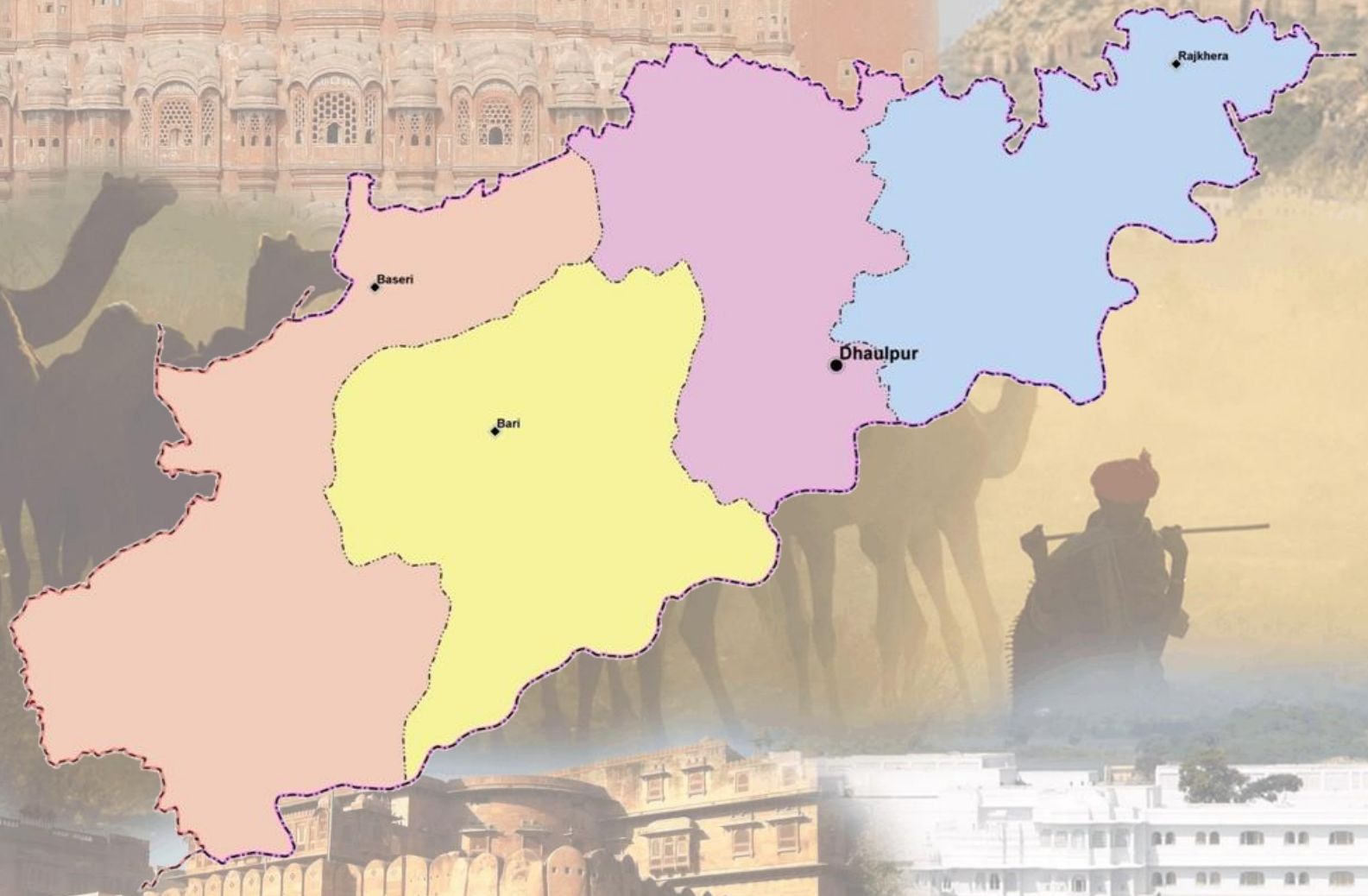
Ground Water Department,
Rajasthan

Hydrogeological Atlas of Rajasthan

Dhaulpur District

European Union
State Partnership Programme



2013

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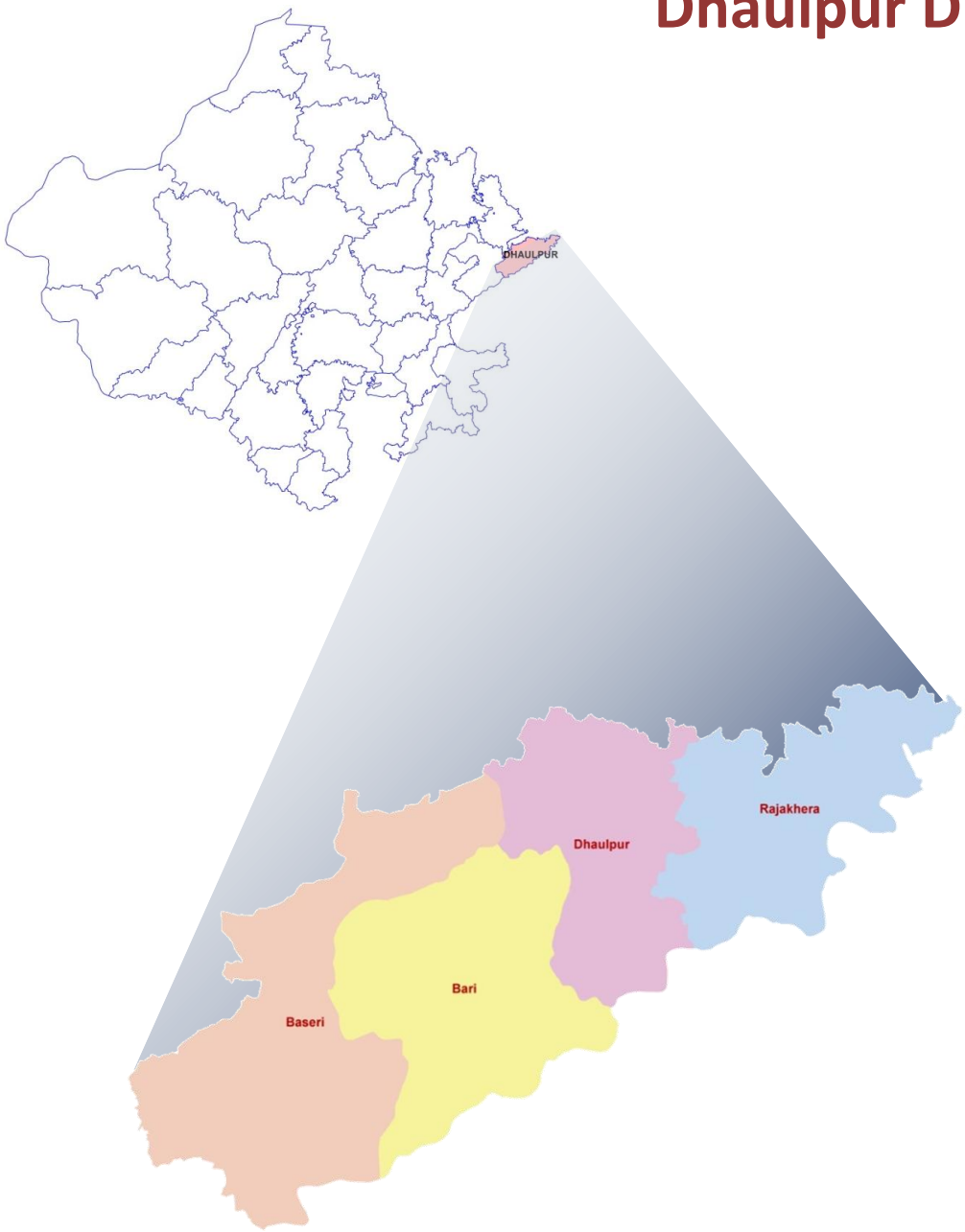
Hydrogeological Atlas of Rajasthan

Dhaulpur District



Contents:

2013

ADMINISTRATIVE SETUP

DISTRICT – DHAULPUR

Location:

Dhaulpur district is located in the eastern part of Rajasthan. It is bounded in the north by state of Uttar Pradesh, east to south by state of Madhya Pradesh and in the west by Karauli and Bharatpur districts. It stretches between 26° 20' 21.53" to 26° 58' 01.23" north latitude and 77° 13' 29.68'' to 78° 16' 27.33'' east longitude covering area of 3,040.3 sq km. The district is drained three almost parallel aligned drainage basins, 'Parbati River Basin' in the centre whereas the Gambir River and Chambal RIver drain in the northwestern and southeastern part respectively.

Administrative Set-up:

Dhaulpur district is administratively divided into four 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	Bari	2,01,069	789.0	26.0	172
2	Baseri	2,01,777	1,009.3	33.0	196
3	Dhaulpur	3,54,764	597.7	20.0	233
4	Rajakhera	2,20,161	644.3	21.0	204
Total		**9,77,771**	**3,040.3**	**100.0**	**805**

Dhaulpur district has 805 towns and villages, of which four are block headquarters as well.

Climate:

Climate of the district can broadly be classified as semi-arid type. The hottest months are May and June, when the day temperatures soar to a maximum of 49-50°C. Temperatures in summers are normally higher than 40°C. Winters are also very cold especially in the months of December and January where temperatures sometimes reach near 0°C or below the sub-zero level. The lowest recorded temperature is -4.3°C on January 29th, 1990. Monsoon season is marked by high humidity in the months of July to September and the area receives relatively low rainfall as the mean annual rainfall of the district is 669.9mm. The months of September and October are pleasant and mark transition to winters.

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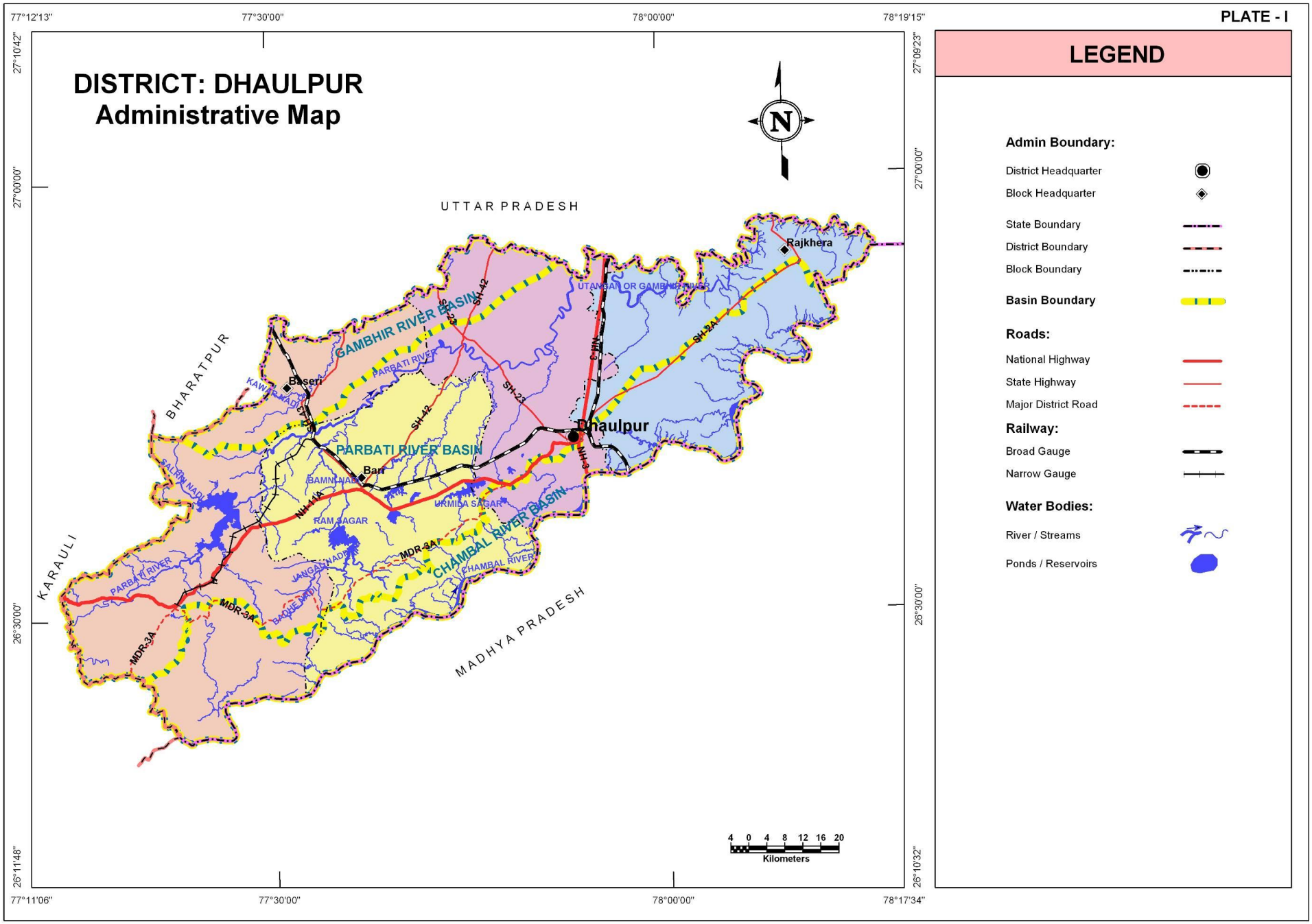
PLATE - I



LEGEND

Admin Boundary:

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

Roads:

- National Highway
- State Highway
- Major District Road

Railway:

- Broad Gauge
- Narrow Gauge

Water Bodies:

- River / Streams
- Ponds / Reservoirs

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TOPOGRAPHY

DISTRICT – DHAULPUR

The district comprises of riverine plains and ravines in eastern part and sandstone plateau in the southwestern part. The central part of the district is undulatingIn the eastern part alluvial plains form low land areas of the district in Rajakhera block with elevation range 111.2 to 184.4m above mean sea level. The drainage system of the district is well developed and is systematically drained by Chambal, Gambhir and Parbati rivers and their various tributaries. Dhaulpur district falls under Chambal, Gambhir and Parbati River Basin. The general topographic elevation in the district is between 150 m to 200 m above mean sea level in most of the blocks. Elevation ranges from a minimum of 111.2 m above mean sea level in Rajakhera block in the NE part of the district and maximum of 340.9 m above mean sea level in Baseri in SW part of the district.

Table: Block wise minimum and maximum elevation

S. No.	Block Name	Min. Elevation (m amsl)	Max. Elevation (m amsl)
1	Bari	119.0	324.4
2	Baseri	129.6	340.9
3	Dhaulpur	114.7	278.1
4	Rajakhera	111.2	184.4

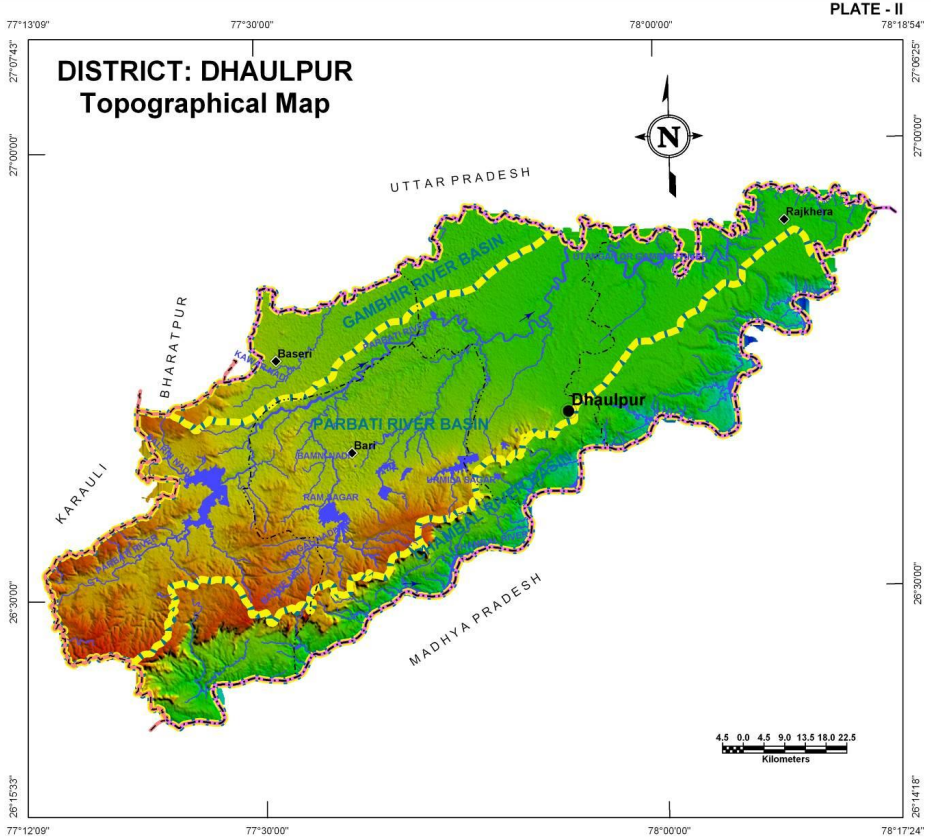
RAINFALL

The general distribution of total annual rainfall across the district can be visualized from isohyets presented in the Plate – III where rainfall is seen gradually increasing from west to east. The maximum part in East, district received 800 to 900 mm rainfall, whereas southwest part received in range 600-700 mm. The annual average rainfall in the year 2010 was thus 794.7 mm based on the data of available blocks while maximum average annual rainfall of 892.8 mm in Dhaulpur block. The lowest of minimum annual rainfall was recorded in Baseri block (571.2 mm). Dhaulpur block received highest annual rainfall of about 973.7 mm.

Table: Block wise annual rainfall statistics (derived from year 2010 meteorological station data)

Block Name	Minimum Annual Rainfall (mm)	Maximum Annual Rainfall (mm)	Average Annual Rainfall (mm)
Bari	595.8	879.5	748.6
Baseri	571.2	816.9	661.2
Dhaulpur	791.2	973.7	892.8
Rajakhera	797.5	963.8	876.3

PLATE - II



LEGEND

Admin Boundary:

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

Basin Boundary

Water Bodies:

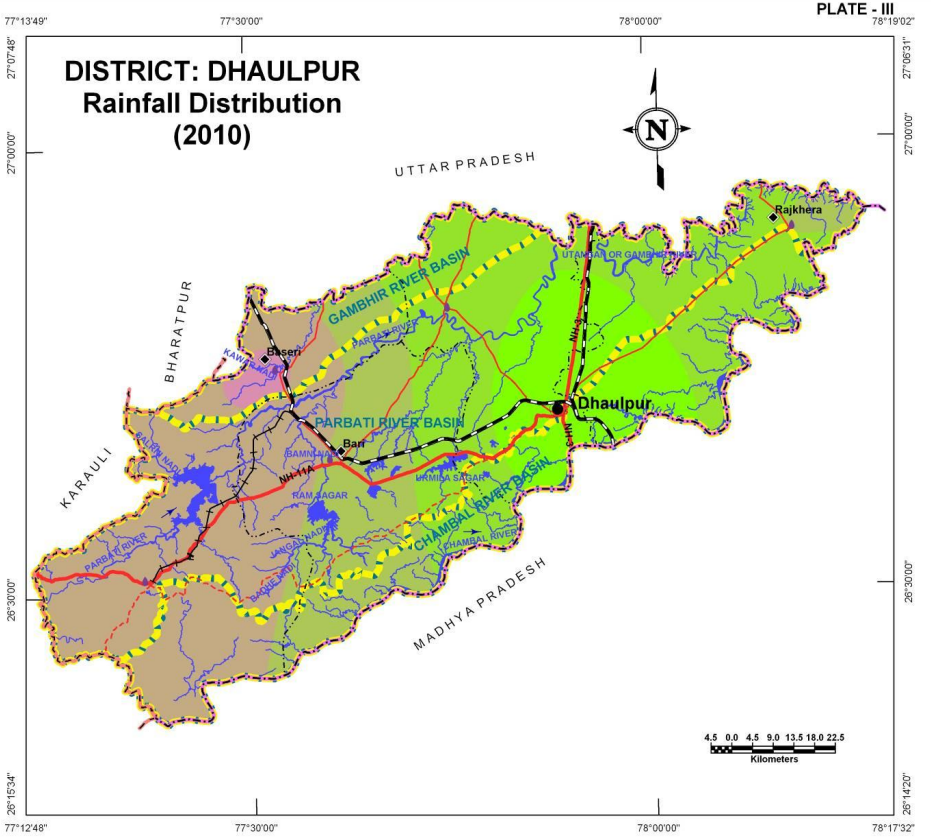
- River / Streams
- Ponds / Reservoirs

Elevation (m amsl):

341
300
250
200
150
111

Source : SRTM DEM

PLATE - III



LEGEND

Admin Boundary:

- District Headquarter
- Block Headquarter
- Raingauge Stations
- State Boundary
- District Boundary
- Block Boundary

Basin Boundary

Roads:

- National Highway
- State Highway
- Major District Road

Railway:

- Broad Gauge
- Metre Gauge

Water Bodies:

- River / Streams
- Ponds / Reservoirs

Isohyets (mm):

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

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GEOLOGY

DISTRICT – DHAULPUR

Vindhyans are predominant all over the district below thin cover of Quaternary alluvium and these are the only two broad lithologic groups that are present in the Dhaulpur district. The hardrock in the entire district comprises the rocks of Bhander Group of Vindhayan Super Group, which consist Sandstone, Shale and Limestone whereas the alluvium is mostly of fluvial origin sand, clay etc.

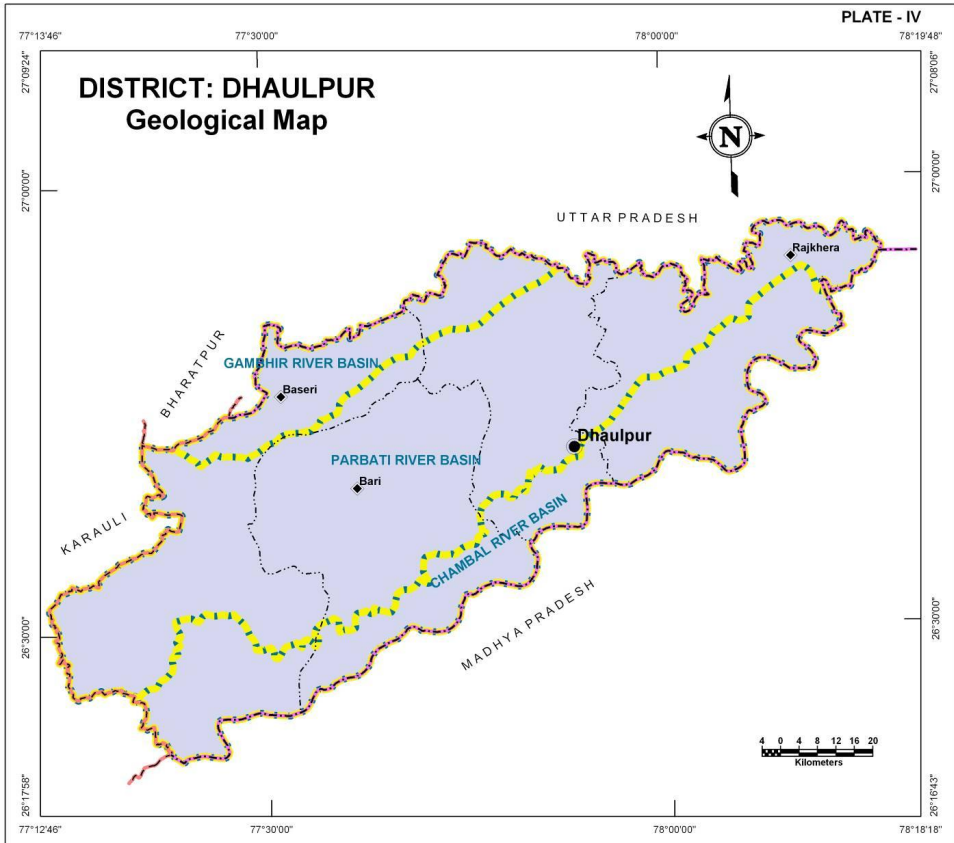
Super Group	Group	Formation
	Quarternary	Soil and Alluvium
----X--------X--------X--------X---Unconformity---X--------X----		
Vindhyan	Bhander	Upper Bhander Sandstone Sirbu Shale Bhander Limestone

GEOMORPHOLOGY

Table: Geomorphologic units, their description and distribution

Origin	Landform Unit	Description
Denudational	Buried Pediment	Pediment covers essentially with relatively thicker alluvial, colluvial or weathered materials.
	Pediment	Broad gently sloping rock flooring, erosional surface of low relief between hill and plain, comprised of varied lithology, criss-crossed by fractures and faults.
Fluvial	Alluvial Plain	Mainly undulating landscape formed due to fluvial activity, comprising of gravels, sand, silt and clay. Terrain mainly undulating, produced by extensive deposition of alluvium.
	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.
Structural	Dissected Plateau	Plateau, criss-crossed by fractures forming deep valleys.
	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



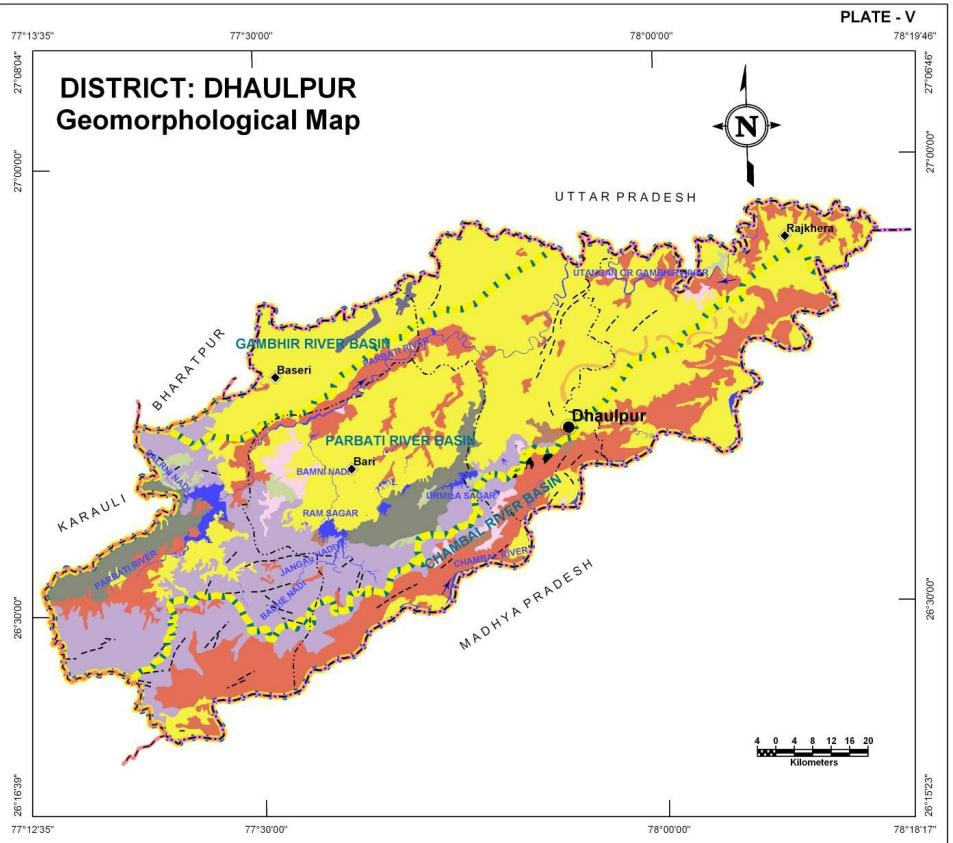
LEGEND

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

Geology:
- Bhander Group

Source: District Resource Map of Rajasthan - GSI

PLATE - V



LEGEND

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

Water Bodies:
- River/Ponds/Reservoirs

Structural Features:
- Fault/Fractures/Lineament

Hills:
- Structural/Denudational/Linear Ridge

Landform Units:

Fluvial Origin:
- Alluvial Plain
- Palaeochannel
- Flood Plain
- Valley Fill
- Ravine

Denudational Origin:
- Pediment
- Buried Pediment

Structural Origin:
- Plateau
- Dissected Plateau

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

AQUIFERS

DISTRICT – DHAULPUR

Aquifers in Dhaulpur district are principally formed in either sandstones belonging to Vindhyan Super Group or in Older Alluvium of Quaternary period. Primary and secondary openings in sandstones contribute to formation of very good aquifers and these occupy about 56% of district. The sandy material in alluvium among clay and kankar forms about 44% of the district aquifers.

Table: Aquifer potential zones their area and their description

Aquifer in Potential Zone	Area (sq km)	% age of district	Description of the unit/Occurrence
Older Alluvium	1,350.2	44.4	This litho unit comprises of mixture of heterogeneous fine to medium grained sand, silt and kankar.
Sandstone	1,690.1	55.6	Fine to medium grained, red colour and compact and at places.
Total	**3,040.3**	**100.0**	

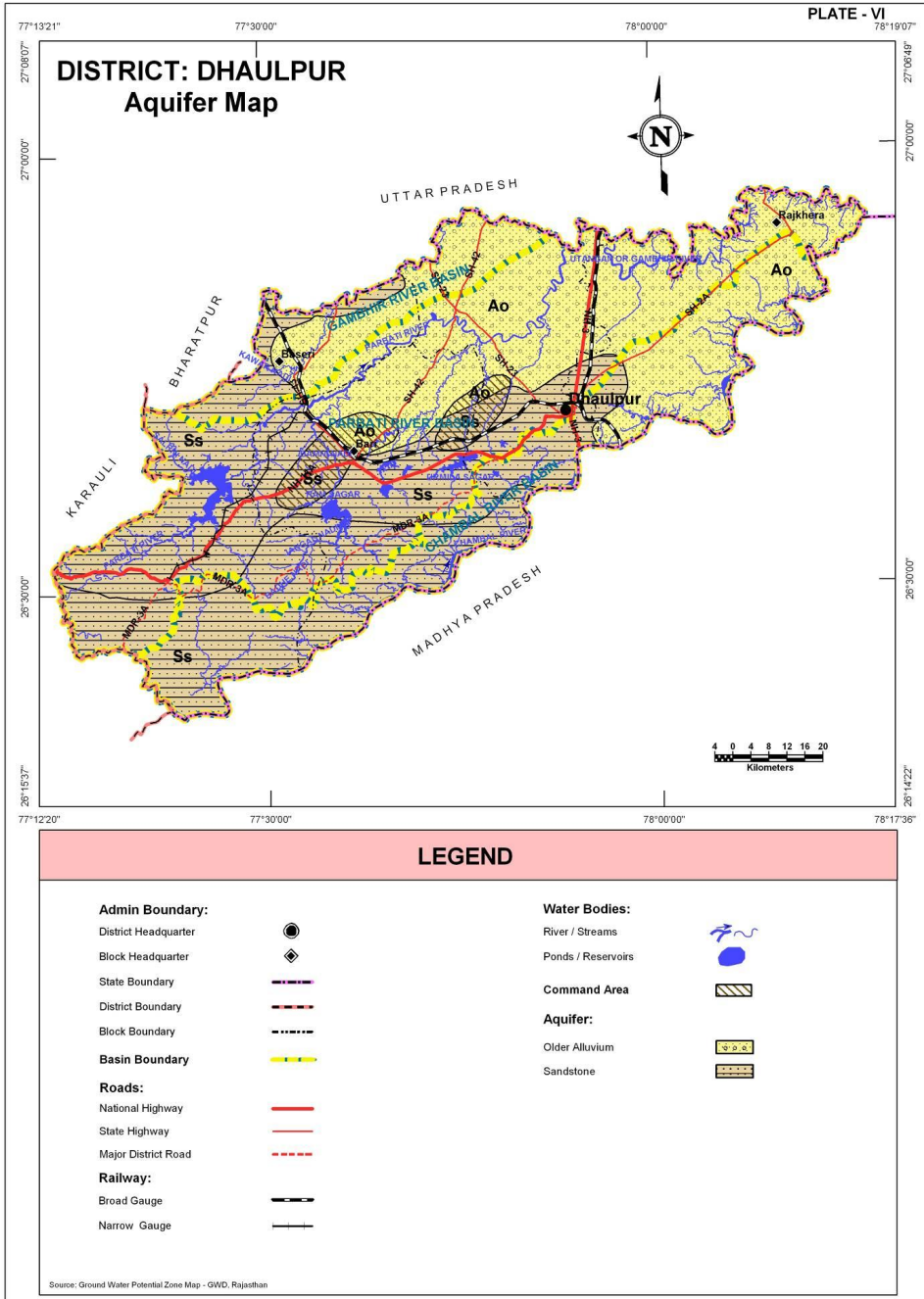
STAGE OF GROUND WATER DEVELOPMENT

Based on the assessment of stage of ground water development of dynamic ground water resources in the district, it is concluded that the Bari block falls within the 'Critical' category where the ground water development is nearly 100% leaving no further scope of further development. Whereas the other three blocks in the district fall under 'Over Exploited' category where steps must be taken to reduce dependence on ground water as the extraction is exceeding annual recharge and the static resource of ground water is being withdrawn now that may lead to further stress on ground water situation.

Categorization on the basis of stage of development of ground water	Block Name
Critical	Bari
Over Exploited	Baseri, Rajakhera, Dhaulpur

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

PLATE - VI



LEGEND

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

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

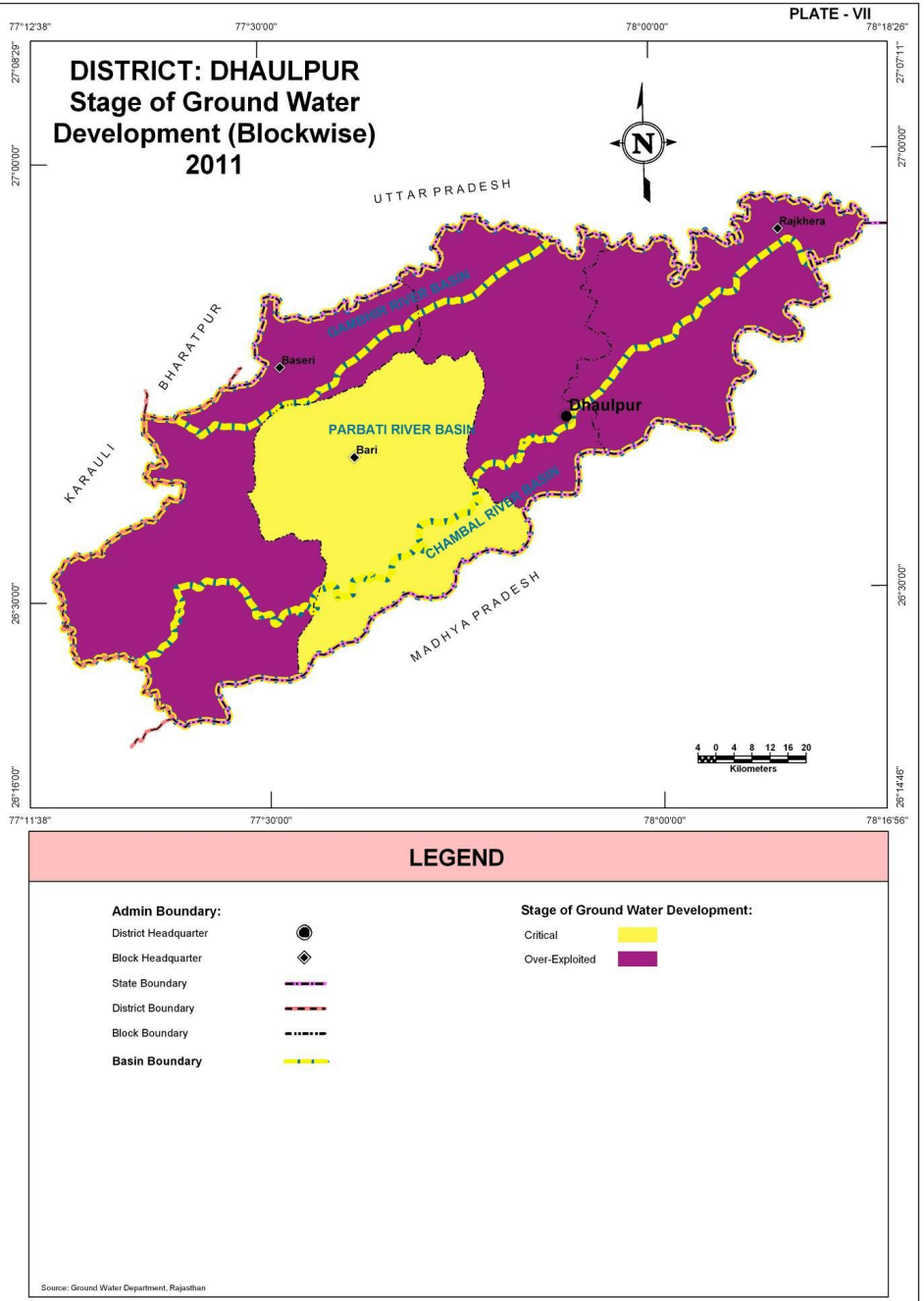
Railway:
- Broad Gauge
- Narrow Gauge

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

Aquifer:
- Older Alluvium
- Sandstone

Source: Ground Water Potential Zone Map - GWD, Rajasthan

PLATE - VII



LEGEND

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

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

Source: Ground Water Department, Rajasthan

LOCATION OF EXPLORATORY AND GROUND WATER MONITORING WELLS DISTRICT – DHAULPUR

Dhaulpur district has a well distributed network of exploratory wells (55) and ground water monitoring stations (132) in the district owned by RGWD (43 and 114 respectively) and CGWB (12 and 18 respectively). The exploratory wells have formed the basis for delineation of subsurface aquifer distribution scenario in three dimensions. Benchmarking and optimization studies suggest that ground water level is being sufficiently monitored but for effectively monitoring the water quality in all the four blocks,63 additional wells must be added to the network.

Table: Block wise count of wells (existing and recommended)

Block Name	Exploratory Wells			Ground Water Monitoring Stations			Recommended additional wells for optimization of monitoring network	
	CGWB	RGWD	Total	CGWB	RGWD	Total	Water Level	Water Quality
Bari	-	12	**12**	2	32	**34**	-	13
Baseri	-	6	**6**	3	34	**37**	-	11
Dhaulpur	9	10	**19**	8	26	**34**	-	17
Rajakhera	3	15	**18**	5	22	**27**	-	22
Total	**12**	**43**	**55**	**18**	**114**	**132**	**-**	**63**

DEPTH TO WATER LEVEL (PRE MONSOON – 2010)

10m interval has been adopted to depict the depth to ground water levels in Dhaulpur district as shown in Plate – IX. Depth to water level shows variation from less than 10m below ground level to about 50m below ground level in different parts of the district. The alluvial aquifers in the eastern parts of the district have shown in general, deeper ground water occurrence i.e., upto 40m depth from ground level whereas the hardrock areas in the western and southern parts within sandstone aquifers have shown very shallow water levels even less than 10m below ground level. In general the depth to water level in the district varies from 10m bgl to 30m bgl.

Table: Block wise area covered in each depth to water level range

Depth to water level (m bgl)	Block wise area coverage (sq km) *				Total Area (sq km)
	Bari	Baseri	Dhaulpur	Rajakhera	
< 10	214.6	350.8	39.5	2.0	**606.9**
10-20	532.9	636.8	301.1	182.4	**1,653.3**
20-30	41.4	21.8	196.0	300.6	**559.8**
30-40	-	-	61.0	159.3	**220.3**
> 40	-	-	0.1	-	**-**
Total	**788.9**	**1,009.4**	**597.7**	**644.3**	**3,040.3**

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

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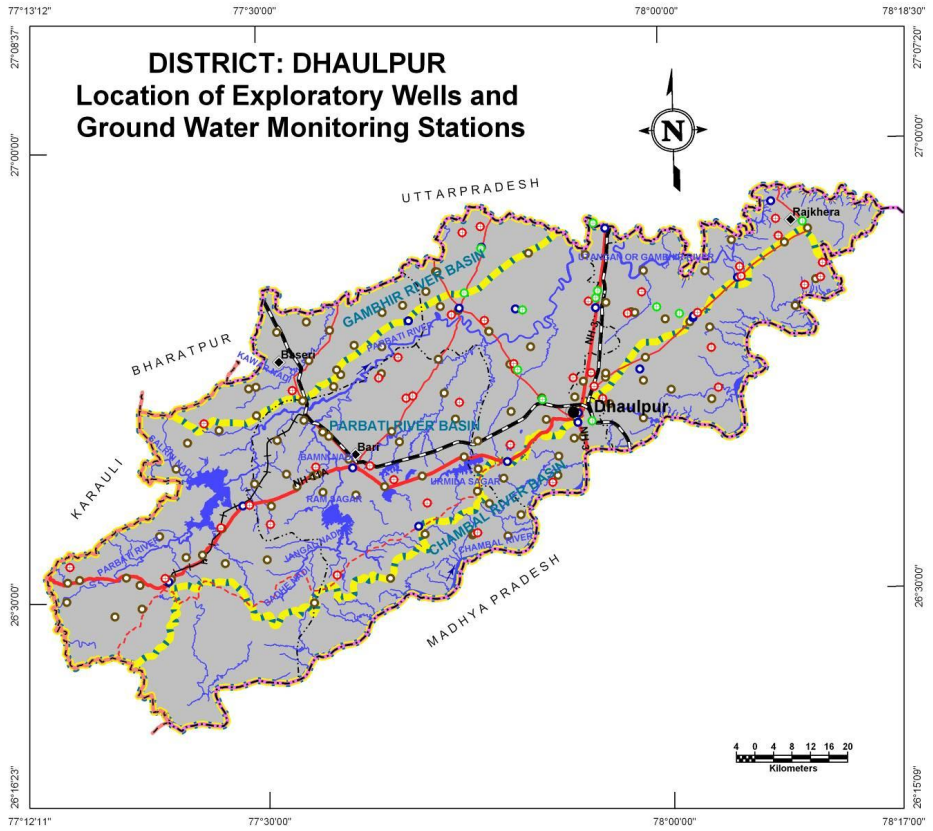
PLATE - VIII



LEGEND

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

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

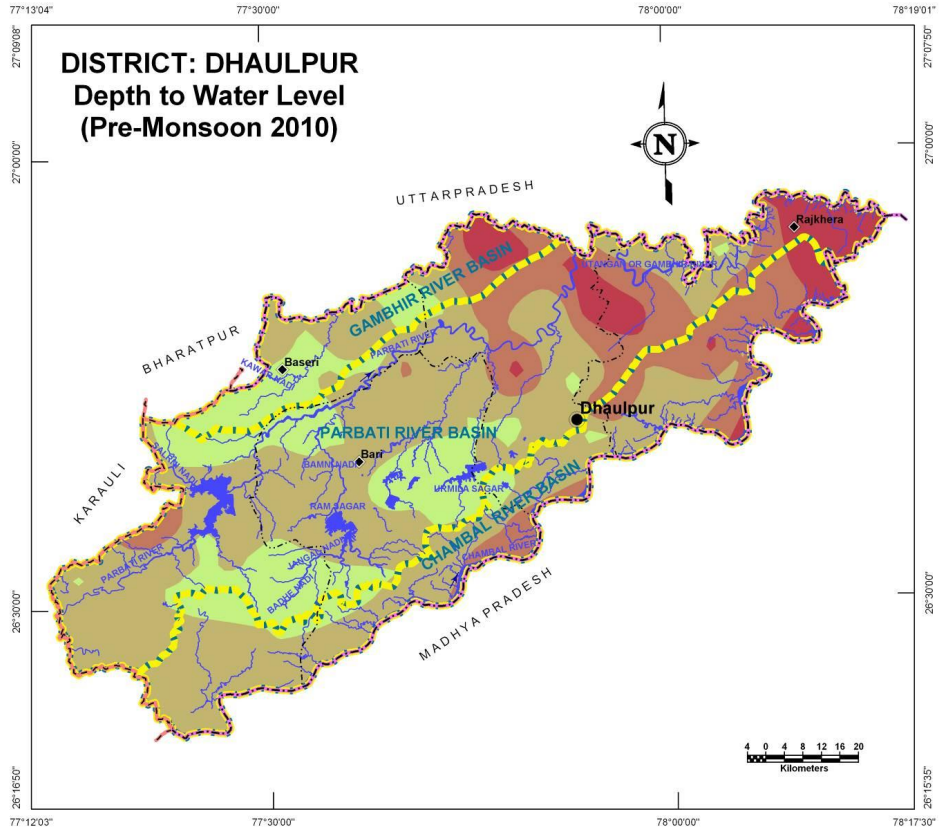
Railway:
- Broad Gauge
- Narrow Gauge

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
- State Boundary
- District Boundary
- Block Boundary
- **Basin Boundary**

Water Bodies:
- River / Streams
- Ponds / Reservoirs

Depth to Water Level(m bgl):
- <10
- 10 - 20
- 20 - 30
- 30 - 40
- >40

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

The district is showing the general flow direction of ground water is from south to north and then to northeast. The maximum elevation of water table is up to >280m amsl in southern part (Bari block) of the district. The water table gradually lowers towards north and then towards northeast reaching a minimum elevation (<140m amsl) in the Rajkhera block. The central parts of the district are having elevation range 180-200m amsl. Flow gradients are steeper in the southern part and sluggish in the northeastern parts of the district.

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

Water table elevation Range(m amsl)	Block wise area coverage (sq km)				Total Area (sq km)
	Bari	Baseri	Dhaulpur	Rajakhera	
< 140	15.1	-	40.0	342.6	**397.7**
140 - 160	21.9	-	295.5	286.6	**604.0**
160 - 180	107.8	65.0	180.3	15.1	**368.2**
180 - 200	176.5	150.2	*57.1*	-	**383.8**
200 - 220	171.4	108.8	24.8	-	**305.0**
220 - 240	106.2	385.0	-	-	**491.2**
240 - 260	94.1	214.2	-	-	**308.3**
260 - 280	80.7	79.4	-	-	**160.1**
> 280	15.2	6.8	-	-	**22.0**
Total	**788.9**	**1,009.4**	**597.7**	**644.3**	**3,040.3**

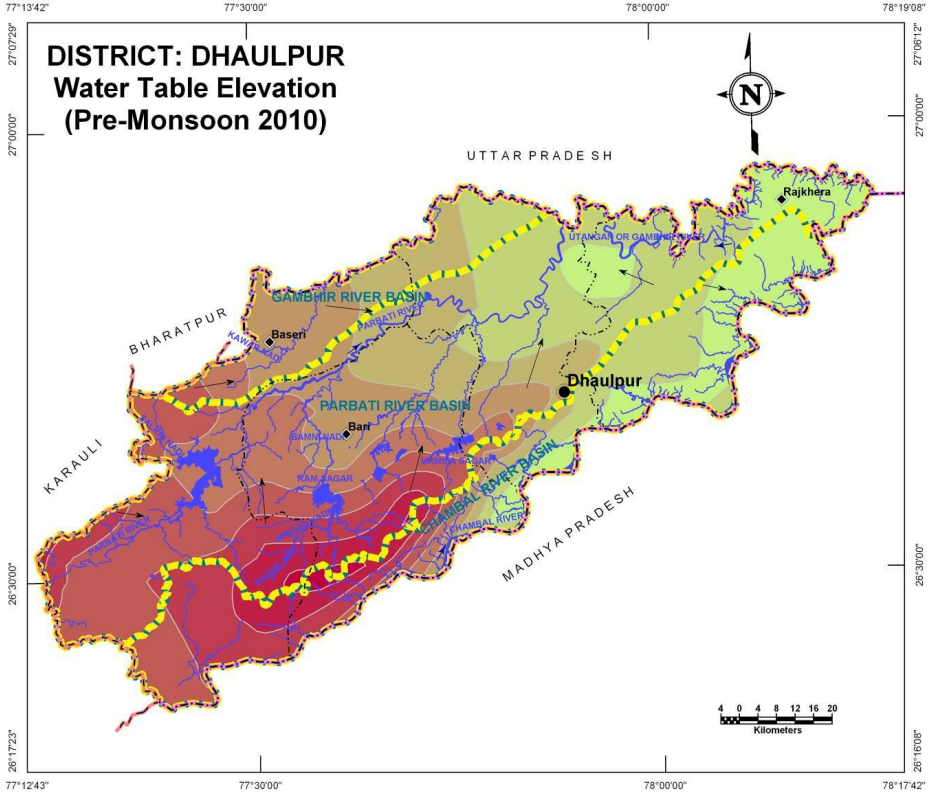
WATER LEVEL FLUCTUATION (PRE TO POST MONSOON 2010)

A 2m contour interval adopted to visualize the ground water level fluctuation reveals a fall of 8m in one area to rise in other areas reaching upto 10m, as seen in Plate – XI. The negative 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 the northern part of Dhaulpur and Bari and eastern part of Rajkhera. Rest of the district has shown a general to significant rise in ground water level in the post monsoon season with respect to pre monsoon region. Maximum rise of more than 10m is noticed in southwestern part of Baseri block.There are some steep ground water level rise areas in the eastern part also within alluvial aquifers.

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)
	Bari	Baseri	Dhaulpur	Rajakhera	
<-8	-	-	-	0.2	**0.2**
-8 – -6	-	-	-	2.8	**2.8**
-6 – -4	-	-	23.7	6.3	**30.0**
-4 – -2	2.0	-	21.4	18.2	**41.6**
-2 – 0	71.5	34.6	64.8	75.6	**246.5**
0 – 2	245.9	234.9	208.8	193.8	**883.4**
2 – 4	232.4	138.3	172.5	178.1	**721.3**
4 – 6	186.2	246.2	82.8	103.4	**618.6**
6 – 8	46.4	287.4	23.7	53.8	**411.3**
8 – 10	4.5	63.5	-	11.7	**79.7**
>10	-	4.5	-	0.4	**4.9**
Total	**788.9**	**1,009.4**	**597.7**	**644.3**	**3,040.3**

PLATE - X



LEGEND

Admin Boundary:

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

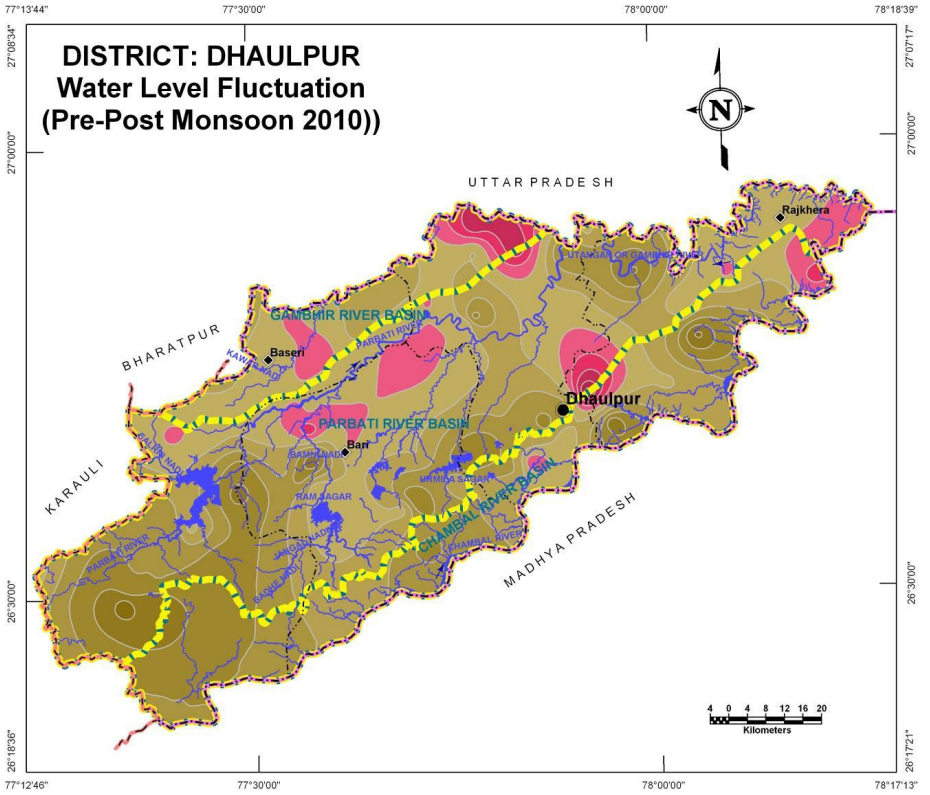
Water Bodies:

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

Water Table Elevation(m amsl):

- < 140
- 140 - 160
- 160 - 180
- 180 - 200
- 200 - 220
- 220 - 240
- 240 - 260
- 260 - 280
- >280

PLATE - XI



LEGEND

Admin Boundary:

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

Water Bodies:

- River / Streams
- Ponds / Reservoirs

Water Level Fluctuation (m):

- < -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

GROUND WATER ELECTRICAL CONDUCTIVITY DISTRIBUTION DISTRICT – DHAULPUR

The Electrical conductivity (at 25°C) distribution map is presented in Plate – XII. The areas with low EC values in ground water (<2000 µS/cm) are shown in yellow color and occupies almost 86% of the district area indicating that, by and large the ground water in this district is suitable for domestic purpose. The areas with moderately high EC values (2000 - 4000 µS/cm) are shown in green color occupy 13% of the district area, largely northeastern part of the district. Remaining small part of the district approximately 2% has high EC values in ground water (>4000 µS/cm) which is shown in red color, largely western part of Rajakhera block adjoining Dhaulpur block where the ground water is not suitable for domestic purpose.

Table: Block wise area of Electrical conductivity distribution

Electrical Conductivity Ranges (µS/cm at 25°C) (Ave. of years 2005-09)	Block wise area coverage (sq km)								Total Area (sq km)
	Bari		Baseri		Dhaulpur		Rajakhera		
	Area	%age	Area	%age	Area	%age	Area	%age	
<2000	754.1	95.6	1,001.0	99.2	429.3	71.8	416.9	64.7	**2,601.3**
2000-4000	34.8	4.4	8.4	0.8	162.7	27.2	215.1	33.4	**388.5**
>4000	-	-	-	-	5.7	1.0	12.3	1.9	**50.5**
Total	**788.9**	**100.0**	**1,009.4**	**100.0**	**597.7**	**100.0**	**644.3**	**100.0**	**3,040.3**

GROUND WATER CHLORIDE DISTRIBUTION

The yellow colored regions in Plate – XIII are such areas where chloride concentration in ground water is low (<250 mg/l), and such areas occupy approximately 84% of the district area and is suitable for domestic purpose. The areas with moderately high chloride concentration (250-1000mg/l) are shown in green color and occupy approximately 15% of the district area, largely in the northern part of the district. Remaining part (<1%) of the district falls under high (>1000 mg/l) chloride concentration in ground water category as shown in red color in the map. The ground water in this region is not suitable for domestic purpose.

Table: Block wise area of Chloride distribution

Chloride Concentration Range (mg/l) (Ave. of years 2005-09)	Block wise area coverage (sq km)								Total Area (sq km)
	Bari		Baseri		Dhaulpur		Rajakhera		
	Area	%age	Area	%age	Area	%age	Area	%age	
<250	788.8	100.0	1,009.4	100.0	311.2	52.0	463.7	72.0	**2,573.1**
250-1000	0.1	-	-	-	285.1	48.0	176.9	27.0	**462.1**
>1000	-	-	-	-	1.4	-	3.7	1.0	**5.1**
Total	**788.9**	**100.0**	**1,009.4**	**100.0**	**597.7**	**100.0**	**644.3**	**100.0**	**3,040.3**

PLATE - XII

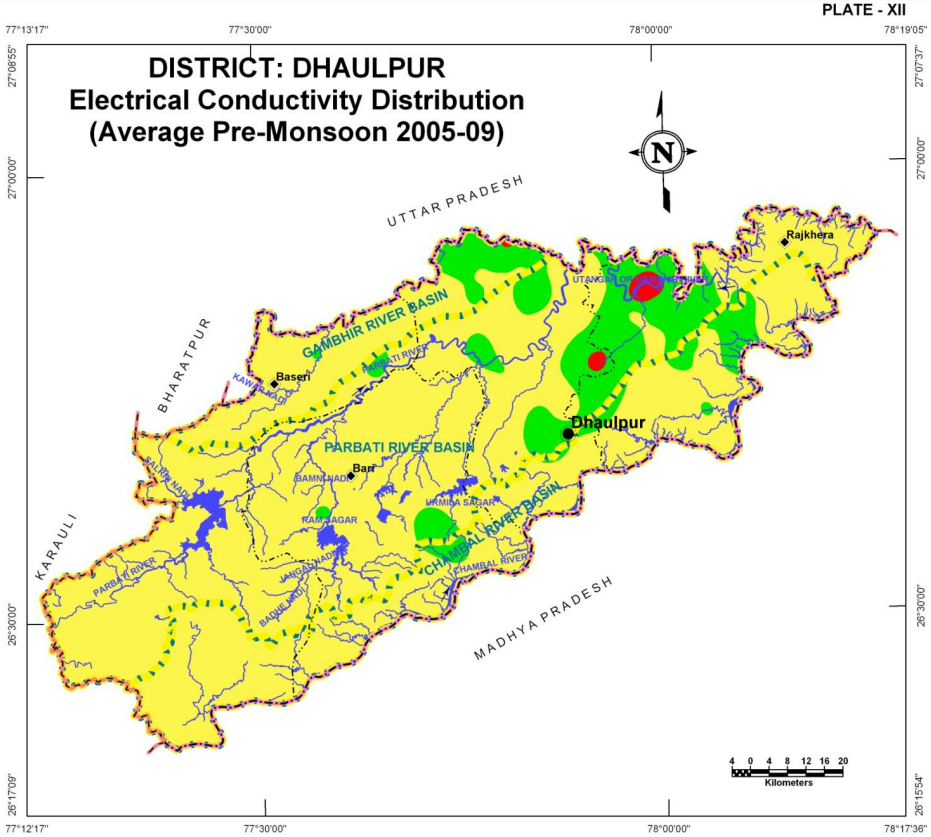
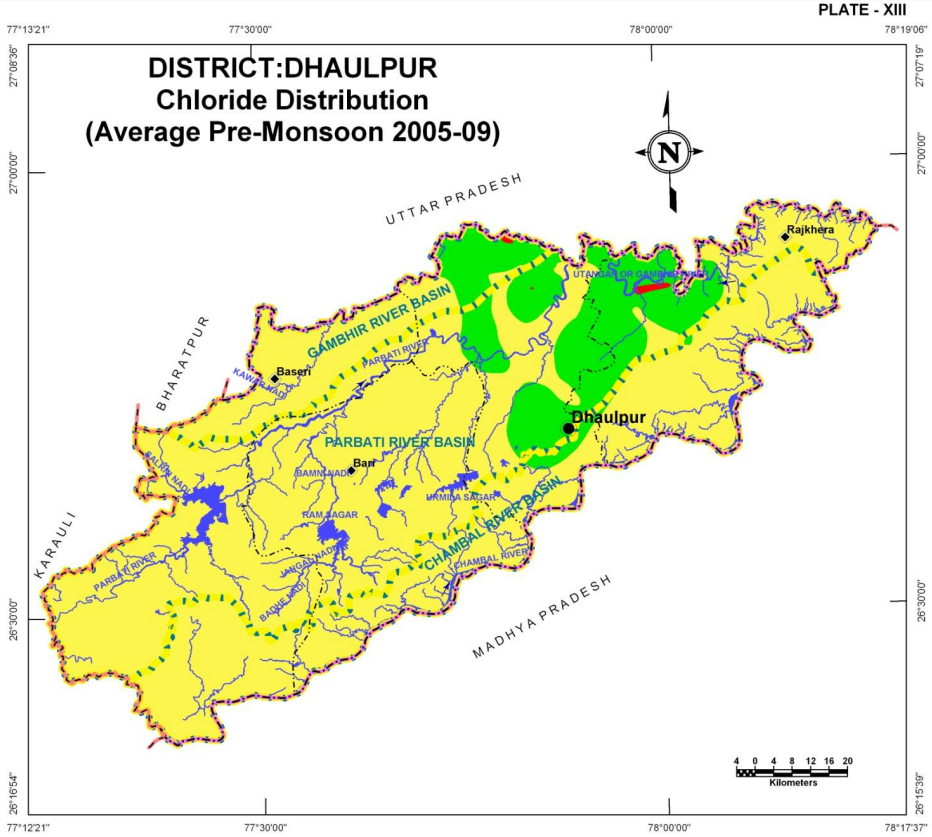


PLATE - XIII



LEGEND

Admin Boundary:

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

Basin Boundary

Water Bodies:

- River / Streams
- Ponds / Reservoirs

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

- < 2000
- 2000-4000
- >4000

LEGEND

Admin Boundary:

- District Headquarter
- Block Headquarter
- State 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 – DHAULPUR

The Fluoride concentration map is presented in Plate – XIV.The areas with low concentration (i.e.,>1.5 mg/l) are shown in yellow color and occupies almost 78% of the district area which is suitable for domestic purpose. The areas with moderately high concentration (1.5-3.0 mg/l) are shown in green color and occupy approximately 20% of the district area, largely around Baseri and northern part of Bari. Remaining small part of the district approximately 2% has high Fluoride concentration (>3.0 mg/l) which is shown in red color, largely scattered as patches in east-west direction in the northern part of the district where the ground water is not suitable for domestic purpose.

Table: Block wise area of Fluoride distribution

Fluoride concentration Range (mg/l) (Ave. of years 2005-09)	Block wise area coverage (sq km)								Total Area (sq km)
	Bari		Baseri		Dhaulpur		Rajakhera		
	Area	%age	Area	%age	Area	%age	Area	%age	
<1.5	723.0	91.6	736.4	73.0	428.5	71.7	505.3	78.4	**2,393.2**
1.5-3.0	62.0	7.9	272.9	27.0	150.5	25.2	121.1	18.8	**606.5**
>3.0	3.9	0.5	0.1	-	18.7	3.1	17.9	2.8	**40.6**
Total	**788.9**	**100.0**	**1,009.4**	**100.0**	**597.7**	**100.0**	**644.3**	**100.0**	**3,040.3**

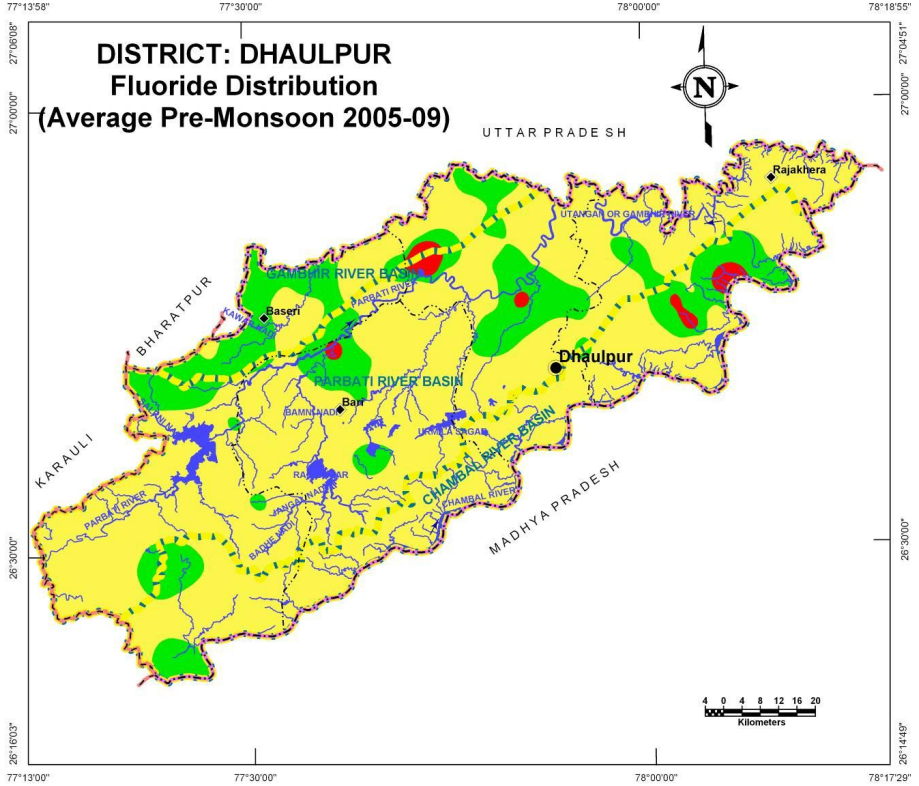
GROUND WATER NITRATE DISTRIBUTION

High nitrate concentration in ground water renders it unsuitable for agriculture purposes. Plate – XV shows distribution of Nitrate in ground water. Low nitrate concentration (<50 mg/l) is shown in yellow color and occupies approximately 74% of the district area which is suitable for agriculture purpose. The areas with moderately high nitrate concentration (50-100 mg/l) are shown in green color and occupy approximately 18% of the district area, largely in the northern part of the district. Remaining 8% of the district area the ground water has very high nitrate concentration (>100 mg/l) in ground water which is shown as red colored patches, largely in the central and northern part of the district. The ground water in this high nitrate region is not suitable for agriculture purpose.

Table: Block wise area of Nitrate distribution

Nitrate concentration Range (mg/l) (Ave. of years 2005-09)	Block wise area coverage (sq km)								Total Area (sq km)
	Bari		Baseri		Dhaulpur		Rajakhera		
	Area	%age	Area	%age	Area	%age	Area	%age	
<50	573.8	72.7	974.3	96.5	344.1	57.6	348.0	54.1	**2,240.2**
50-100	164.4	20.9	35.1	3.5	174.8	29.2	184.5	28.6	**558.8**
>100	50.7	6.4	-	-	78.8	13.2	111.8	17.3	**241.3**
Total	**788.9**	**100.0**	**1,009.4**	**100.0**	**597.7**	**100.0**	**644.3**	**100.0**	**3,040.3**

PLATE - XIV



LEGEND

Admin Boundary:

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

Basin Boundary

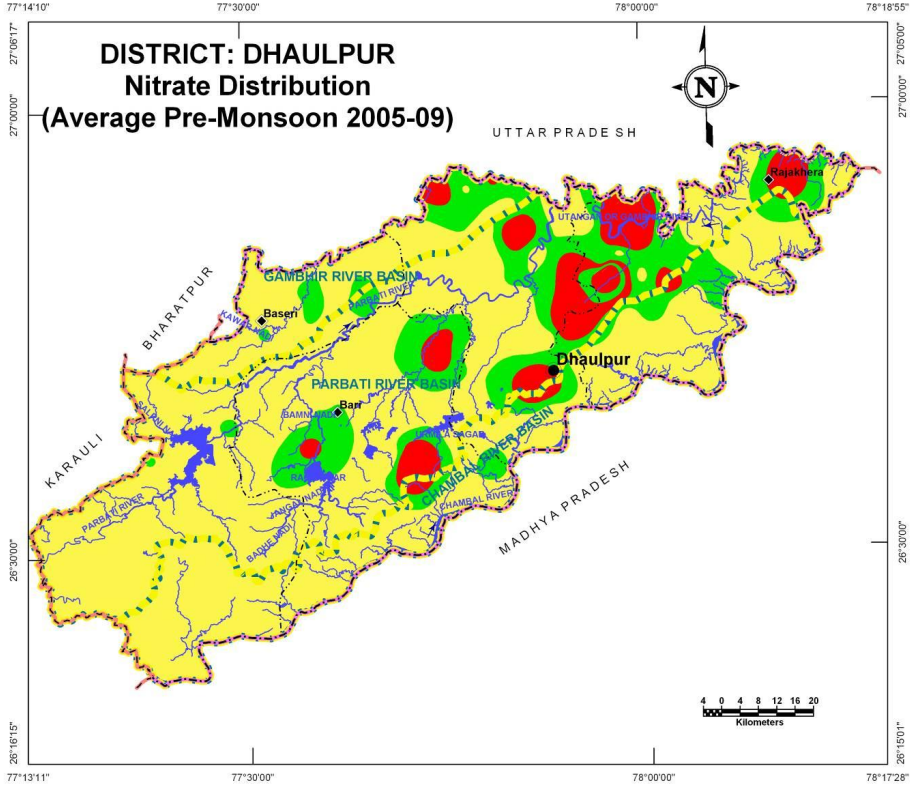
Water Bodies:

- River / Streams
- Ponds / Reservoirs

Fluoride Concentration (mg/l):

- < 1.5
- 1.5-3.0
- >3.0

PLATE - XV



LEGEND

Admin Boundary:

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

Basin Boundary

Water Bodies:

- River / Streams
- Ponds / Reservoirs

Nitrate Concentration (mg/l):

- < 50
- 50-100
- >100

DEPTH TO BEDROCK

DISTRICT – DHAULPUR

From hydrogeological perspective, the beginning of massive bedrock has been considered for defining top of bedrock surface. Depth to bedrock map of Dhaulpur district (Plate – XVI) reveals wide variation of about 100m reaching a maximum depth of more than 100m in the eastern part of the district. In general the variation in depth to bedrock is seen between 20 to 60m bgl in the district. Areas in the eastern part of the district indicate the occurrence of bedrock at very deep levels (80m bgl to more than 100m bgl). In the southern part in Baseri, northeastern part of Dhaulpur, central part of Bari block and almost 80% area of Rajakhera, moderately deep bedrock depths are encountered i.e., in between 60m bgl to 80m bgl. Shallow bedrock depth is mostly found in southern part of Bari and Baseri block and central part of Rajakhera block. Bedrock near to surface reported less than 20 meter below ground level has been encountered in Bari and Baseri block covering negligibly small area.

Depth to bedrock (m bgl)	Block wise area coverage (sq km)								Total Area (sq km)
	Bari		Baseri		Dhaulpur		Rajakhera		
	Area	%age	Area	%age	Area	%age	Area	%age	
<20	23.8	3.0	9.9	1.0	-	-	-	-	**33.7**
20-40	120.8	15.3	130.7	13.0	-	-	21.0	3.3	**272.5**
40-60	425.2	54.0	686.0	67.9	325.1	54.3	123.0	19.1	**1,559.3**
60-80	199.0	25.2	148.3	14.7	223.3	37.4	396.2	61.4	**966.8**
80-100	20.1	2.5	34.5	3.4	26.9	4.5	55.1	8.6	**136.6**
>100	-	-	-	-	22.4	3.8	49.0	7.6	**71.4**
Total	**788.9**	**100.0**	**1,009.4**	**100.0**	**597.7**	**100.0**	**644.3**	**100.0**	**3,040.3**

UNCONFINED AQUIFER

Alluvial material forms aquifers in most of northern part and a narrow fringe in the southeastern part of the district. The thickness of unconfined aquifer varies from less than 10m to about 30m with the thickest parts lying to the west of Baseri block along Gambhir River course. Weathered, fractured and jointed rock formations form the phreatic aquifer in the areas where hardrock are exposed. Such zones range in thickness from less than 10 meter to more than 90 meter throughout the south and northwest parts of the district. These high thickness zones are localized in occurrence and their general thickness in the district is less than 70m. These formations constitute very good aquifers in the southern periphery of Baseri and lower part of Rajakhera block reaching a thickness of more than 90 meters.

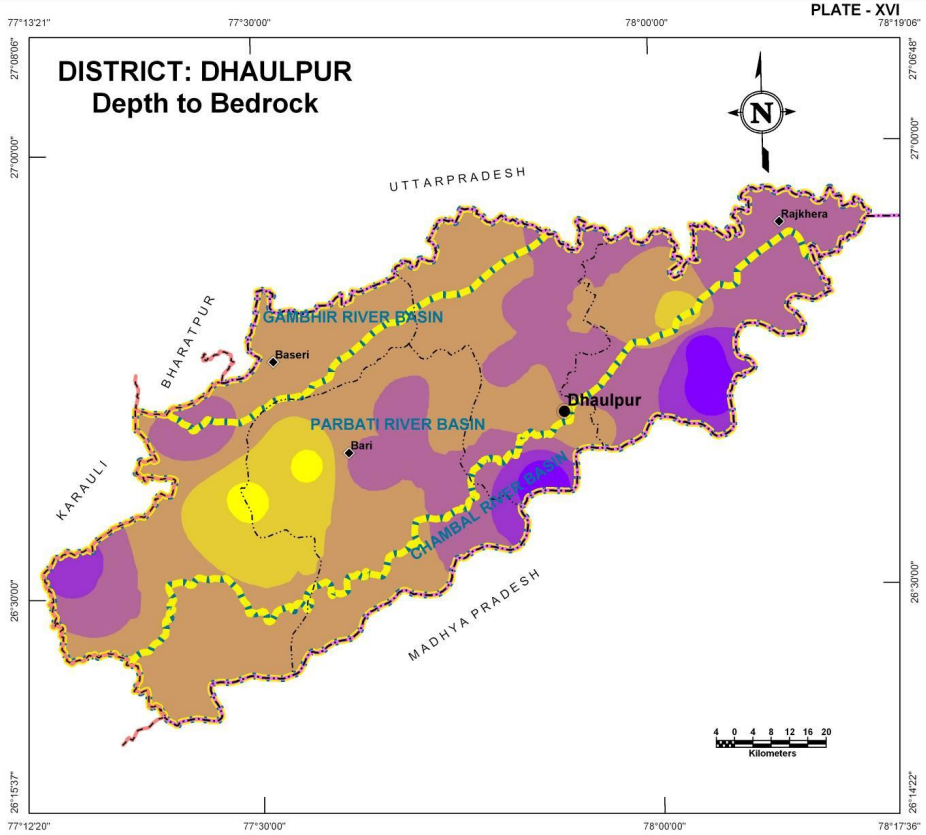
Alluvial areas

Unconfined aquifer Thickness (m)	Block wise area coverage (sq km)				Total Area (sq km)
	Bari	Baseri	Dhaulpur	Rajakhera	
< 10	255.8	99.4	301.8	446.9	**1,103.9**
10-20	81.2	90.1	99.6	156.4	**427.3**
> 20	-	58.6	7.7	2.1	**68.4**
Total	**337**	**248.1**	**409.1**	**605.4**	**1,599.6**

Hardrock areas

Unconfined aquifer Thickness (m)	Block wise area coverage (sq km)				Total Area (sq km)
	Bari	Baseri	Dhaulpur	Rajakhera	
<10	94.1	90.6	-	-	**184.7**
10-20	59.0	133.0	5.8	-	**197.8**
20-30	48.9	99.5	20.2	-	**168.6**
30-40	109.3	120.4	30.5	4.9	**265.1**
40-50	134.3	111.8	35.8	4.8	**286.7**
50-60	6.3	95.8	35.8	5.7	**143.6**
60-70	-	52.2	31.4	6.3	**89.9**
70-80	-	33.3	21.4	7.0	**61.7**
80-90	-	18.4	7.7	9.4	**35.5**
> 90	-	6.3	-	0.8	**7.1**
Total	**451.9**	**761.3**	**188.6**	**38.9**	**1,440.7**

PLATE - XVI



LEGEND

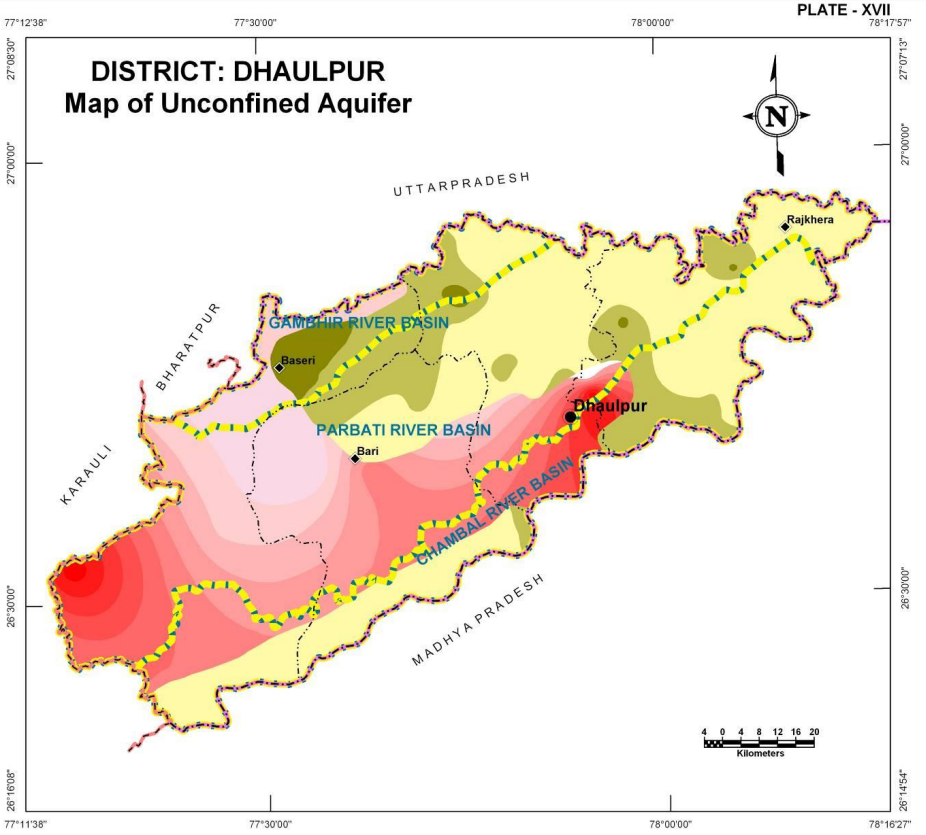
Admin Boundary:

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

Depth to Bedrock(m bgl):

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

PLATE - XVII



LEGEND

Admin Boundary:

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

Aquifer Thickness (m):

Alluvial Area:

- <10
- 10-20
- >20

Weathered & Fractured Zone in Hardrock Area

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

Glossary of terms

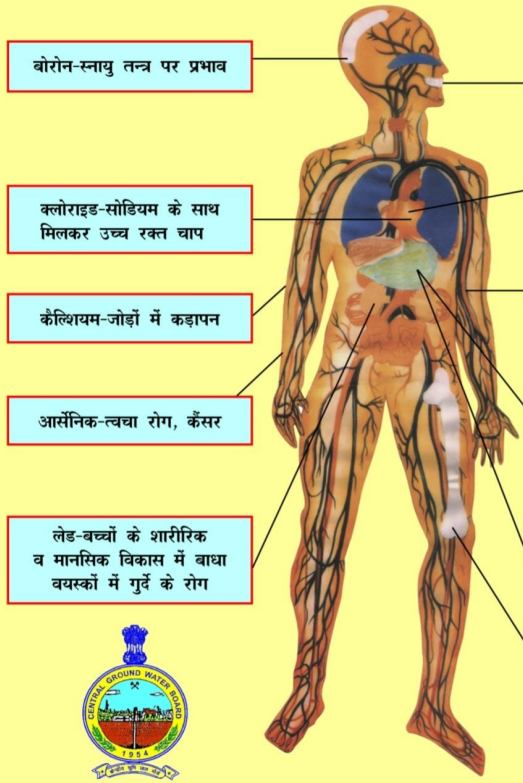
S. No.	Technical Terms	Definition
1	AQUIFER	A saturated geological formation which has good permeability to supply sufficient quantity of water to a Tube well, well or spring.
2	ARID CLIMATE	Climate characterized by high evaporation and low precipitation.
3	ARTIFICIAL RECHARGE	Addition of water to a ground water reservoir by manmade activity
4	CLIMATE	The sum total of all atmospheric or meteorological influences principally temperature, moisture, wind, pressure and evaporation of a region.
5	CONFINED AQUIFER	A water bearing strata having confined impermeable overburden. In this aquifer, water level represents the piezometric head.
6	CONTAMINATION	Introduction of undesirable substance, normally not found in water, which renders the water unfit for its intended use.
7	DRAWDOWN	The drawdown is the depth by which water level is lowered.
8	FRESH WATER	Water suitable for drinking purpose.
9	GROUND WATER	Water found below the land surface.
10	GROUND WATER BASIN	A hydro-geologic unit containing one large aquifer or several connected and interrelated aquifers.
11	GROUND WATER RECHARGE	The natural infiltration of surface water into the ground.
12	HARD WATER	The water which does not produce sufficient foam with soap.
13	HYDRAULIC CONDUCTIVITY	A constant that serves as a measure of permeability of porous medium.
14	HYDROGEOLOGY	The science related with the ground water.
15	HUMID CLIMATE	The area having high moisture content.
16	ISOHYET	A line of equal amount of rainfall.
17	METEOROLOGY	Science of the atmosphere.
18	PERCOLATION	It is flow through a porous substance.
19	PERMEABILITY	The property or capacity of a soil or rock for transmitting water.
20	pH	Value of hydrogen-ion concentration in water. Used as an indicator of acidity (pH < 7) or alkalinity (pH > 7).
21	PIEZOMETRIC HEAD	Elevation to which water will rise in a piezometers.
22	RECHARGE	It is a natural or artificial process by which water is added from outside to the aquifer.
23	SAFE YIELD	Amount of water which can be extracted from ground water without producing undesirable effect.
24	SALINITY	Concentration of dissolved salts.
25	SEMI-ARID	An area is considered semiarid having annual rainfall between 10-20 inches.
26	SEMI-CONFINED AQUIFER	Aquifer overlain and/or underlain by a relatively thin semi-pervious layer.
27	SPECIFIC YIELD	Quantity of water which is released by a formation after it's complete saturation.
28	TOTAL DISSOLVED SOLIDS	Total weight of dissolved mineral constituents in water per unit volume (or weight) of water in the sample.
29	TRANSMISSIBILITY	It is defined as the rate of flow through an aquifer of unit width and total saturation depth under unit hydraulic gradient. It is equal to product of full saturation depth of aquifer and its coefficient of permeability.
30	UNCONFINED AQUIFER	A water bearing formation having permeable overburden. The water table forms the upper boundary of the aquifer.
31	UNSATURATED ZONE	The zone below the land surface in which pore space contains both water and air.
32	WATER CONSERVATION	Optimal use and proper storage of water.
33	WATER RESOURCES	Availability of surface and ground water.
34	WATER RESOURCES MANAGEMENT	Planned development, distribution and use of water resources.
35	WATER TABLE	Water table is the upper surface of the zone of saturation at atmospheric pressure.
36	ZONE OF SATURATION	The ground in which all pores are completely filled with water.
37	ELECTRICAL CONDUCTIVITY	Flow of free ions in the water at 25C mu/cm.
38	CROSS SECTION	A Vertical Projection showing sub-surface formations encountered in a specific plane.
39	3-D PICTURE	A structure showing all three dimensions i.e. length, width and depth.
40	GWD	Ground Water Department
41	CGWB	Central Ground Water Board
42	CGWA	Central Ground Water Authority
43	SWRPD	State Water Resources Planning Department
44	EU-SPP	European Union State Partnership Programme
45	TOPOGRAPHY	Details of drainage lines and physical features of land surface on a map.
46	GEOLOGY	The science related with the Earth.
47	GEOMORPHOLOGY	The description and interpretation of land forms.
48	PRE MONSOON SURVEY	Monitoring of Ground Water level from the selected DKW/Piezometer before Monsoon (carried out between 15th May to 15th June)
49	POST-MONSOON SURVEY	Monitoring of Ground Water level from the selected DKW/Piezometer after Monsoon (carried out between 15th October to 15th November)
50	PIEZOMETER	A non-pumping small diameter bore hole used for monitoring of static water level.
51	GROUND WATER FLUCTUATION	Change in static water level below ground level.
52	WATER TABLE	The static water leval found in unconfined aquifer.
53	DEPTH OF BED ROCK	Hard & compact rock encountered below land Surface.
54	G.W. MONITORING STATION	Dug wells selected on grid basis for monitoring of state water level.
55	EOLIAN DEPOSITS	Wind-blown sand deposits

(Contd…)

Ground Water Department,
Rajasthan

European Union
State Partnership Programme

भूजल में घुले मुख्य तत्वों की अधिकता का मानव शरीर पर दुष्प्रभाव



- बोरोन-स्नायु तन्त्र पर प्रभाव
- 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

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भारत सरकार
e-mail:cgwbwr@sancharnet.in

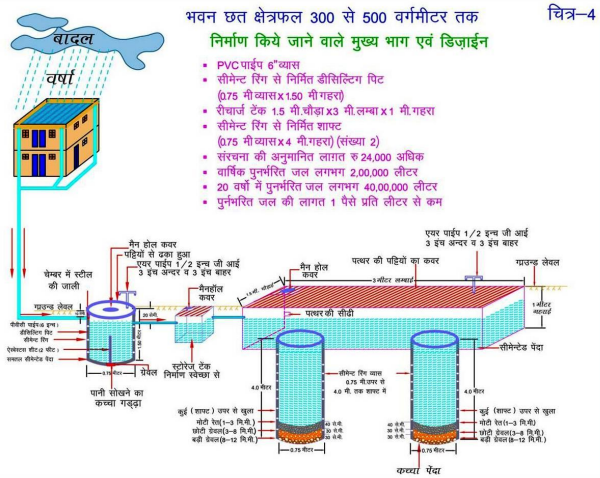
भूजल अमूल्य है इसे प्रदूषित न करें।

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

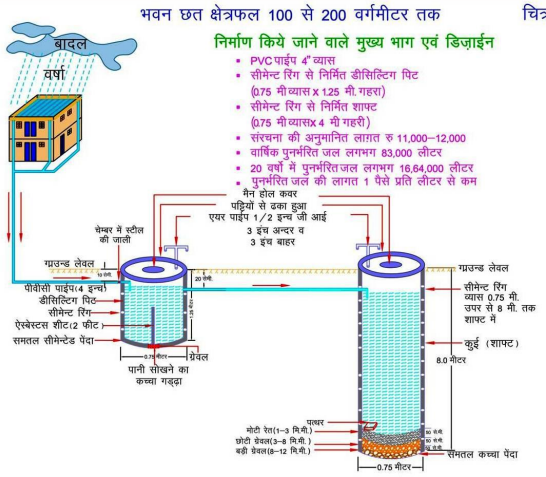


चित्र–2

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

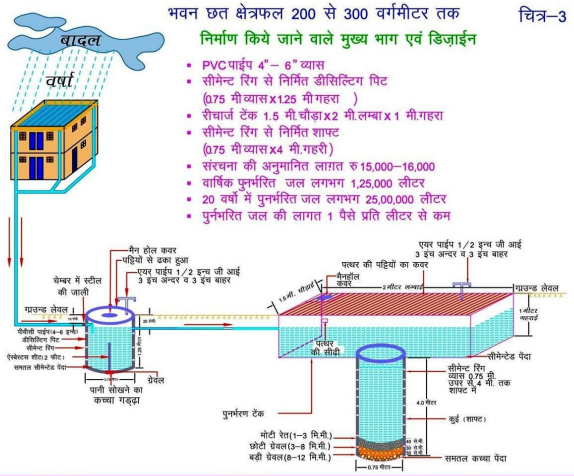


चित्र–3

भवन छत क्षेत्रफल 200 से 300 वर्गमीटर तक

निर्माण किये जाने वाले मुख्य भाग एवं डिज़ाईन

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

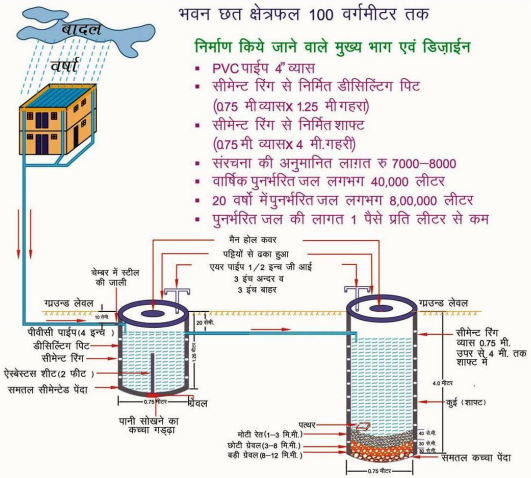


चित्र–1

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



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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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