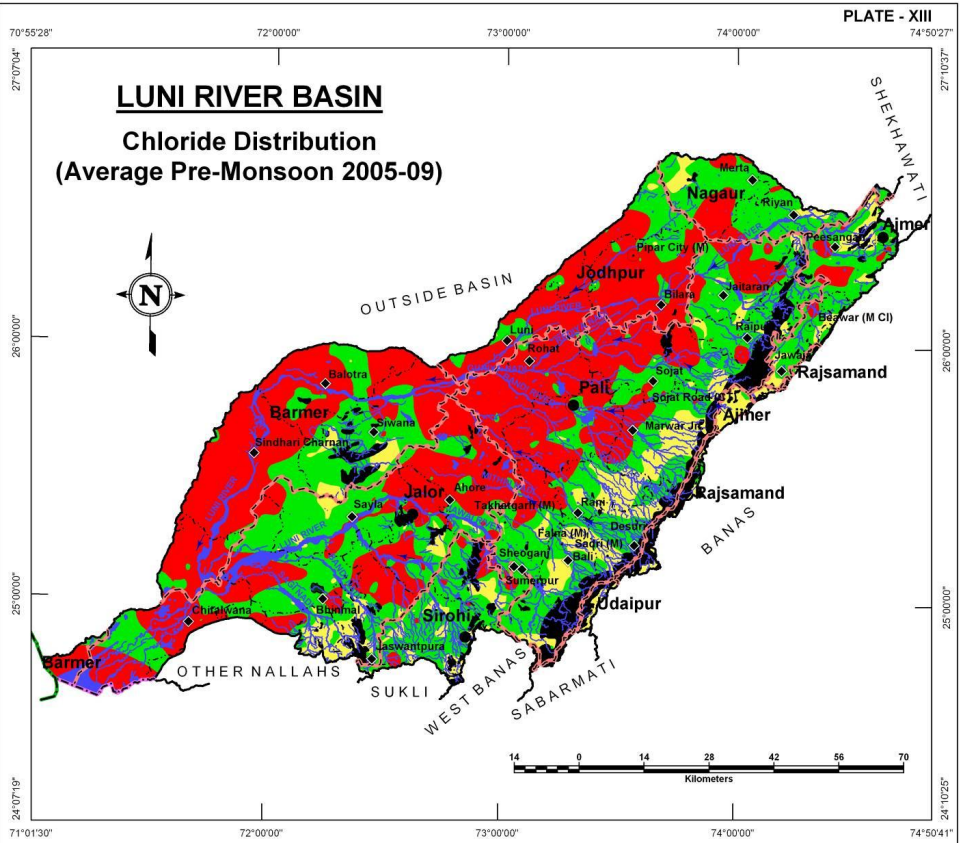
Electrical Conductivity (µS/cm at 25°C):

- < 2000
- 2000-4000
- > 4000

PLATE - XIII

LUNI RIVER BASIN

Chloride Distribution (Average Pre-Monsoon 2005-09)



LEGEND

Admin Boundary:

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

Water Bodies:

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

Chloride Concentration (mg/l):

- < 250
- 250 - 1000
- > 1000

FLUORIDE DISTRIBUTION

LUNI RIVER BASIN

The Fluoride concentration map (Plate – XIV) displays a number of scattered patches of high fluoride concentration (>3 mg/l) which is surrounded but an even larger area having 1.5 – 3.0 mg/l of fluoride in ground water. Together these two areas combined (i.e., > 1.5 mg/l), occupy close to 70% of the basin rendering the ground water of limited use from fluoride concentration point of view. The areas showing low concentration of fluoride in ground water are seen in Sayla-Siwara-BalotraSindhari-Charnan region, southwest of Chiralwana, and some isolated pockets in the east and north of the basin which are suitable for all purposes.

Fluoride Ranges (mg/l) (Ave. of years 2005-09)	District wise area coverage (sq km)																				Total Area (sq km)
	Ajmer		Barmer		Bhilwara		Jalor		Jodhpur		Nagaur		Pali		Rajsamand		Sirohi		Udaipur		
	Area	% age	Area	% age	Area	% age	Area	% age	Area	% age	Area	% age	Area	% age	Area	% age	Area	% age	Area	% age	
<1.5	839.4	47.2	3,305.6	51.4		0.0	2,536.4	29.5	403.4	11.5	396.3	21.1	2,210.1	19.6	139.6	90.9	274.9	14.5	60.8	100.0	**10,166.3**
1.5-3.0	899.6	50.6	2,340.7	36.4	-	100.0	3,772.5	43.8	2,012.6	57.6	1,363.9	72.6	6,144.9	54.6	14.0	9.1	949.3	49.9		0.0	**17,497.6**
>3.0	40.7	2.3	781.6	12.2	-	0.0	2,304.7	26.8	1,078.8	30.9	119.3	6.4	2,907.7	25.8	-	0.0	678.1	35.7	-	0.0	**7,910.8**
Total	**1,779.7**	**100.0**	**6,427.9**	**100.0**	**-**	**100.0**	**8,613.5**	**100.0**	**3,494.8**	**100.0**	**1,879.5**	**100.0**	**11,262.7**	**100.0**	**153.6**	**100.0**	**1,902.2**	**100.0**	**60.8**	**100.0**	**35,574.8**

NITRATE DISTRIBUTION

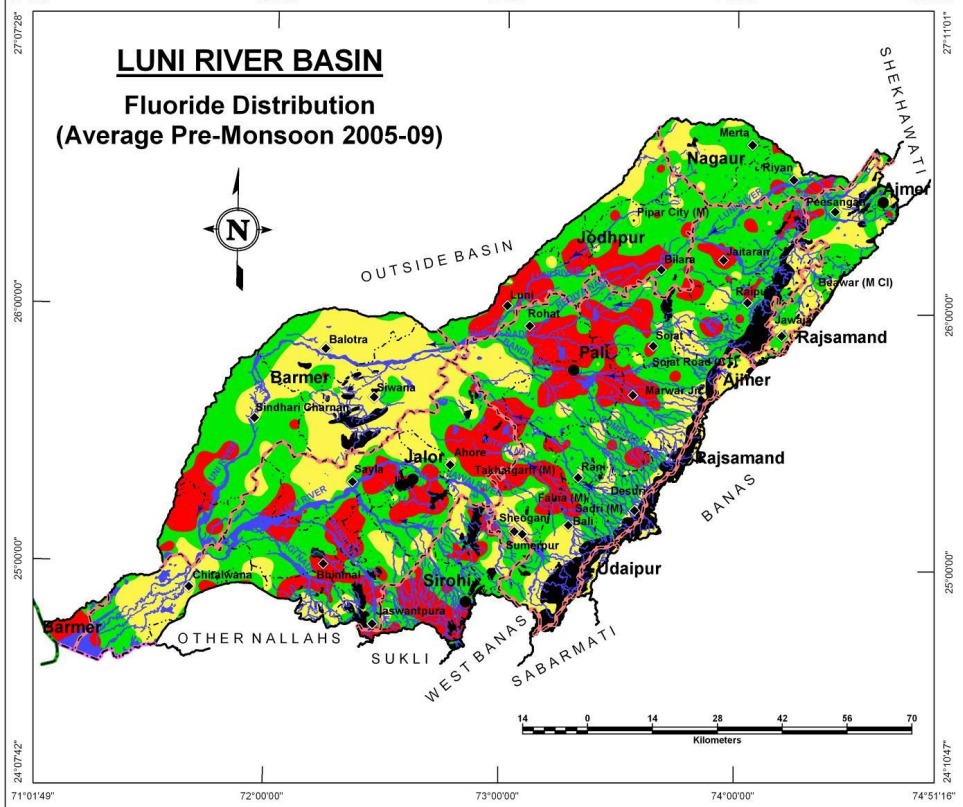
High nitrate concentration in ground water renders it unsuitable for agriculture purposes. Plate – XV shows distribution of Nitrate in groundwater. The Nitrate concentration is also high in this basin as seen by the red and green coloured regions occupying about 73% basin area. Such high Nitrate areas are seen in the western fringes, NW and scattered patches in rest of the area.

Nitrate Ranges (mg/l) (Ave. of years 2005-09)	District wise area coverage (sq km)																				Total Area (sq km)
	Ajmer		Barmer		Bhilwara		Jalor		Jodhpur		Nagaur		Pali		Rajsamand		Sirohi		Udaipur		
	Area	% age	Area	% age	Area	% age	Area	% age	Area	% age	Area	% age	Area	% age	Area	% age	Area	% age	Area	% age	
< 50	655.2	36.8	592.4	9.2	-	100.0	1,476.1	17.1	650.0	18.6	701.4	37.3	4,539.8	40.3	112.5	73.2	716.4	37.7	50.4	82.9	9,494.0
50-100	743.0	41.8	1,877.5	29.2		0.0	3,441.1	40.0	1,155.9	33.1	958.8	51.0	4,266.9	37.9	35.5	23.1	667.8	35.1	10.4	17.1	13,156.9
> 100	381.5	21.4	3,957.9	61.6	-	0.0	3,696.3	42.9	1,688.9	48.3	219.4	11.7	2,456.1	21.8	5.7	3.7	518.2	27.2	-	0.0	12,923.9
Total	1,779.7	100.0	6,427.9	100.0	-	100.0	8,613.5	100.0	3,494.8	100.0	1,879.5	100.0	11,262.7	100.0	153.6	100.0	1,902.3	100.0	60.8	100.0	35,574.8

PLATE - XIV

LUNI RIVER BASIN

Fluoride Distribution
(Average Pre-Monsoon 2005-09)



LEGEND

Admin Boundary:

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

Water Bodies:

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

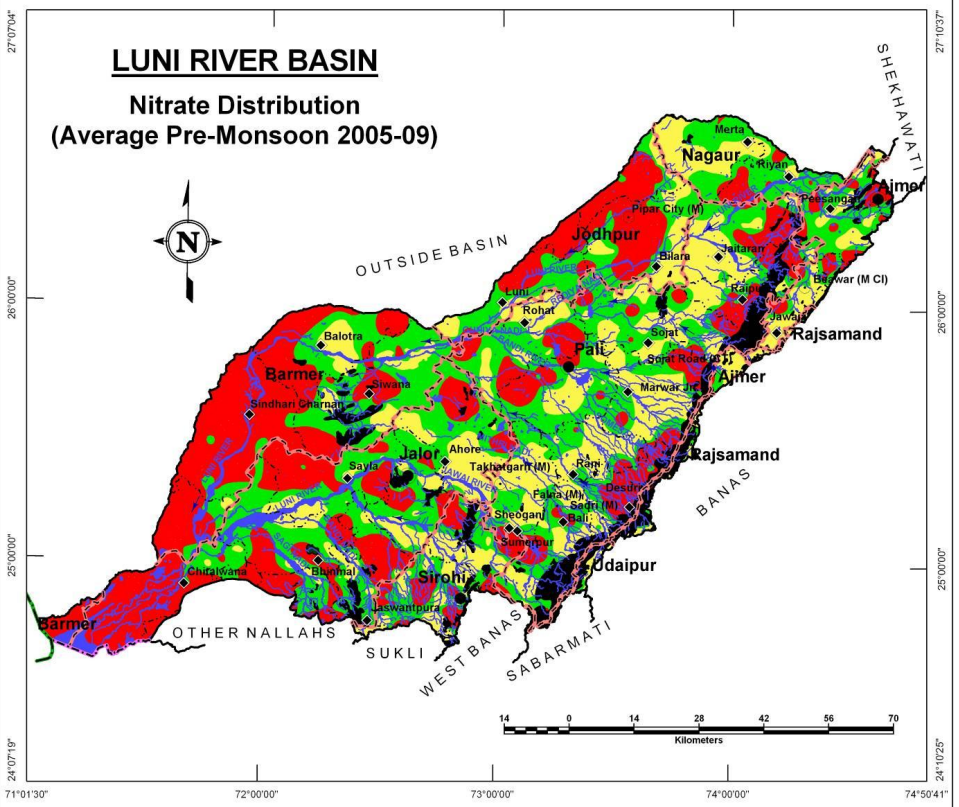
Fluoride Concentration(mg/l):

- < 1.5
- 1.5-3.0
- > 3.0

PLATE - XV

LUNI RIVER BASIN

Nitrate Distribution
(Average Pre-Monsoon 2005-09)



LEGEND

Admin Boundary:

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

Water Bodies:

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

Nitrate Concentration (mg/l):

- < 50
- 50-100
- > 100

DEPTH TO BEDROCK

LUNI RIVER BASIN

Apart from surface exposures, the bedrock is encountered below soil cover and thick pile alluvial material at different depths. The sedimentary, igneous and metamorphic rock types that constitute the bedrock in Luni Basin which are: Sandstone, Limestone Shale, Granite, Rhyolite, Schist, Phyllite, Quartzite, Dolomite and Gneiss.

Plate XVI represents depth to bed rock in meters below ground level. Shallower depth to bedrock is found in areas closer to Aravalli Range i.e., within 40m of depth below ground level and around Siwana in the western part of the basin. Deeper bedrock lies below alluvial cover in west, northwest and southwestern parts of the basin reaching upto 120m bgl.

Depth to Bedrock (m bgl)	District wise area coverage (sq km)										Total Area (sq km)
	Ajmer	Barmer	Bhilwara	Jalor	Jodhpur	Nagaur	Pali	Rajsamand	Sirohi	Udaipur	
< 20	35.2	-	-	-	-	-	26.0	-	8.2	25.7	95.0
20-40	1,465.0	294.3	-	2,872.2	-	36.1	5,311.4	137.2	1,881.5	35.1	12,032.8
40-60	276.3	2,796.9	-	1,177.5	135.2	46.2	2,819.6	16.4	3.3	-	7,271.4
60-80	3.2	668.3	-	1,652.7	1,686.7	203.4	1,727.6	-	-	-	5,941.9
80-100	-	695.9	-	1,338.6	1,672.8	1,520.0	1,371.3	-	-	-	6,598.6
100-120	-	1,737.0	-	857.0	-	73.8	-	-	-	-	2,667.8
> 120	-	235.6	-	731.7	-	-	-	-	-	-	967.3
Total	1,779.7	6,427.9	-	8,629.7	3,494.8	1,879.5	11,255.8	153.7	1,893.0	60.8	35,574.8

UNCONFINED AQUIFER

Hydrogeological properties are different for alluvial and hard rock aquifers and therefore, this aquifer has been mapped as two separate regions viz, unconfined aquifers in alluvial and in hard rock areas.

The alluvial material is predominantly alluvial or fluvial origin sand, clay and gravel. The thickness of this aquifer varies from very thin layers to upto 120m as seen around Sheoganj and Peesangaon. The hardrock aquifers are formed in weathered and fractured part of the hard rocks that can sustain water under unconfined conditions. Such aquifers are formed in Sandstone, Limestone, Shale, Dolomite, Phyllite, Schist, Quartzite, Granites and Gneiss. These aquifers are formed mainly in Eastern part of the basin close to Aravalli range and the belt runs parallel to the ridges and in Nagaur area.

Alluvial areas

Unconfined aquifer Thickness (m)	District wise area coverage (sq km)										Total Area (sq km)
	Ajmer	Barmer	Bhilwara	Jalor	Jodhpur	Nagaur	Pali	Rajsamand	Sirohi	Udaipur	
<10	256.9	3,998.4	-	4,108.3	779.9	584.1	2,006.8	-	619.5	-	12,353.8
10-20	0.0	692.1	-	1,031.2	405.7	115.7	830.2	-	55.0	-	3,130.0
20-30	-	354.6	-	613.4	6.0	55.6	304.7	-	48.7	-	1,382.9
30-40	-	349.9	-	616.5	-	55.3	98.0	-	19.8	-	1,139.5
40-50	-	348.8	-	739.8	-	5.5	48.0	-	-	-	1,142.2
50-60	-	159.8	-	456.5	-	2.3	25.7	-	-	-	644.3
60-70	-	82.0	-	169.7	-	0.0	14.8	-	-	-	266.5
70-80	-	49.6	-	42.9	-	-	7.8	-	-	-	100.3
80-90	-	32.6	-	29.4	-	-	3.6	-	-	-	65.6
90-100	-	22.6	-	24.9	-	-	0.8	-	-	-	48.3
100-110	-	5.4	-	35.4	-	-	-	-	-	-	40.7
110-120	-	0.8	-	10.2	-	-	-	-	-	-	11.0
>120	-	-	-	0.4	-	-	-	-	-	-	0.4
Total	256.9	6,096.8	-	7,878.3	1,191.5	818.5	3,340.3	-	743.0	-	20,325.3

Hardrock areas:

Unconfined aquifer Thickness (m)	District wise area coverage (sq km)										Total Area (sq km)
	Ajmer	Barmer	Bhilwara	Jalor	Jodhpur	Nagaur	Pali	Rajsamand	Sirohi	Udaipur	
<10	755.7	328.7	-	167.9	734.9	828.3	1,168.2	53.2	174.8	41.0	4,252.7
10-20	318.0	2.4	-	230.3	459.9	222.7	2,605.8	65.0	423.2	14.2	4,341.5
20-30	212.9	-	-	259.3	626.2	10.0	2,387.9	17.2	273.9	5.5	3,792.9
30-40	104.5	-	-	74.5	283.3	-	1,198.1	8.2	163.4	-	1,831.9
40-50	60.5	-	-	3.3	113.1	-	357.7	9.3	109.9	-	653.8
50-60	43.6	-	-	-	63.1	-	103.2	0.9	11.1	-	221.8
60-70	16.4	-	-	-	18.2	-	49.5	-	2.7	-	86.8
70-80	9.0	-	-	-	4.6	-	25.7	-	0.3	-	39.6
80-90	2.3	-	-	-	-	-	15.0	-	-	-	17.3
90-100	-	-	-	-	-	-	7.8	-	-	-	7.8
>100	-	-	-	-	-	-	3.5	-	-	-	3.5
Total	1,522.8	331.1	-	735.2	2,303.2	1,061.0	7,922.4	153.7	1,159.2	60.8	15,249.5

PLATE - XVI

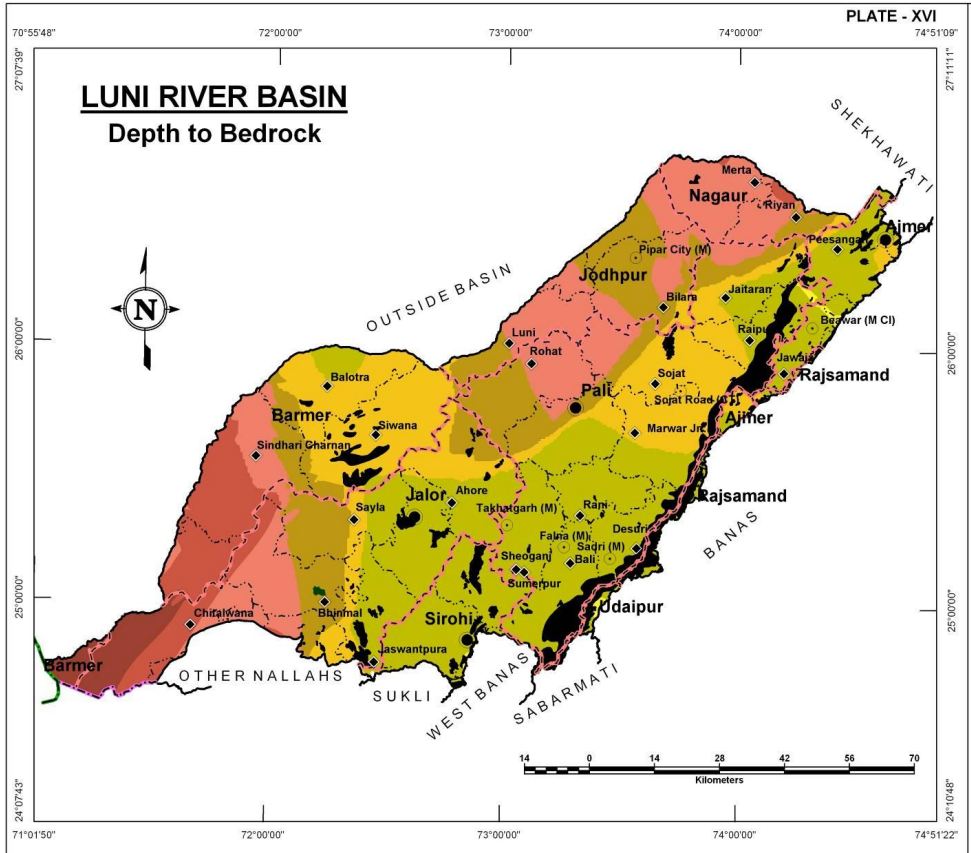
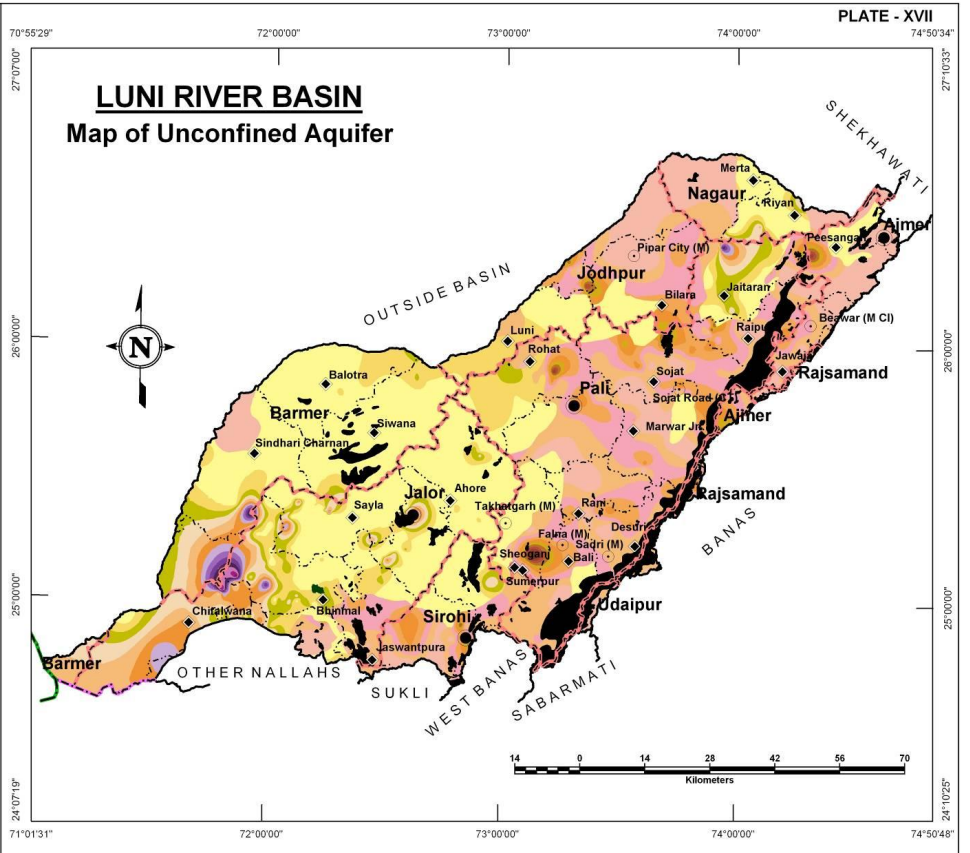


PLATE - XVII



LEGEND

Admin Boundary:

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

Depth to Bedrock (m bgl):

- <20
- 20-40
- 40-60
- 60-80
- 80-100
- 100-120
- >120

LEGEND

Admin Boundary:

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

Aquifer Thickness (m):

Alluvial Area:	Weathered & Fractured Zone in Hardrock Area :
<10	<10
10-20	10-20
20-30	20-30
30-40	30-40
40-50	40-50
50-60	50-60
60-70	60-70
70-80	70-80
80-90	80-90
90-100	90-100
100-110	>100
110-120	
>120	

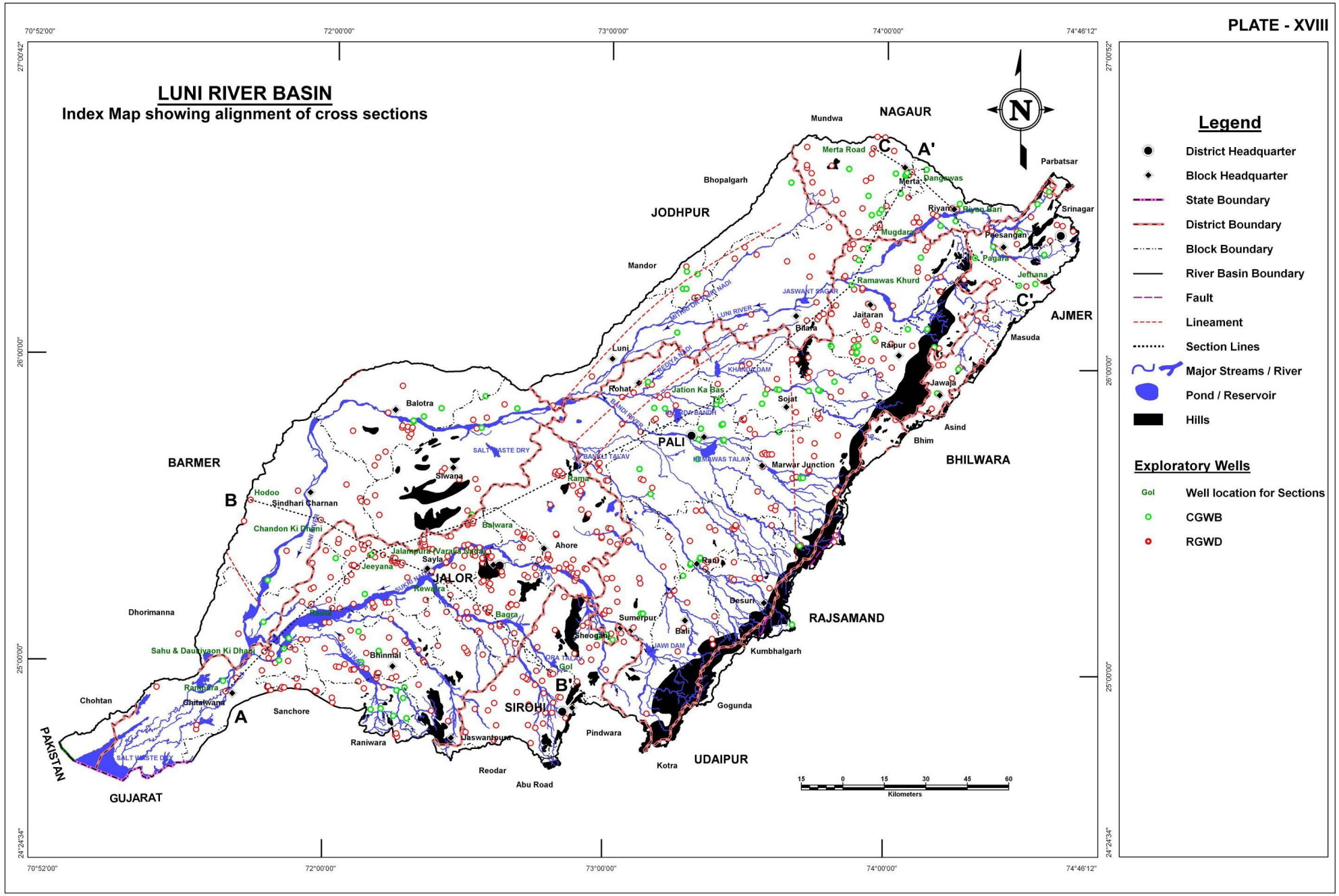
CROSS SECTIONS

LUNI RIVER BASIN

Several hydrogeologic cross sections have been drawn to better depict the sub-surface distribution of lithology. These sections have been overlaid with geological maps and structural faults if there are any have been transferred for verification of their impact on sub-surface material disposition. The alignment of the cross sections is shown in Plate XVIII and corresponding sections are presented in Plates – XIX to XXI. The broad alignment of the sections is as given below:

Name of Section Line	Orientation
Section AA’	SW – NE
Section BB’	NW – SE
Section CC’	NW – SE

PLATE - XVIII


LUNI RIVER BASIN
Index Map showing alignment of cross sections
N
Legend
District Headquarter
Block Headquarter
State Boundary
District Boundary
Block Boundary
River Basin Boundary
Fault
Lineament
Section Lines
Major Streams / River
Pond / Reservoir
Hills
Exploratory Wells
GoI Well location for Sections
CGWB
RGWD
NAGAUR
JODHPUR
AJMER
BARMER
PALI
BHILWARA
JALOR
SIROHI
RAJSAMAND
UDAIPUR
PAKISTAN
GUJARAT
A
A'
B
B'
C
C'
Mundwa
Merta Road
Merta
Dangawas
Parbatsar
Bhopalgarh
Riyan
Riyan Bari
Srinagar
Mugdara
Peesangan
Pagara
Jethana
Mandor
Ramawas Khurd
Jaitaran
Bilara
Raipur
Masuda
Luni
Rohat
Jation Ka Bas
Sojat
Jawaja
Asind
Bhim
Balotra
Siwana
Rama
Marwar Junction
Hodoo
Sindhari Charnan
Chandon Ki Dhani
Balwara
Ahore
Jalampura
Varala
Sayla
Jeeyana
Rani
Kewara
Bagra
Desuri
Dhorimanna
Sumerpur
Sheogani
Bali
Kumbhalgarh
Sahu & Daurivaon Ki Dhani
Bhinmal
Gol
Rampura
Chitalwana
Chohtan
Sanchore
Raniwara
Jaswantpura
Pindwara
Gogunda
Reodar
Abu Road
Kotra
SALT WASTE DRY
LUNI RIVER
SUKRI NADI
BANDI RIVER
SEDIYA NADI
MITHRI CHOTI NADI
JASWANT SAGAR
KHAMLI DAM
KEMAWAS TALAV
BANKALI TALAV
ORA TALAV
JAWI DAM
70°52'00"
72°00'00"
73°00'00"
74°00'00"
74°46'12"
27°00'42"
26°00'00"
25°00'00"
24°24'34"
27°00'52"
15 0 15 30 45 60
Kilometers

Section A-A':

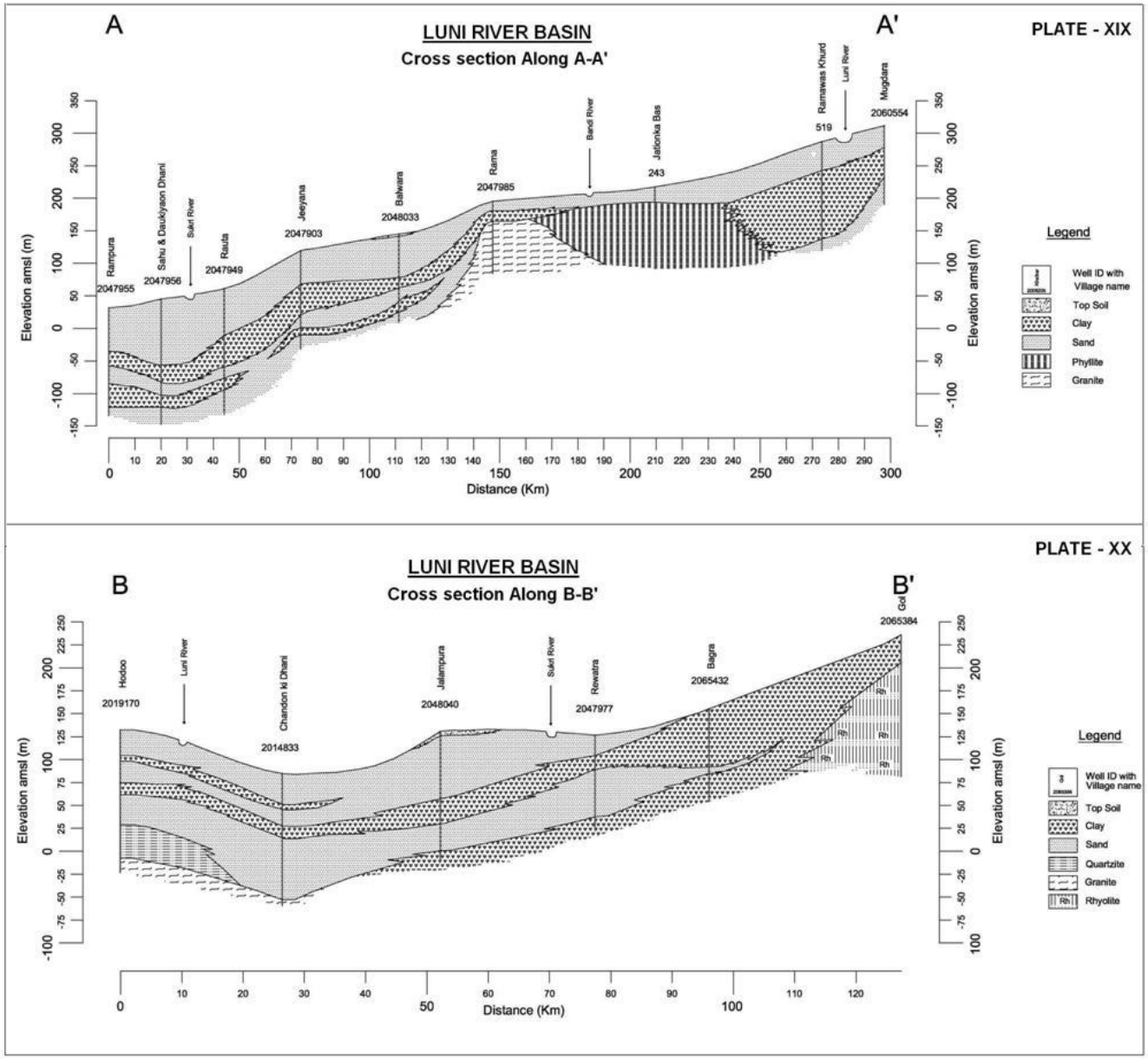
This section is the longest of the sections plotted in the basin and trends in SW-NE direction, cutting across the basin. The section depicts the disposition of different layers of sand and clay along with weathered and fractured zones sandstone, phyllite, granite and gneiss. On perusal of the cross section, it is apparent that sand is the predominant lithology while there are some lenses of clay. In the northern part of the river basin hard rock is observed underlined by sand. The general slope of the terrain is from NE to SW and the Luni River is present in the northern part of the section.

The depth of exploration varies from 215 m amsl to -150 m amsl.

Section B-B':

The section B-B' trending NW-SE has been plotted and presented in Plate – XX. The section depicts predominantly sand and clay layers in alluvial aquifers. The western part of the section shows predominantly alternate layers of sand and clay. Granite is observed as the bedrock. In the central part of the section, the alternate layers of clay and sand which forms major aquifer system in these areas. In some of the wells towards the SE of the cross section Rhyolite is encountered which attains good thickness but it does not form good aquifer due to lack of any significant weathered and fractured zone. Granite, Quartzite and Rhyolite seem to form the bedrock over which the alluvial material is deposited.

In this section, the depth of drilling is between 100m to 150m bgl.

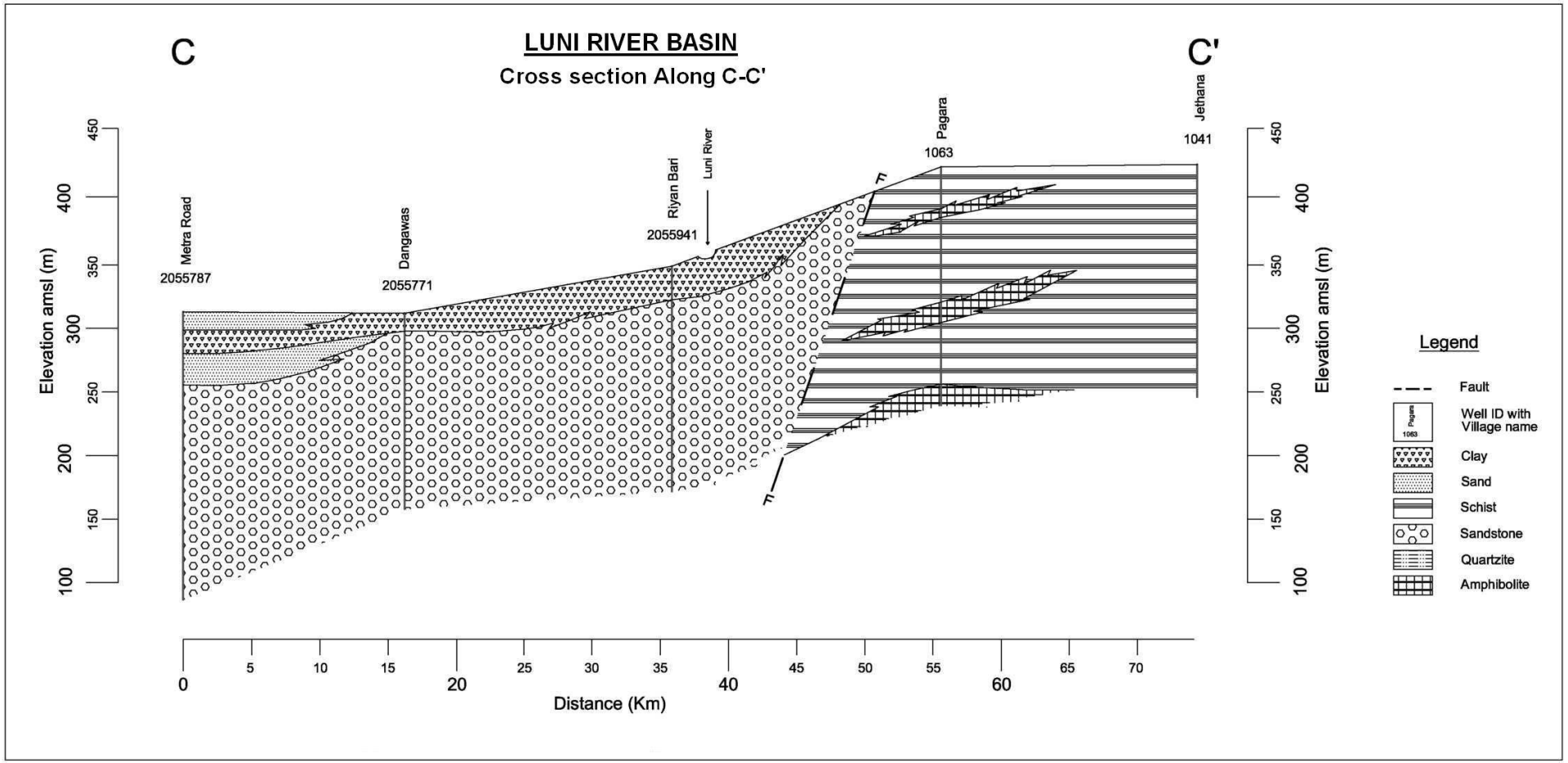

A
LUNI RIVER BASIN
Cross section Along A-A'
A'
PLATE - XIX
Rampura
2047955
Sahu & Daukiyaon Dhani
2047956
Sukri River
Rauda
2047949
Jeeyana
2047903
Balwara
2048033
Rama
2047985
Bandi River
Jatlonka Bas
243
Ramawas Khurd
519
Luni River
Mugdara
2060554
Elevation amsl (m)
Distance (Km)
Legend
Well ID with Village name
Top Soil
Clay
Sand
Phyllite
Granite
PLATE - XX
B
LUNI RIVER BASIN
Cross section Along B-B'
B'
Hodoo
2019170
Luni River
Chandon ki Dhani
2014833
Jalampura
2048040
Sukri River
Rewatra
2047977
Bagra
2065432
Gol
2065384
Elevation amsl (m)
Distance (Km)
Legend
Well ID with Village name
Top Soil
Clay
Sand
Quartzite
Granite
Rhyolite

Section C-C':

The section C-C has been selected across the northern part of the basin trending NW-SE. The eastern part of the section is characterized by thick sequence of schist whereas the major part of section in the west side is made up of sandstone. The weathered and fractured portions of schist constitute aquifer zones and in sandstone, both its porosity and secondary openings make them good aquifers. There is a layer of alluvium near Merta Road that would form major aquifer which is underlain by sandstone which is also a good aquifer.

There is a fault in the eastern part of the area which possibly separates the schistose rocks in the east with sandstones in the west.

PLATE - XXI


LUNI RIVER BASIN
Cross section Along C-C'
C
C'
Metra Road
2055787
Dangawas
2055771
Riyan Bari
2055941
Luni River
Pagara
1063
Jethana
1041
Elevation amsl (m)
100
150
200
250
300
350
400
450
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
Distance (Km)
Legend
Fault
Well ID with Village name
Clay
Sand
Schist
Sandstone
Quartzite
Amphibolite

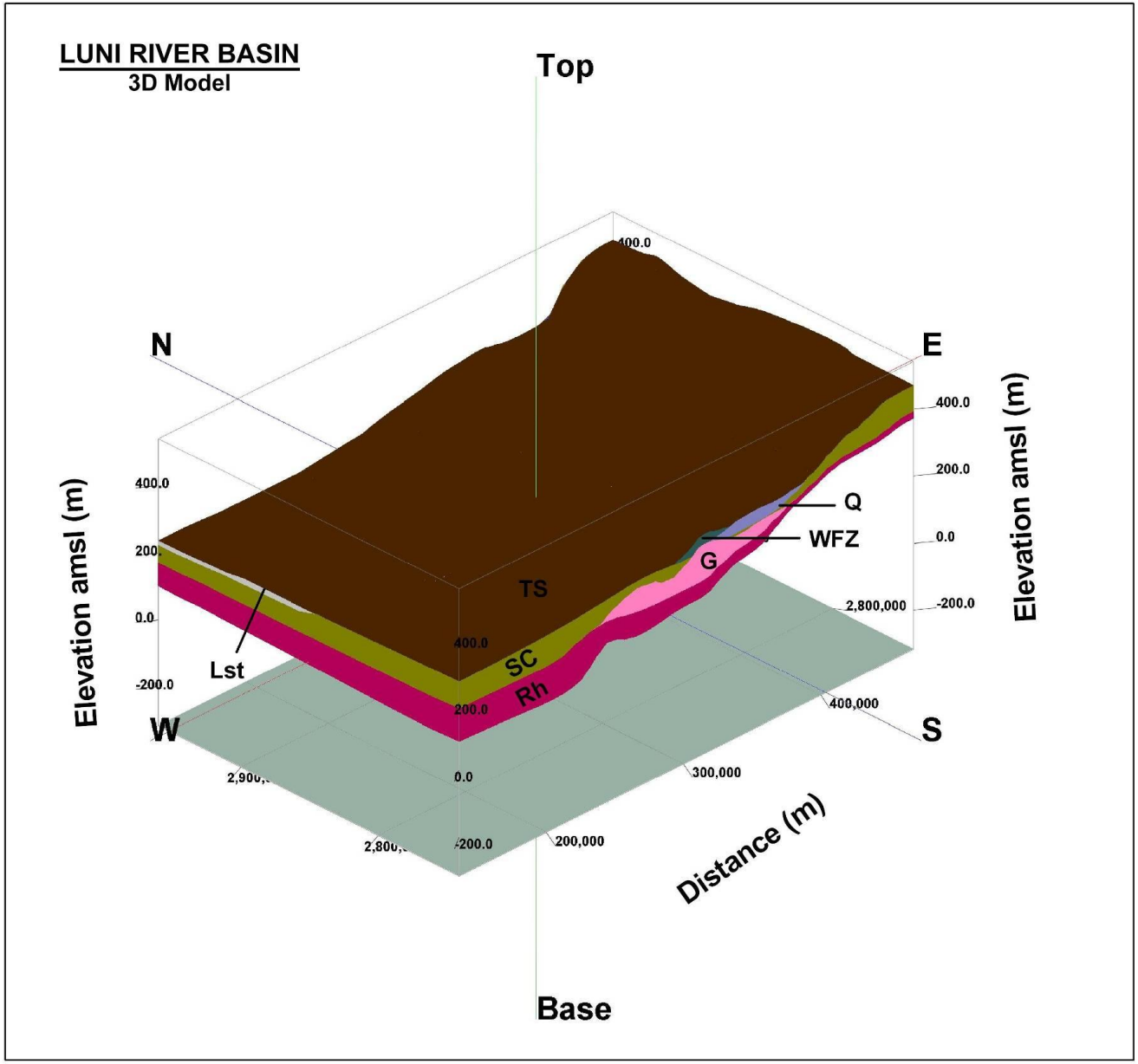
3D MODEL OF AQUIFERS

LUNI RIVER BASIN

The continuous litho-stratigraphic model has been developed for the Luni River Basin using the data of scattered wells as input. 3D model depicts the sub-surface aquifer disposition of litho-stratigraphic units forming aquifers, aquicludes and aquitards in the area. Plate – XXII presents 3D model depicting the various litho-stratigraphic units in the entire river basin. With this model it is apparent that schist is a continuous formation in the area overlain by limestone and quartzite formations, in the south east weathered and fractured zone often serves as aquifer.

The depth of bedrock is low in the eastern part as compared to the western part of the basin. Granite gneiss is the basement forming rock in this basin. The small discontinuous patches depicted in 3D model are indicative of occurrence of limestone, quartzite, weathered & fractured zone as reported in data of GWD and CGWB. In absence of continuity of the similar formation in adjacent wells they are appear as small patches.

PLATE - XXII



Legend

TS	Top Soil
S1	Sand
C1	Clay
S2	Sand
C2	Clay
WFZ	Weathered & Fractured Zone
Sst	Sandstone
Lst	Limestone
Q	Quartzite
Ph	Phyllite
SC	Phyllite
Rh	Rhyolite
G	Granite
Gn	Granite Gneiss

Glossary of terms

S. No.	Technical Terms	Definition
1	AQUIFER	A saturated geological formation which has good permeability to supply sufficient quantity of water to a Tube well, well or spring.
2	ARID CLIMATE	Climate characterized by high evaporation and low precipitation.
3	ARTIFICIAL RECHARGE	Addition of water to a groundwater reservoir by 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	GROUNDWATER RECHARGE	The natural infiltration of surface water into the ground.
12	HARD WATER	The water which does not produce sufficient foam with soap.
13	HYDRAULIC CONDUCTIVITY	A constant that serves as a measure of permeability of porous medium.
14	HYDROGEOLOGY	The science related with the ground water.
15	HUMID CLIMATE	The area having high moisture content.
16	ISOHYET	A line of equal amount of rainfall.
17	METEOROLOGY	Science of the atmosphere.
18	PERCOLATION	It is flow through a porous substance.
19	PERMEABILITY	The property or capacity of a soil or rock for transmitting water.
20	pH	Value of hydrogen-ion concentration in water. Used as an indicator of acidity (pH < 7) or alkalinity (pH > 7).
21	PIEZOMETRIC HEAD	Elevation to which water will rise in a piezometers.
22	RECHARGE	It is a natural or artificial process by which water is added from outside to the aquifer.
23	SAFE YIELD	Amount of water which can be extracted from groundwater without producing undesirable effect.
24	SALINITY	Concentration of dissolved salts.
25	SEMI-ARID	An area is considered semiarid having annual rainfall between 10-20 inches.
26	SEMI-CONFINED AQUIFER	Aquifer overlain and/or underlain by a relatively thin semi-pervious layer.
27	SPECIFIC YIELD	Quantity of water which is released by a formation after its complete saturation.
28	TOTAL DISSOLVED SOLIDS	Total weight of dissolved mineral constituents in water per unit volume (or weight) of water in the sample.

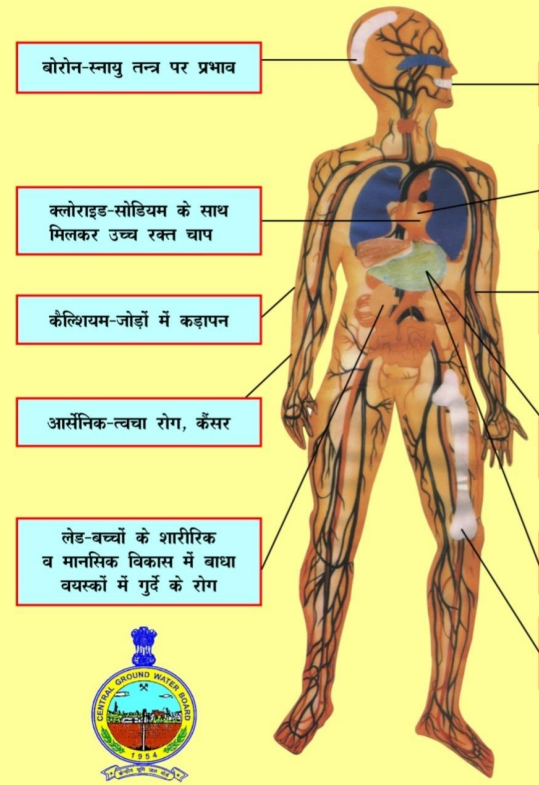
(Contd…)

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
- क्लोराइड-सोडियम के साथ मिलकर उच्च रक्त चाप
- सोडियम-हृदय, गुर्दा व रक्त परिसंचरण रोगों से ग्रसित लोगों को हानिकारक
- कैल्शियम-जोड़ों में कड़ापन
- नाइट्रेट-नवजात शिशुओं में ब्लू बेबी बीमारी (मेथमोग्लोबिनिमिया)
- आर्सेनिक-त्वचा रोग, कैंसर
- सल्फेट-अधिकता में मैग्नेशियम के साथ मिलकर दस्तावर
- लेड-बच्चों के शारीरिक व मानसिक विकास में बाधा वयस्कों में गुर्दे के रोग
- आयरन-आयरन जीवाणु से आमाशय संबंधी रोग
- फ्लोराइड-जोड़ों में अकड़न, हड्डियों में मुड़ाव

केन्द्रीय भूमि जल बोर्ड,
पश्चिमी क्षेत्र, जयपुर
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भारत सरकार
e-mail:cgwbwr@sancharnet.in

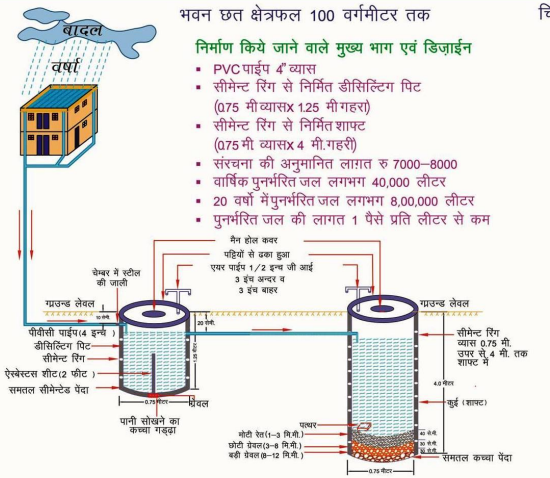
भूजल अमूल्य है इसे प्रदूषित न करें।

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

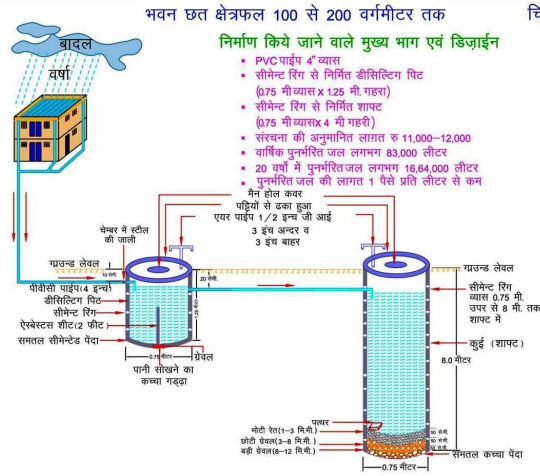


चित्र–2

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

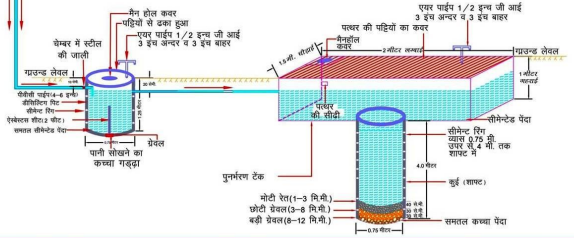


चित्र–3

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
- पुर्नभरित जल की लागत 1 पैसे प्रति लीटर से कम

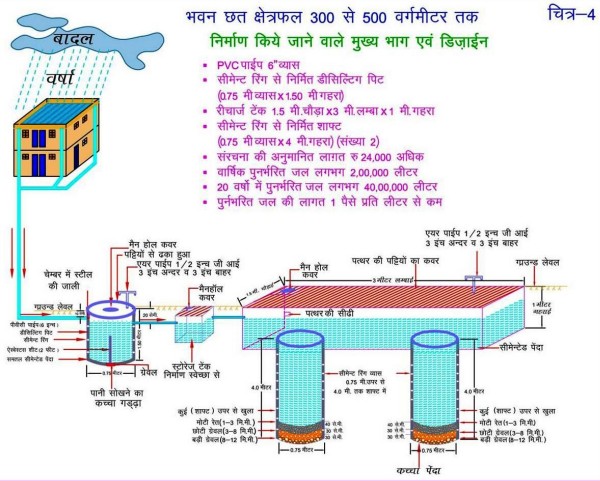


चित्र–4

भवन छत क्षेत्रफल 300 से 500 वर्गमीटर तक

निर्माण किये जाने वाले मुख्य भाग एवं डिज़ाईन

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



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Myths and Facts about Ground Water

S No	Myths	Facts
1	What is Ground Water • an underground lake • a net work of underground rivers • a bowl filled with water	Water which occurs below the land in geological formations/rocks is Ground water
2	Ground Water occurs everywhere beneath the Land Surface	Not really, it depends on the nature of rock formation
3	There is a relationship between ground water and surface water	Not all the places. Near streams/rivers there is relation
4	Groundwater is not renewable resource	It is renewable source and every year it is being recharged through rain/applied irrigation etc
5	Ground water is unlimited and deeper you drill more discharge	It is limited to annual recharge from rain/applied irrigation. The discharge may not increase if you go deeper
6	Ground Water moves rapidly	The movement of ground water is very slow
7	Ground water pumped from wells is thousands of years old	Generally the ground water being tapped through wells is a few years old
8	If water taste good—it is safe to drink	It may have other chemicals e.g. fluoride, nitrates etc which are harmful
9	Water from free flowing tube wells is very pure	This water can also be contaminated so test before use
10	If I recharge my TW/DW/HP it will not benefit me	It will also benefit you and also adjoing wells
11	There is no static ground water resources in Rajasthan	Rajasthan is also having Static GW resources, and being tapped in most of areas as GW annual withdrawal is more than annual recharge
12	I cannot meet annual cooking and drinking water requirement by rain water harvesting	The water requirement for drinking and cooking is only 8 lit/day. You can harvest this water for family of 5 persons from roof top or paved area of 75 Sq m to meet annual requirement
13	You can increase ground water recharge	This can be done by harvesting the rain water and storing in sub surface reservoir (GW) by constructing the recharge structures
14	You cannot use abandoned TW/HP/DW for ground water recharge	These should be used as recharge structures as harvested rain water is directly put into GW reservoir
15	Putting waste near HP/TW will not cause any problem	Such actions will pollute wells and water

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