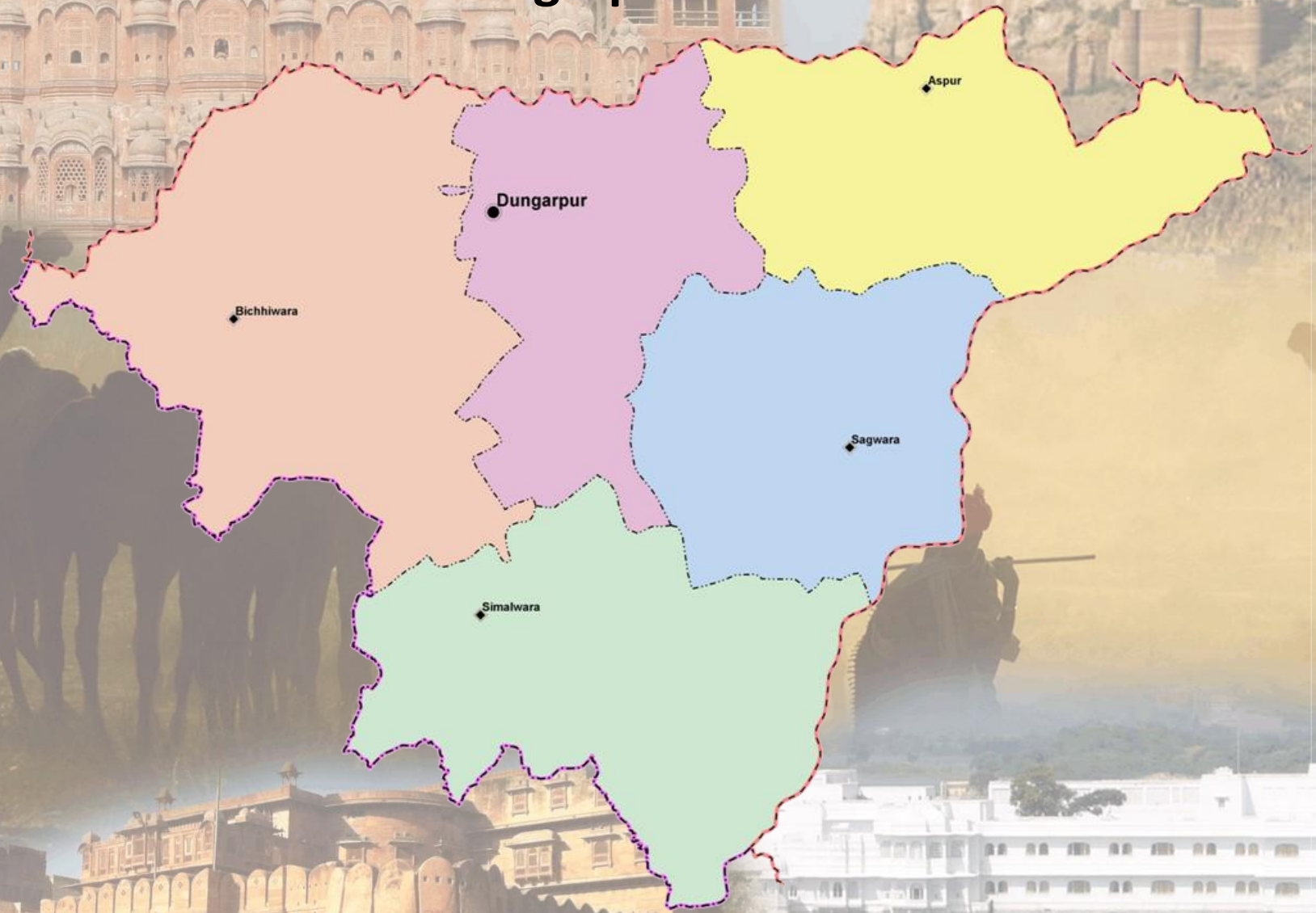
Ground Water Department,
Rajasthan

Hydrogeological Atlas of Rajasthan

Dungarpur District

European Union
State Partnership Programme



2013

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Hydrogeological Atlas of Rajasthan

Dungarpur District

Contents:

2013

ADMINISTRATIVE SETUP

DISTRICT – DUNGARPUR

Location:

Dungarpur district is located in the southern part of Rajasthan. It is bounded in the north by Udaipur district and northeast by Pratapgarh districts, in the east by Banswara and the state of Gujarat constitutes the boundary in south and west. It stretches between 23^{o} 19' 42.87" to 24^{o} 00' 42.68" north latitude and 73^{o} 20' 59.23'' to 74^{o} 23' 42.87'' east longitude covering area of 3,770.6 sq km. The district is drained by two river basins namely 'Sabarmati River Basin' as a strip in the western part whereas 'Mahi River Basin' forms most part of the district eastwards.

Administrative Set-up:

Dungarpur district is administratively divided into five 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	Aspur	1,84,508	690.9	18.0	146
2	Bichhiwara	2,36,114	1,006.5	27.0	175
3	Dungarpur	2,15,493	609.5	16.0	160
4	Sagwara	2,23,808	633.2	17.0	159
5	Simalwara	2,47,720	830.5	22.0	221
Total		**11,07,643**	**3,770.6**	**100.0**	**861**

Dungarpur district has 861 towns and villages, of which five are block headquarters as well.

Climate:

The Climate of this district is largely dry. Summer from April to June when maximum temperature rises to 45^{o}C and average temperature remains around 36 ^{o}C. Monsoon season is spread over months of July to Mid-September resulting into average annual rainfall of 756.4 mm with relatively lower average temperature of around 32 ^{o}C. Post Monsoon from Mid-September to October when temperature remains around 27 ^{o}C is very pleasant. Winters extend from November to February/March when minimum temperature falls to around 5 ^{o}C, while the average temperature during day time remains around 20^{o}C.

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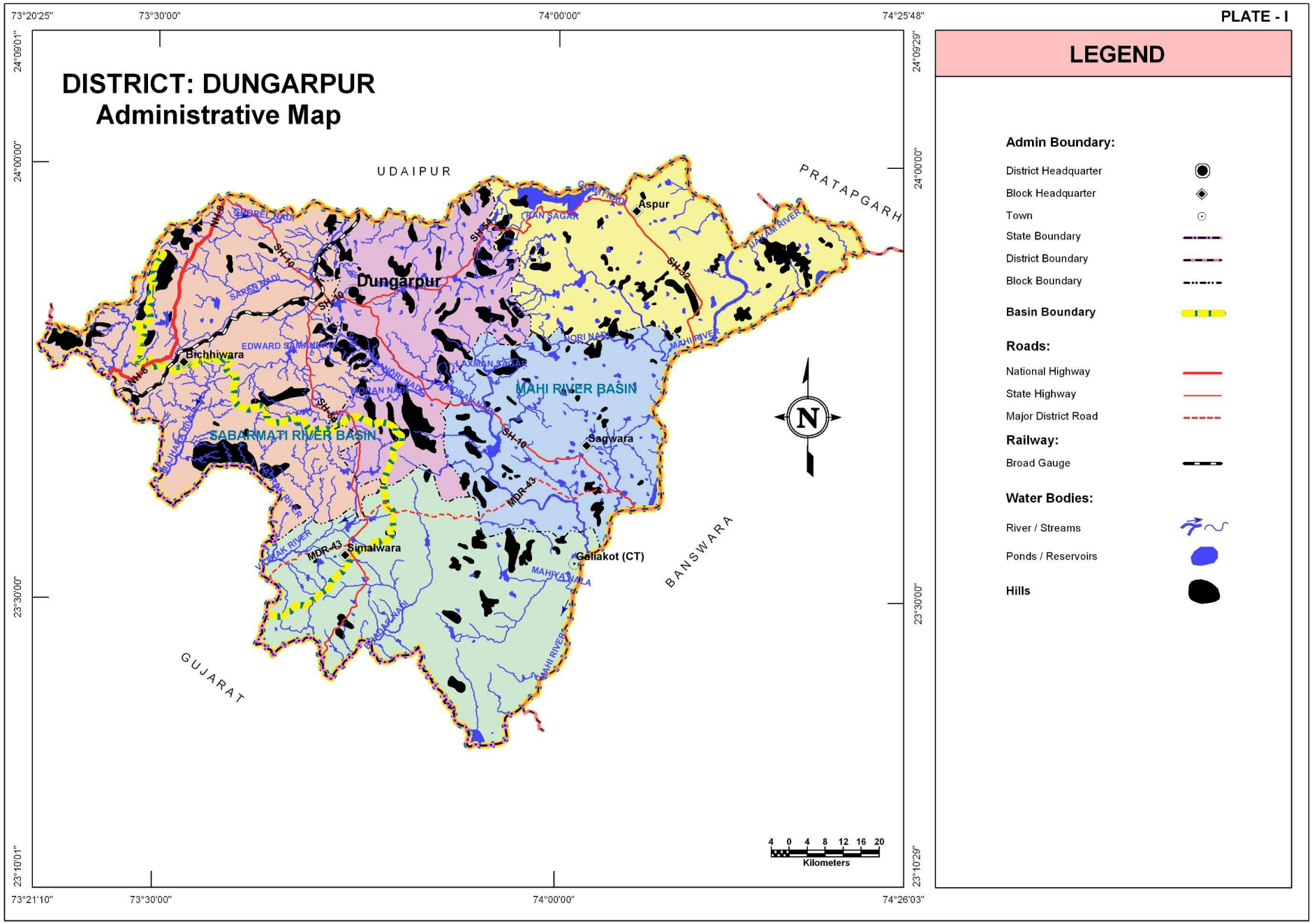
PLATE - I



LEGEND

Admin Boundary:

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

Roads:

- National Highway
- State Highway
- Major District Road

Railway:

- Broad Gauge

Water Bodies:

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

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TOPOGRAPHY

DISTRICT – DUNGARPUR

Physiographically, the district is characterized by low-lying hills intervening with valleys and rocky plains and can be broadly divided in three distinct unit viz. Rocky uplands, Erosional valleys and pediplains. The area is drained by Mahi and its tributaries like Nori, Jakam, Gomti, Saren, Ghorel and Moran. The general topographic elevation in the district is between 200m to 250m above mean sea level in most of the blocks. Elevation ranges from a minimum of 112 m amsl in Simalwara block in the southwestern part of the district to a maximum of 545.6 m amsl In Bichhiwara in northwestern part of the district.

Table: Block wise minimum and maximum elevation

S. No.	Block Name	Min. Elevation (m amsl)	Max. Elevation (m amsl)
1	Aspur	131.3	380.7
2	Bichhiwara	185.3	545.6
3	Dungarpur	178.4	452.7
4	Sagwara	113.2	348.5
5	Simalwara	112.0	285.8

RAINFALL

The general distribution of total annual rainfall across the district can be visualized from isohyets presented in the Plate – III. Northeastern part of the district received rainfall in the range of 500 – 600 mm which gradually increases towards west. The annual average rainfall was 667.8 mm based on the data of available blocks in the district while highest average annual rainfall is 732.3 mm in Bichhiwara block. Lowest annual rainfall was in Sagwara block (544.8 mm). Bichhiwara block has received highest maximum annual rainfall of about 759.3 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)
Aspur	569.2	650.5	602.5
Bichhiwara	697.7	759.3	732.3
Dungarpur	628.2	758.7	695.4
Sagwara	544.8	695.6	645.4
Simalwara	590.8	711.8	663.6

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PLATE - II

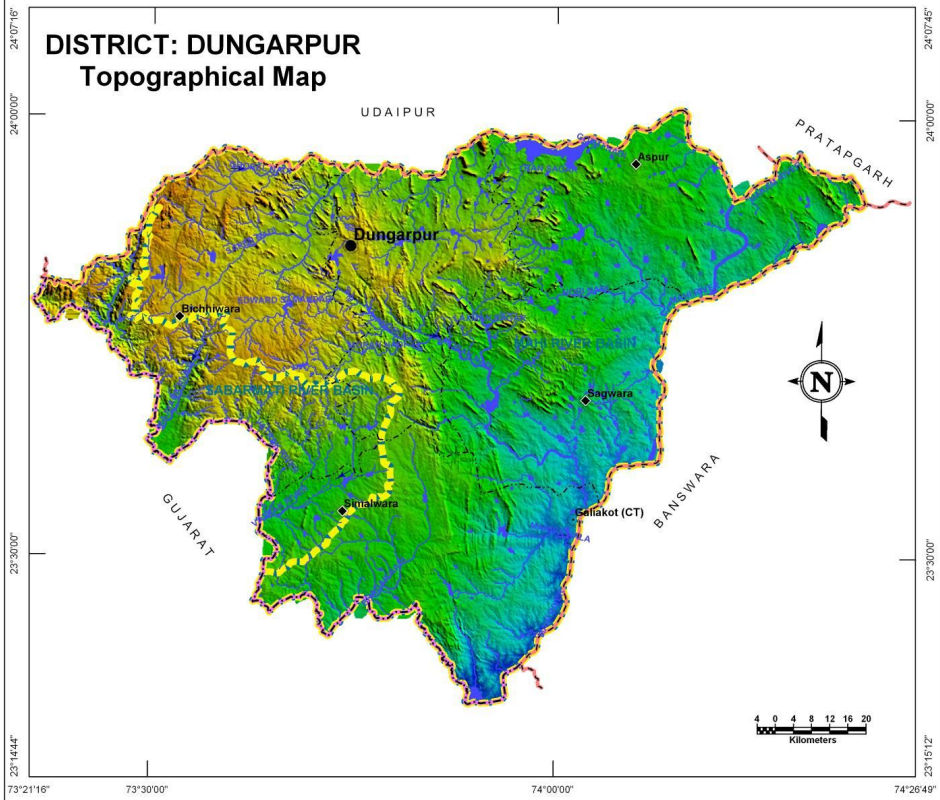
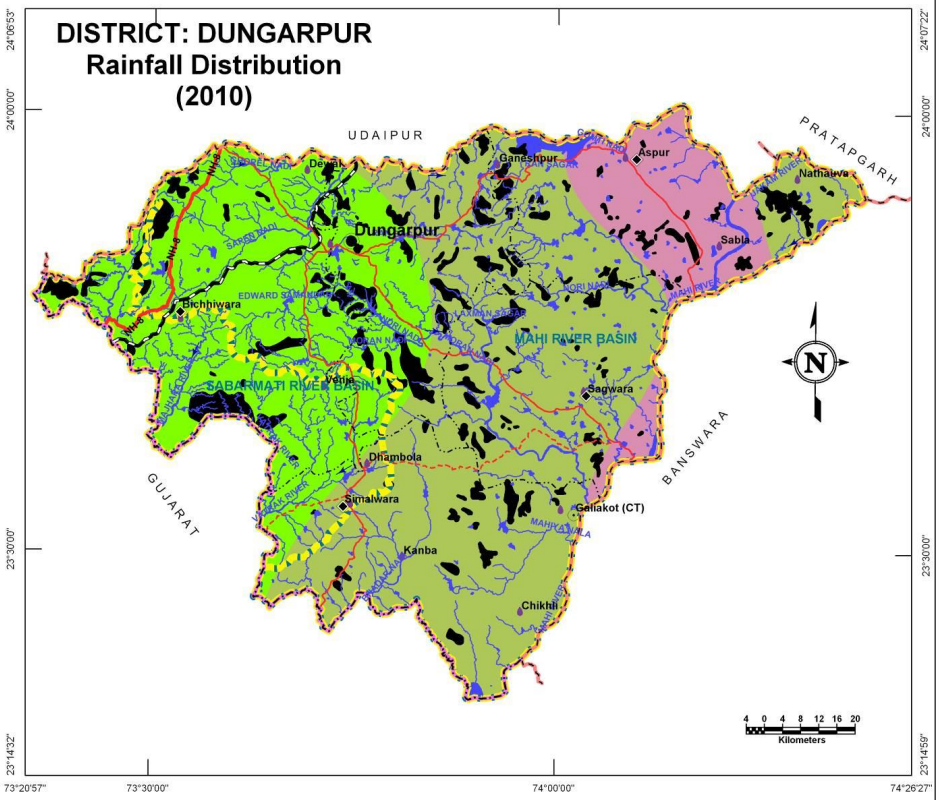


PLATE - III



LEGEND

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

Basin Boundary

Water Bodies:
- River / Streams
- Ponds / Reservoirs

Elevation (m amsl):
546, 500, 450, 400, 350, 300, 250, 200, 150, 112

Source : SRTM DEM

LEGEND

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

Basin Boundary

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

Railway:
- Broad Gauge

Water Bodies:
- River / Streams
- Ponds / Reservoirs

Hills

Isohyets (mm):
- 500-600
- 600-700
- 700-800

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GEOLOGY

DISTRICT – DUNGARPUR

Major part of the district is formed of Aravalli Super Group of rocks represented by schist, gneiss, granite, quartzite and slates. South and southwestern part of the district comes under Lunavada Group which consist phyllite, meta-siltstone, quartzite and dolomite rock formations. Udaipur Group covers maximum part of the district and consists of phyllite, mica schist, quartzite, dolomite and gneisses formation. The chief rock types of the area phyllite and quartzite striking NNW and SSE intruded by ultra basic intrusive.

Super Group	Group	Formation
Aravalli	Lunavada	Sand and younger alluvium, Phyllite, meta-silt stone, garnetiferous mica schist, quartzite & dolomite.
	Rakhabdeo Ultramafic Suite	Serpentinite, talc-chlorite, actinolite-tremolite schist and asbestos.
	Jharol	Chloritic-micaceous schist and calc schists.
	Udaipur	Phyllite, mica schists, meta siltstone, quartzite, Dolomite, gneisses and migmatites.
	Debari	Meta-arkose, quartzite, phyllite, dolomitic marble and dolomite.
--X--------X--------X--------X---Unconformity---X--------X--------X-------X--		
Bhilwara	Mangalwar Complex	Migmatites, quartzofeldspathic gneisses feldspathic garnetiferous-mica schist and amphibolites.

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.
	Pediplain	Coalescence and extensive occurrence of pediment.
Fluvial	Valley Fill	Formed by fluvial activity, usually at lower topographic locations, comprising of boulders, cobbles, pebbles, gravels, sand, silt and clay. The unit has consolidated sediment deposits.
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

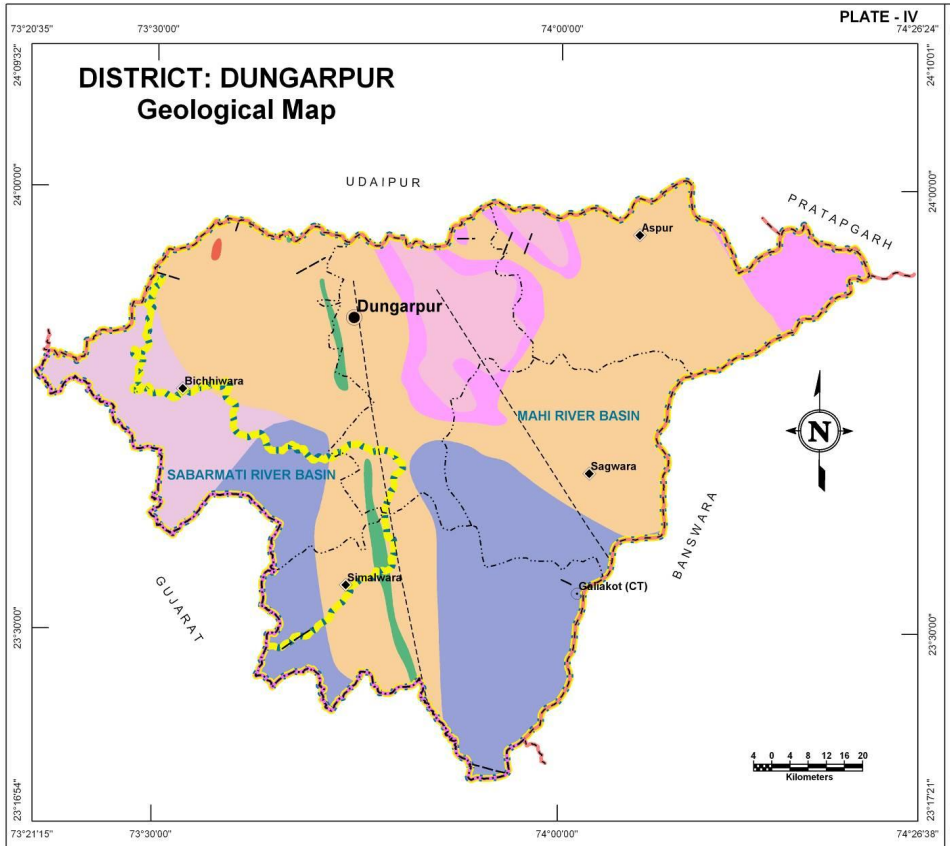
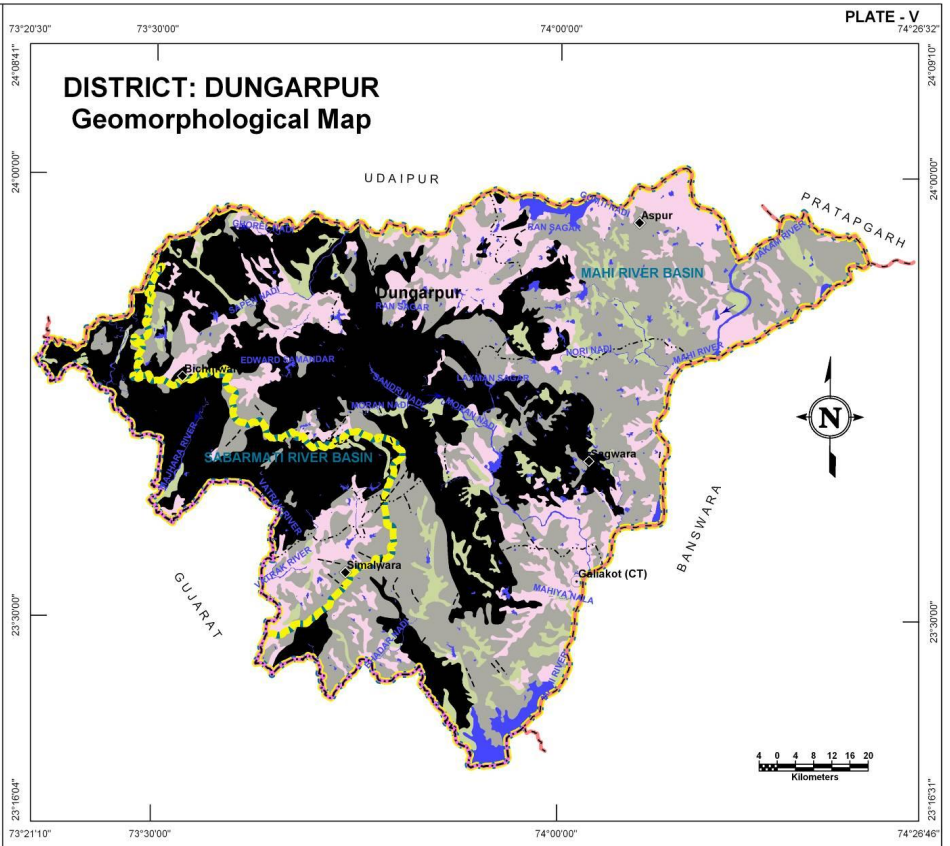


PLATE - V



LEGEND

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

Structural Features:
- Fault
- Lineament

Geology:
- Lunavada Group
- Jharol Group
- Udaipur Group
- Debari Group
- Mangalwar Complex
- Udaipur/Salumbar/Udaisagar/Darwal Granite
- Rakhabdev Ultramafic Suite

Source: District Resource Map of Rajasthan - GSI

LEGEND

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

Water Bodies:
- River/Ponds/Reservoirs

Structural Features:
- Fault/Fractures/Lineament

Hills:
- Structural/Denudational/Linear Ridge

Landform Units:

Fluvial Origin:
- Valley Fill

Denudational Origin:
- Burried Pediment
- Pediplain

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

AQUIFERS

DISTRICT – DUNGARPUR

Aquifers in this district are mostly formed in hardrock formations where weathering, fracturing and jointing leads to formation of secondary openings and thus aquifers. Phyllite is most prominent aquifers here which occupy about 73% of the central and western parts of the district. BGC also constitutes good aquifers in about 10% of the district in northeastern part. Ultrabasic rocks occupy small aquifer tract in southern part of the district and schist in the northeast form about 7% 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
Phyllite	2,741.5	72.7	These include meta sediments and represented by carbonaceous phyllite.
Schist	257.0	6.8	Medium to fine grained compact rock. The lithounits are soft, friable and have closely spaced cleavage.
Ultra Basic	101.2	2.7	This comprises serpentinite, hyperstinite and amphibolite.
BGC	390.9	10.4	Grey to dark coloured, medium to coarse grained rocks.
Hills	280.0	7.4	
Total	**3,770.6**	**100.0**	

STAGE OF GROUND WATER DEVELOPMENT

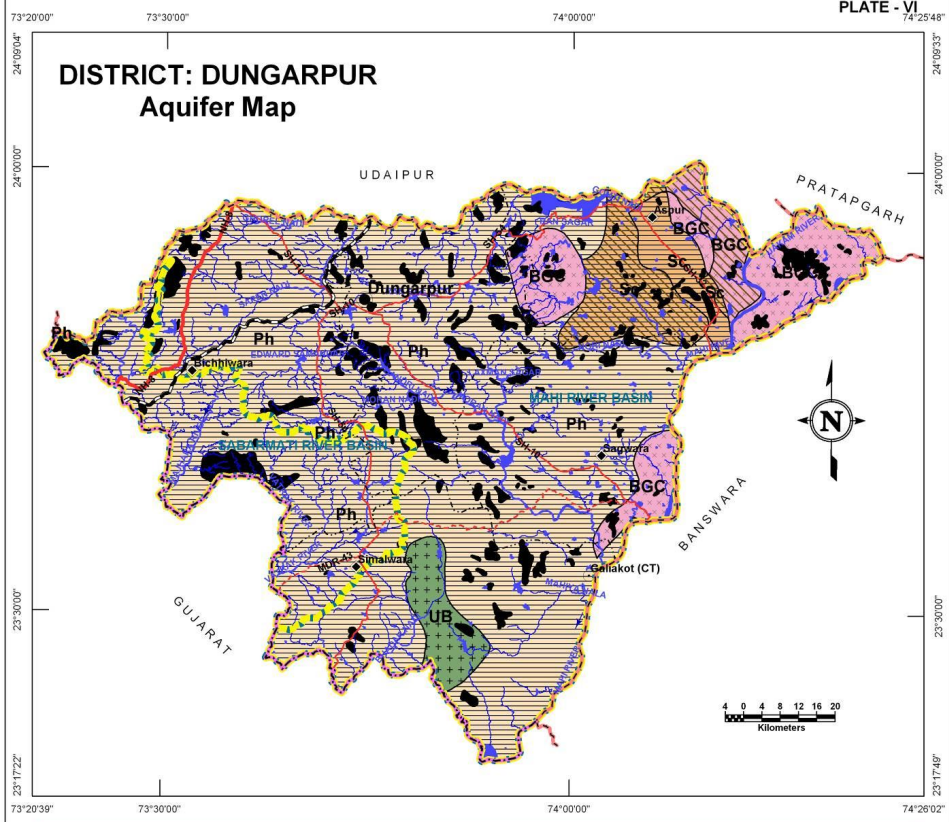
Aspur block in the northeastern part of the district falls under 'Safe' category as assessed from stage of ground water development. Incidentally, these areas correspond to the aquifers formed in BGC and Schistose rocks. The other four blocks of the district fall into 'Semi Critical' category as development has reached very close to the limit and any further development would lead to exhaustion of dynamic ground water resources in these areas.

Categorization on the basis of stage of development of ground water	Block Name
Safe	Aspur
Semi Critical	Sagwara, Dungarpur, Simalwara, Bichhiwara

Basis for categorization: Ground water development <= 70% - Safe; <= 70 – 90% Semi critical

PLATE - VI

DISTRICT: DUNGARPUR
Aquifer Map



LEGEND

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

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

Railway:
- Broad Gauge

Water Bodies:
- River / Streams
- Ponds / Reservoirs

Hills

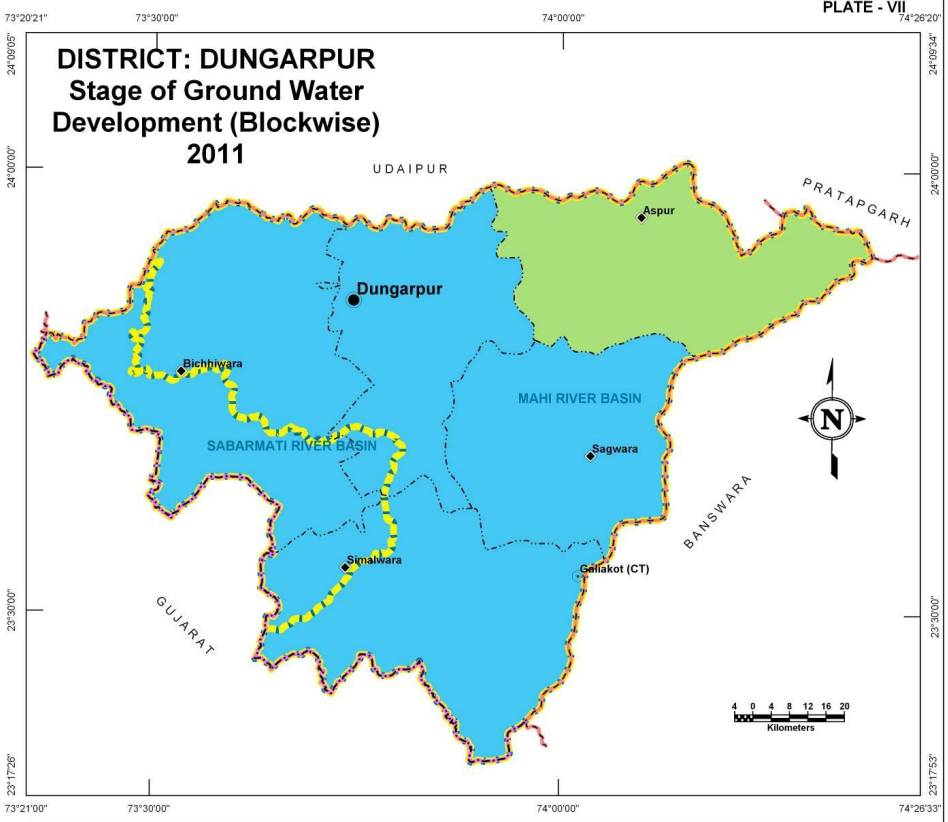
Command Area

Aquifer:
- Phyllite
- Schist
- Ultra Basic
- BGC

Source: Ground Water Potential Zone Map - GWD, Rajasthan

PLATE - VII

DISTRICT: DUNGARPUR
Stage of Ground Water Development (Blockwise) 2011



LEGEND

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

Stage of Ground Water Development:
- Safe
- Semi-Critical

Source: Ground Water Department, Rajasthan

LOCATION OF EXPLORATORY AND GROUND WATER MONITORING WELLS DISTRICT – DUNGARPUR

There is a well distributed network of exploratory wells (109) and ground water monitoring stations (251) in the district owned by RGWD (83 and 231 respectively) and CGWB (20 and 20 respectively) in Dungarpur district. The exploratory wells have formed the basis for delineation of subsurface aquifer distribution scenario in three dimensions. Benchmarking and optimization studies suggest that both ground water level and quality are being sufficiently monitored and no further strengthening is required.

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
Aspur	4	15	**19**	4	45	**49**	-	-
Bichhiwara	5	24	**29**	7	52	**59**	-	-
Dungarpur	4	18	**22**	3	48	**51**	-	-
Sagwara	4	10	**14**	3	39	**42**	-	-
Simalwara	9	16	**25**	3	47	**50**	-	-
Total	**26**	**83**	**109**	**20**	**231**	**251**	**-**	**-**

DEPTH TO WATER LEVEL (PRE MONSOON – 2010)

In spite of being a predominantly hard rock area, the district shows moderate variation in depth to ground water levels from less than 10m bgl to around 40m bgl. Shallow water levels are seen in isolated parts of the district within Bichhiwara and Sagwara blocks. Deeper water level of more than 30m bgl is found in southeastern fringe of Simalwara block. More than 80% of the district has depths of water level ranging between 10m bgl and 30m bgl is seen.

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)
	Aspur	Bichhiwara	Dungarpur	Sagwara	Simalwara	
<10	-	52.8	-	17.2	-	**70.0**
10-20	104.8	493.2	117.8	226.5	587.5	**1,529.8**
20-30	539.3	368.5	410.2	357.6	209.9	**1,885.5**
>30	-	-	-	-	5.3	**5.3**
Total	**644.1**	**914.5**	**528.0**	**601.3**	**802.7**	**3,490.6**

* 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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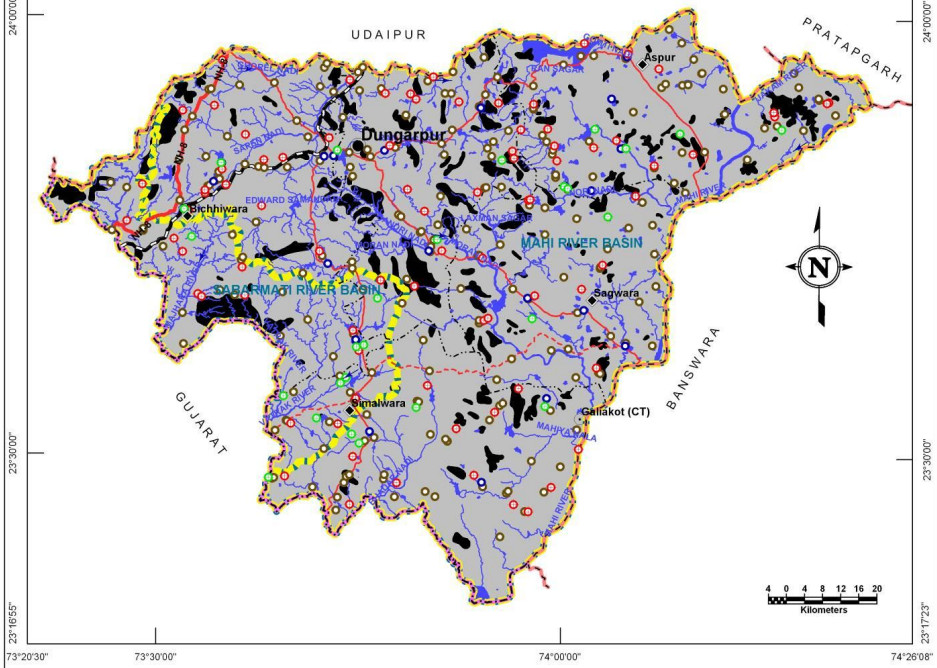
PLATE - VIII

DISTRICT: DUNGARPUR
Location of Exploratory Wells and Ground Water Monitoring Stations



LEGEND

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

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

Railway:
- Broad Gauge

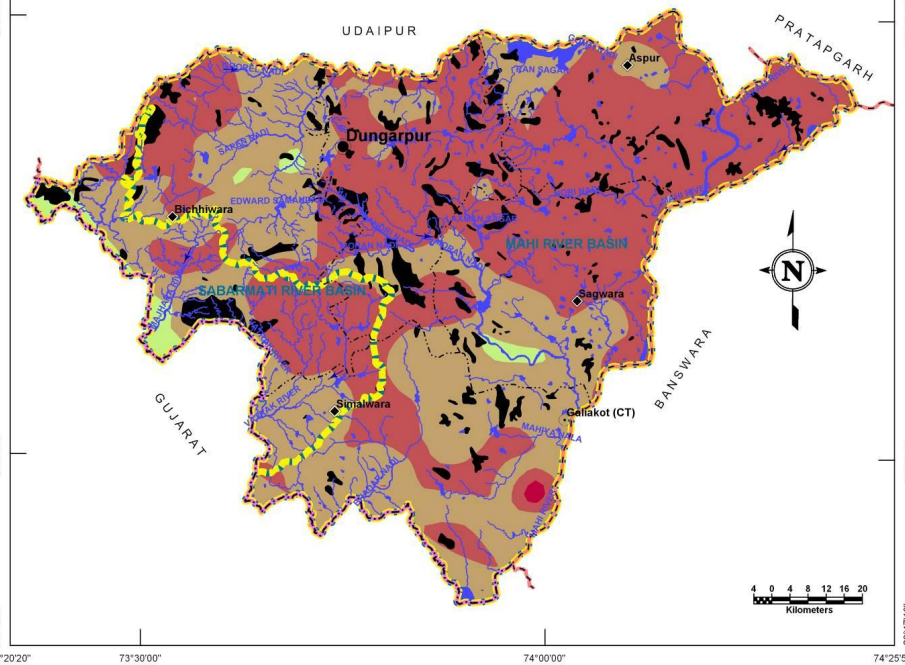
Water Bodies:
- River / Streams
- Ponds / Reservoirs
- **Hills**

Exploratory Wells:
- CGWB
- RGWD

Ground Water Monitoring Stations:
- CGWB
- RGWD

PLATE - IX

DISTRICT: DUNGARPUR
Depth to Water Level (Pre-Monsoon 2010)



LEGEND

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

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

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

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

Large variation in the water table elevation from about 120m amsl to more than 340m is seen in the district (Plate – X). General flow direction of ground water is from west to east and southeast within major part of the district. Maximum water table elevation of upto >340m amsl is noticed in the northwestern part (Bichhiwara Block) of the district. The water table gradually lowers towards southeast reaching a minimum elevation of about 120m amsl in the Sagwara and Simalwara blocks of the district.

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

Block Name	Block wise area coverage (sq km) per water table elevation (amsl) range													Total Area (sq km)
	< 120	120 - 140	140 - 160	160 - 180	180 - 200	200 - 220	220 - 240	240 - 260	260 - 280	280 - 300	300 - 320	320 - 340	> 340	
Aspur	-	1.4	38.9	232.0	220.1	93.7	50.7	7.3	-	-	-	-	-	**644.1**
Bichhiwara	-	-	-	-	5.8	71.0	68.9	54.4	145.6	191.1	228.1	134.7	14.9	**914.5**
Dungarpur	-	-	-	0.3	8.4	33.8	94.5	220.0	136.7	33.6	0.7	-	-	**528.0**
Sagwara	-	200.1	119.5	109.4	92.8	57.6	21.4	0.5	-	-	-	-	-	**601.3**
Simalwara	20.8	134.2	80.9	93.2	244.5	196.1	31.2	1.8	-	-	-	-	-	**802.7**
Total	**20.8**	**335.7**	**239.3**	**434.9**	**571.6**	**452.2**	**266.7**	**284**	**282.3**	**224.7**	**228.8**	**134.7**	**14.9**	**3,490.6**

WATER LEVEL FLUCTUATION (PRE TO POST MONSOON 2010)

A 2m contour interval adopted to visualize the ground water level fluctuation reveals no change in one area to rise in other areas reaching upto more than 14m, as seen in Plate – XI. The district shows a general rise of upto 6m in most part of the area. Unusually high values of ground water rise (to more than 14m in water level of post monsoon season with respect to pre monsoon) however, very localized in distribution is seen in the western part of Bichhiwara block.

Table: Block wise area covered in each water fluctuation zone

Water level fluctuation range (m)	Block wise area coverage (sq km)					Total Area (sq km)
	Aspur	Bichhiwara	Dungarpur	Sagwara	Simalwara	
<0	-	0.3	3.6	-	-	**3.9**
0to2	339.8	24.1	78.1	93.9	-	**535.9**
2to4	302.7	166.6	229.0	332.4	244.7	**1,275.4**
4to6	1.6	358.7	193.3	157.3	368.4	**1,079.3**
6to8	-	260.1	24.0	15.6	145.1	**444.8**
8to10	-	72.9	-	2.1	39.6	**114.6**
10to12	-	21.0	-	-	4.9	**25.9**
12to14	-	7.5	-	-	-	**7.5**
>14	-	3.3	-	-	-	**3.3**
Total	**644.1**	**914.5**	**528.0**	**601.3**	**802.7**	**3,490.6**

PLATE - X

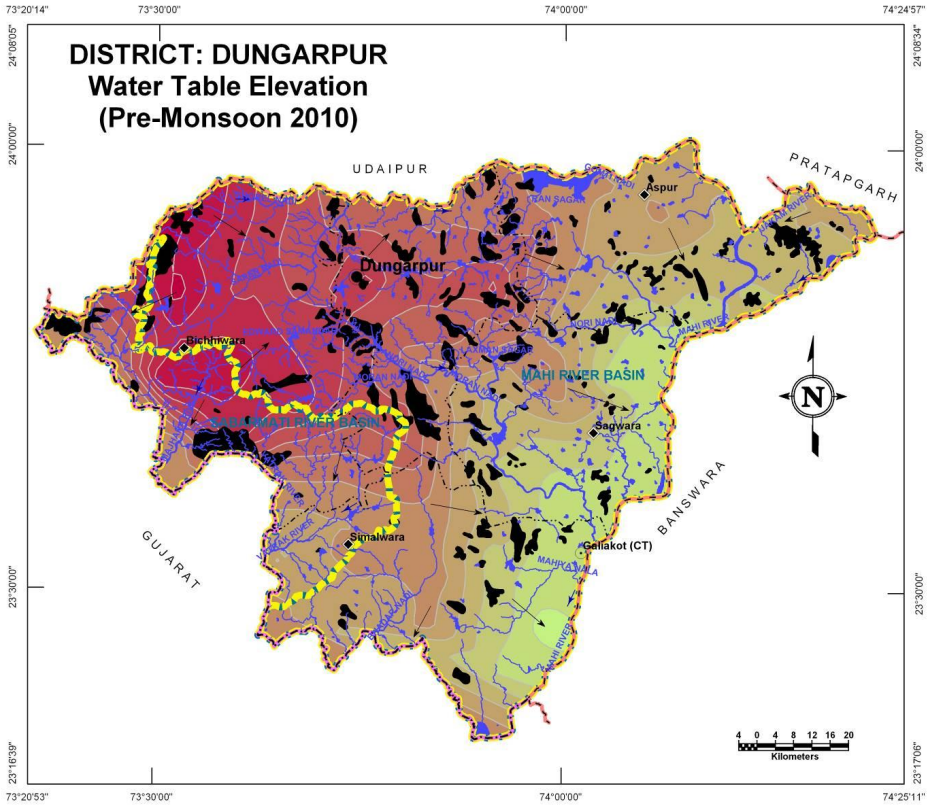
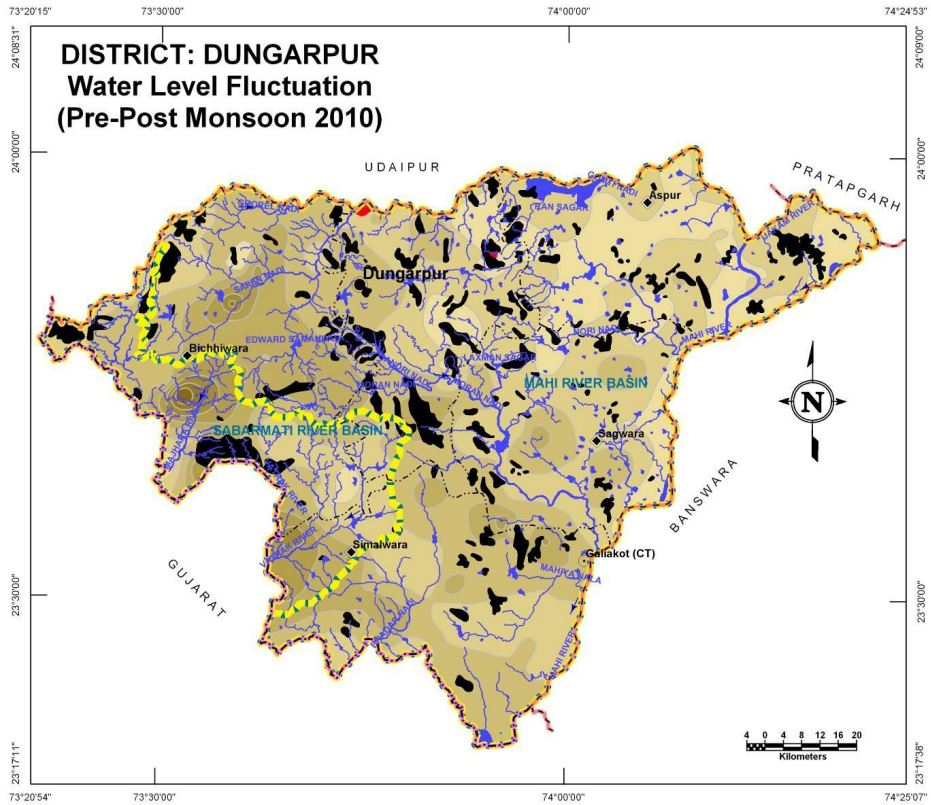


PLATE - XI



LEGEND

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

Basin Boundary

Water Bodies:
- River / Streams
- Ponds / Reservoirs

Hills

Water Table Elevation

Water Table Elevation(m amsl):
- <120
- 120 - 140
- 140 - 160
- 160 - 180
- 180 - 200
- 200 - 220
- 220 - 240
- 240 - 260
- 260 - 280
- 280 - 300
- 300 - 320
- 320 - 340
- >340

LEGEND

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

Basin Boundary

Water Bodies:
- River / Streams
- Ponds / Reservoirs

Hills

Water Level Elevation(m):
- < 0
- 0 to 2
- 2 to 4
- 4 to 6
- 6 to 8
- 8 to 10
- 10 to 12
- 12 to 14
- >14

GROUND WATER ELECTRICAL CONDUCTIVITY DISTRIBUTION DISTRICT – DUNGARPUR

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 94% of the district area indicating that, by and large the ground water in the district is suitable for domestic purpose. The areas with moderately high EC values (2000 - 4000 µS/cm) are shown in green color and occupy 5% of the district area, largely southern part of Aspur. A negligibly small part of the district has shown high EC value and it appears to be a localized pocket.

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)
	Aspur		Bichhiwara		Dungarpur		Sagwara		Simalwara		
	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	
<2000	534.1	82.9	914.5	100.0	528.0	100.0	531.4	88.4	802.7	100.0	**3,310.7**
2000-4000	109.8	17.1	-	-	-	-	62.6	10.4	-	-	**172.4**
>4000	0.2	-	-	-	-	-	7.3	1.2	-	-	**7.5**
Total	**644.1**	**100.0**	**914.5**	**100.0**	**528.0**	**100.0**	**601.3**	**100.0**	**802.7**	**100.0**	**3,490.6**

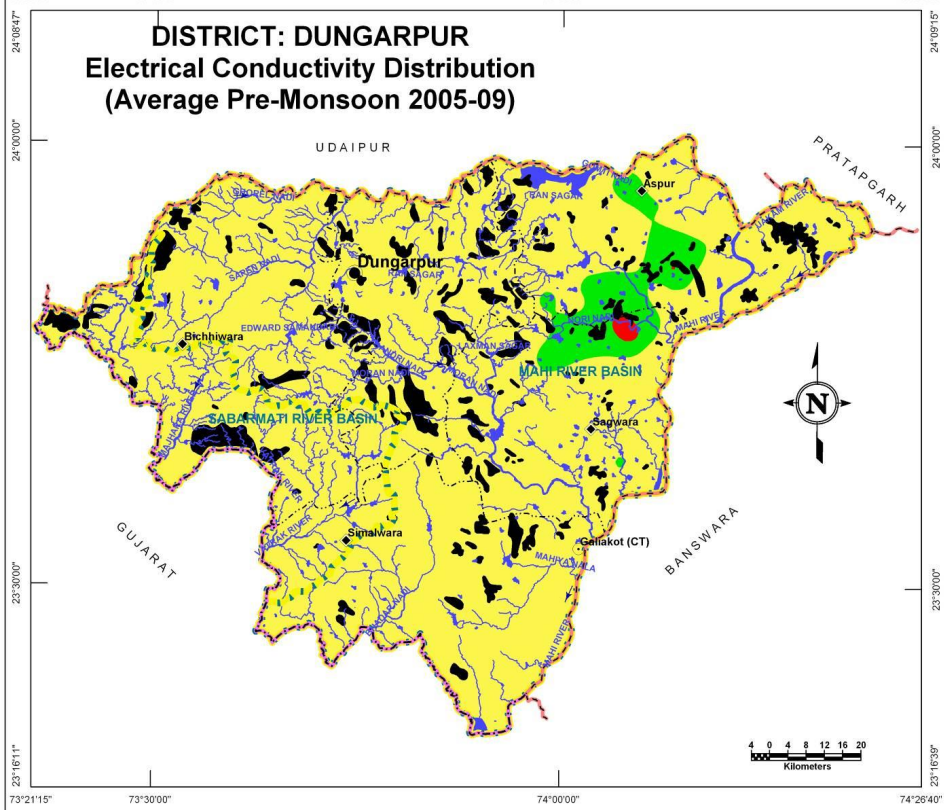
GROUND WATER CHLORIDE DISTRIBUTION

The yellow colored regions in Plate – XIII are such areas where chloride concentration is low (<250 mg/l) occupies approximately 87% of the district area. The ground water in this district is therefore, largely fresh and suitable for domestic purpose. The areas with moderately high chloride concentration (250-1000mg/l) are shown in green color occupy approximately 12% of the district area, largely northeastern part of the district around Aspur. A negligibly small area in the district has shown >1000 mg/l of chloride concentration in ground water but is very localized in distribution.

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)
	Aspur		Bichhiwara		Dungarpur		Sagwara		Simalwara		
	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	
<250	418.7	65.0	873.9	96.0	504.6	96.0	483.0	80.0	792.0	99.0	**3,072.2**
250-1000	223.8	35.0	40.6	4.0	23.4	4.0	118.3	20.0	10.7	1.0	**416.8**
>1000	1.6	-	-	-	-	-	-	-	-	-	**1.6**
Total	**644.1**	**100.0**	**914.5**	**100.0**	**528.0**	**100.0**	**601.3**	**100.0**	**802.7**	**100.0**	**3,490.6**

PLATE - XII



LEGEND

Admin Boundary:

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

Basin Boundary

Water Bodies:

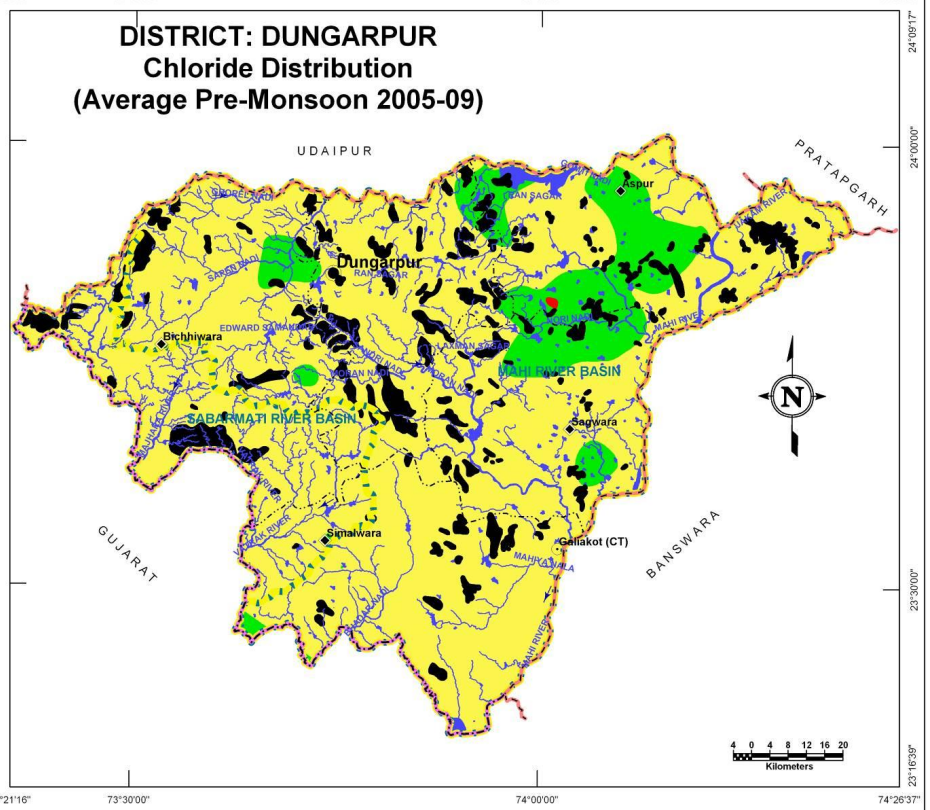
- River / Streams
- Ponds / Reservoirs

Hills

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

- < 2000
- 2000-4000
- >4000

PLATE - XIII



LEGEND

Admin Boundary:

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

Basin Boundary

Water Bodies:

- River / Streams
- Ponds / Reservoirs

Hills

Chloride Concentration (mg/l):

- < 250
- 250 - 1000
- > 1000

GROUND WATER FLUORIDE DISTRIBUTION DISTRICT – DUNGARPUR

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 75% 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, largely northeastern part of district. Remaining small part of the district approximately 5% of area of the district has high Fluoride concentration (>3.0 mg/l), largely southern part of Aspur and making it unsuitable for domestic purpose. On overlaying this map with aquifer distribution map it is interesting to find that these high fluoride areas are surrounded by gneissic (BGC) aquifer areas and within schistose rocks.

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)
	Aspur		Bichhiwara		Dungarpur		Sagwara		Simalwara		
	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	
<1.5	131.3	20.4	914.5	100.0	387.6	73.4	382.0	63.5	802.7	100.0	**2,618.1**
1.5-3.0	374.1	58.1	-	-	121.5	23.0	212.3	35.3	-	-	**707.9**
>3.0	138.7	21.5	-	-	18.9	3.6	7.0	1.2	-	-	**164.6**
Total	**644.1**	**100.0**	**914.5**	**100.0**	**528.0**	**100.0**	**601.3**	**100.0**	**802.7**	**100.0**	**3,490.6**

GROUND WATER NITRATE DISTRIBUTION

High nitrate concentration in ground water renders it unsuitable for agriculture purposes. Plate – XV shows distribution of Nitrate in ground water. Low nitrate concentration (<50 mg/l) is shown in yellow color occupies most of the western part of the district and partly in the eastern part of the district accounting for approximately 66% of the district area suitable for agriculture purpose. The areas with moderately high nitrate concentration (50-100 mg/l) and the high concentration nitrate (>100 mg/l) are shown respectively in green and red colours. Such patches occupy significant areas in the eastern part of the district accounting for about 34% of the district area that is marginally or not suitable for agriculture.

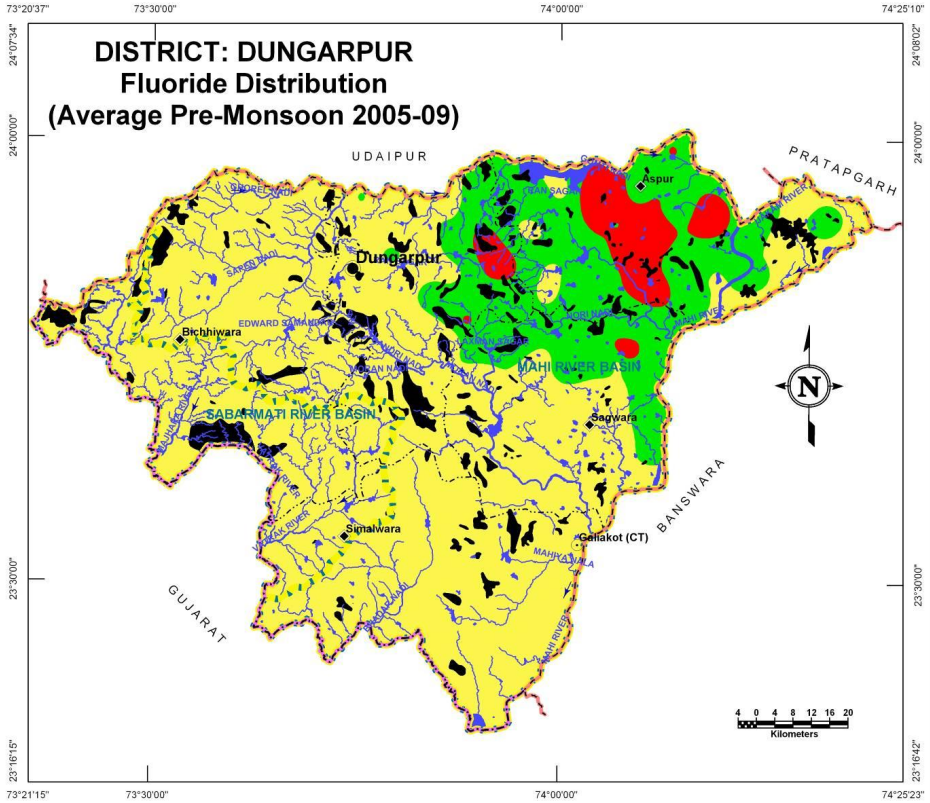
Table: Block wise area of Nitrate distribution

Nitrate Concentration Range (mg/l) (Ave. of years 2005-09)	Block wise area coverage (sq km)										Total Area (sq km)
	Aspur		Bichhiwara		Dungarpur		Sagwara		Simalwara		
	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	
<50	231.3	35.9	872.2	95.4	421.4	79.8	240.5	40.0	546.1	68.0	**2,311.5**
50-100	207.4	32.2	42.3	4.6	64.2	12.2	255.2	42.5	214.4	26.7	**783.5**
>100	205.4	31.9	-	-	42.4	8.0	105.6	17.6	42.2	5.3	**395.6**
Total	**644.1**	**100.0**	**914.5**	**100.0**	**528.0**	**100.0**	**601.3**	**100.1**	**802.7**	**100.0**	**3,490.6**

Ground Water Department,
Rajasthan

European Union
State Partnership Programme

PLATE - XIV



LEGEND

Admin Boundary:

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

Basin Boundary

Water Bodies:

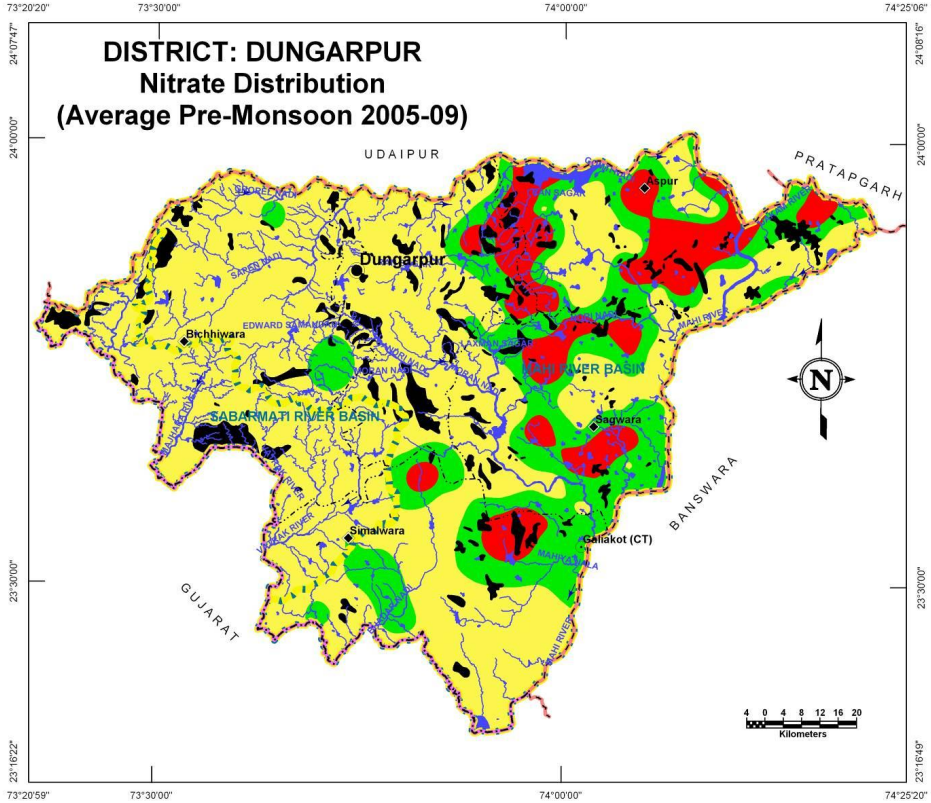
- River / Streams
- Ponds / Reservoirs

Hills

Fluoride Concentration (mg/l):

- < 1.5
- 1.5-3.0
- >3.0

PLATE - XV



LEGEND

Admin Boundary:

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

Basin Boundary

Water Bodies:

- River / Streams
- Ponds / Reservoirs

Hills

Nitrate Concentration (mg/l):

- < 50
- 50-100
- >100

ROLTA
Rolta India Limited

DEPTH TO BEDROCK

DISTRICT – DUNGARPUR

From hydrogeological perspective, the beginning of massive bedrock has been considered for defining top of bedrock surface. The major rocks types present in the district are phyllite, schist, ultrabasic and BGC. These rocks are overlain by soil cover of variable thickness. Depth to bedrock map of Dungarpur district (Plate – XVI) reveals wide variation of more than 100m below ground level reaching a maximum depth of more than 120m in the southern part of Aspur block. Areas around Aspur, Bichhiwara, Dungarpur, Sagwara and Simalwara blocks indicate the occurrence of bedrock at moderate depths of the order of 40m bgl and often reaching depth of upto 80m bgl. Most of the district represents a moderate bedrock depth reaching a maximum of 60m bgl and very deep bedrock is encountered in Aspur block, in the eastern part of the district where a depth of >120m bgl is seen.

Depth to bedrock (m bgl)	Block wise area coverage (sq km)										Total Area (sq km)
	Aspur		Bichhiwara		Dungarpur		Sagwara		Simalwara		
	Area	%age	Area	%age	Area	%age	Area	%age	Area	%age	
<20	-	-	-	-	-	-	9.7	1.6	0.3	-	**10.0**
20-40	182.6	28.0	214.9	23.0	248.3	47.0	136.4	22.7	490.6	61.0	**1,272.8**
40-60	216.0	34.0	624.2	69.0	279.7	53.0	356.3	59.3	291.5	36.0	**1,767.7**
60-80	128.2	20.0	75.4	8.0	-	-	90.2	15.0	20.3	3.0	**314.1**
80-100	53.7	8.0	-	-	-	-	8.1	1.3	-	-	**61.8**
100-120	40.9	6.0	-	-	-	-	0.6	0.1	-	-	**41.5**
>120	22.7	4.0	-	-	-	-	-	-	-	-	**22.7**
Total	**644.1**	**100.0**	**914.5**	**100.0**	**528.0**	**100.0**	**601.3**	**100.0**	**802.7**	**100.0**	**3,490.6**

UNCONFINED AQUIFER

Hard rock areas

Aquifers in the district are predominantly formed in weathered, fractured and jointed rock formations occurring at shallower depths and these constitute good unconfined aquifers. The thickness of aquifers thus formed varies from less than 10m to about 90m however; major part of the district shows a thickness range of upto 30m. The southwestern and central part has shown occasional high thickness zones in Bichhiwara and Dungarpur blocks and partly in Aspur block.

Unconfined aquifer Thickness (m)	Block wise area coverage (sq km)					Total Area (sq km)
	Aspur	Bichhiwara	Dungarpur	Sagwara	Simalwara	
< 10	115.8	123.5	138.7	53.8	229.9	**661.7**
10-20	273.5	321.6	222.9	141.7	262.5	**1,222.2**
20-30	126.4	233.9	87.9	290.5	260.9	**999.6**
30-40	60.2	132.8	36.8	84.7	49.3	**363.8**
40-50	35.6	60.5	18.7	22.1	0.1	**137.0**
50-60	21.7	23.6	9.7	7.3	-	**62.3**
60-70	9.3	11.6	6.4	1.2	-	**28.5**
70-80	1.6	5.1	4.7	-	-	**11.4**
> 80	-	1.9	2.2	-	-	**4.1**
Total	**644.1**	**914.5**	**528.0**	**601.3**	**802.7**	**3,490.6**

PLATE - XVI

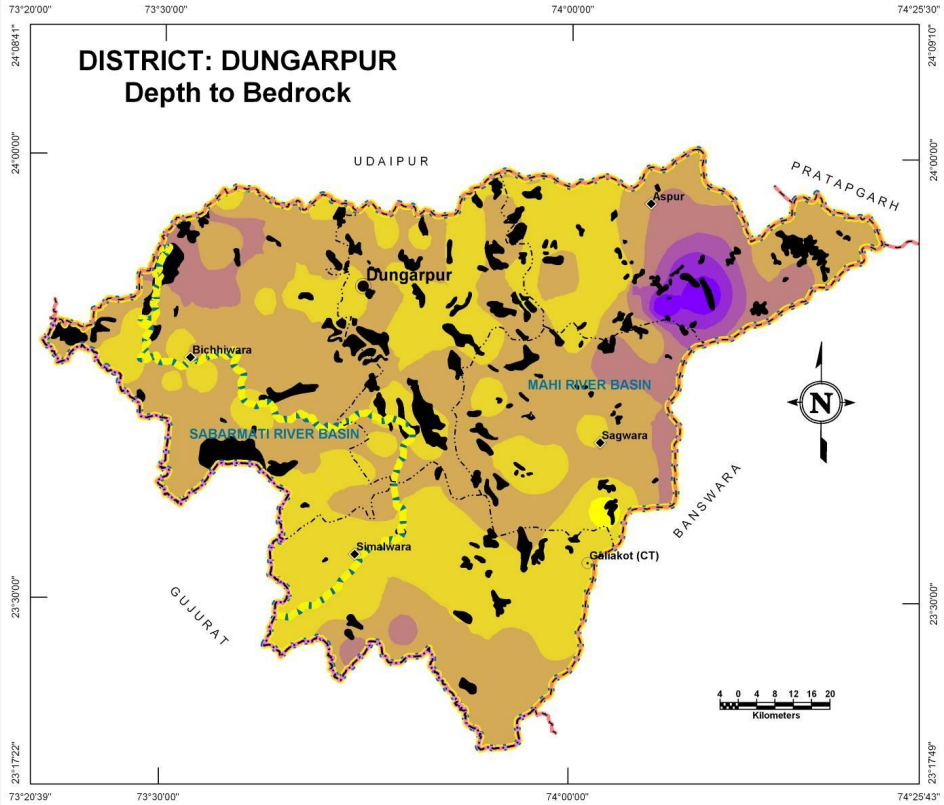
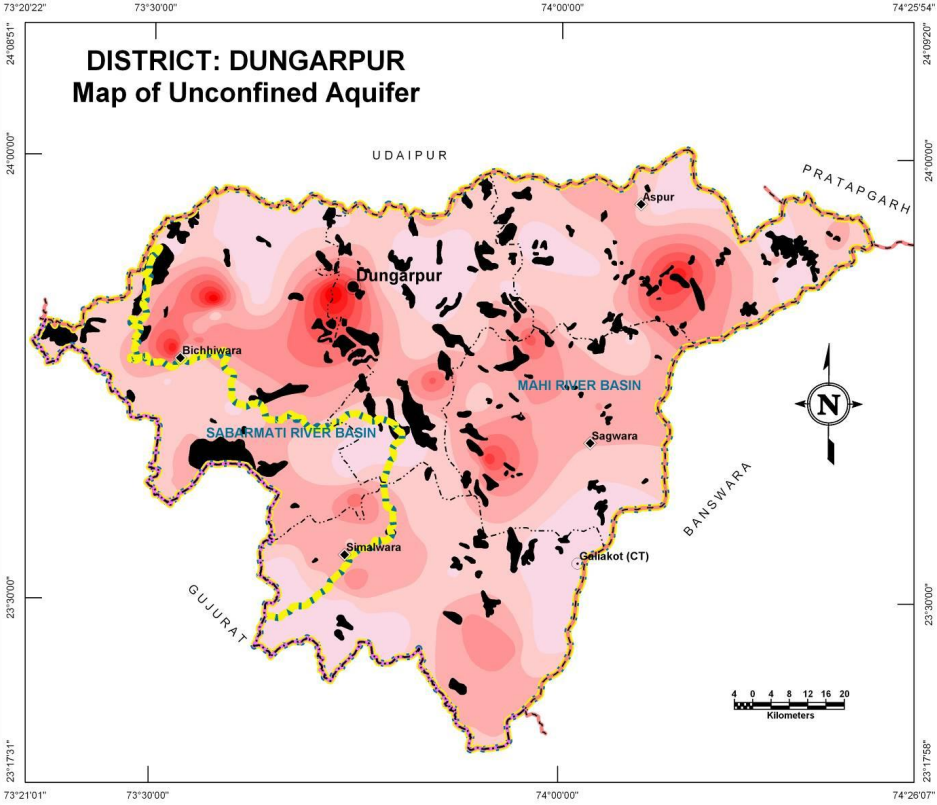


PLATE - XVII



LEGEND

Admin Boundary:

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

Depth to Bedrock(m bgl):

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

LEGEND

Admin Boundary:

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

Aquifer Thickness (m):

Weathered & Fractured Zone in Hardrock Area

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

Glossary of terms

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

(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

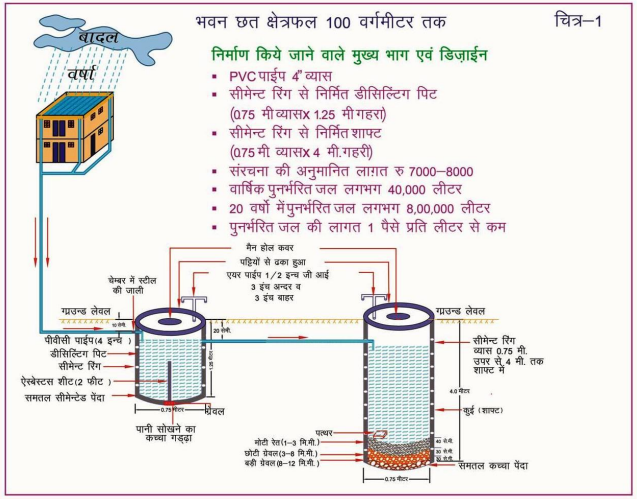
केन्द्रीय भूमि जल बोर्ड,
पश्चिमी क्षेत्र, जयपुर
जल संसाधन मंत्रालय
भारत सरकार
e-mail:cgwbwr@sancharnet.in

भूजल अमूल्य है इसे प्रदूषित न करें।

चित्र–1 भवन छत क्षेत्रफल 100 वर्गमीटर तक

निर्माण किये जाने वाले मुख्य भाग एवं डिज़ाईन

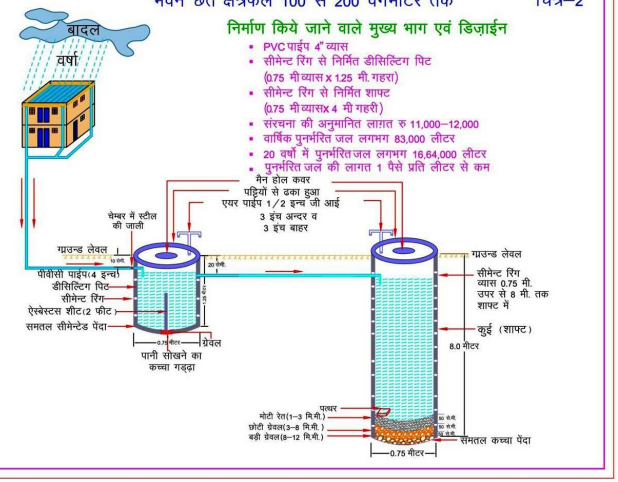
- PVC पाईप 4" व्यास
- सीमेन्ट रिंग से निर्मित डीसिल्टिंग पिट (0.75 मी.व्यास x 1.25 मी.गहरा)
- सीमेन्ट रिंग से निर्मित शाफ्ट (0.75 मी.व्यास x 4 मी.गहरी)
- संरचना की अनुमानित लाग़त रु 7000–8000
- वार्षिक पुनर्भरित जल लगभग 40,000 लीटर
- 20 वर्षों में पुनर्भरित जल लगभग 8,00,000 लीटर
- पुनर्भरित जल की लागत 1 पैसे प्रति लीटर से कम



चित्र–2 भवन छत क्षेत्रफल 100 से 200 वर्गमीटर तक

निर्माण किये जाने वाले मुख्य भाग एवं डिज़ाईन

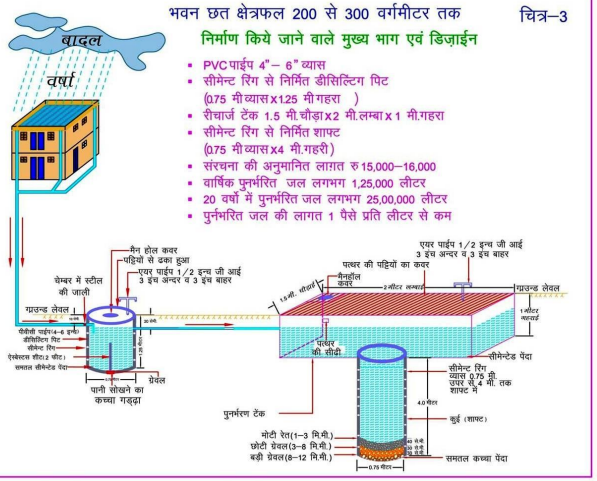
- PVC पाईप 4" व्यास
- सीमेन्ट रिंग से निर्मित डीसिल्टिंग पिट (0.75 मी.व्यास x 1.25 मी.गहरा)
- सीमेन्ट रिंग से निर्मित शाफ्ट (0.75 मी.व्यास x 4 मी गहरी)
- संरचना की अनुमानित लाग़त रु 11,000–12,000
- वार्षिक पुनर्भरित जल लगभग 83,000 लीटर
- 20 वर्षों में पुनर्भरित जल लगभग 16,64,000 लीटर
- पुनर्भरित जल की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



चित्र–3 भवन छत क्षेत्रफल 200 से 300 वर्गमीटर तक

निर्माण किये जाने वाले मुख्य भाग एवं डिज़ाईन

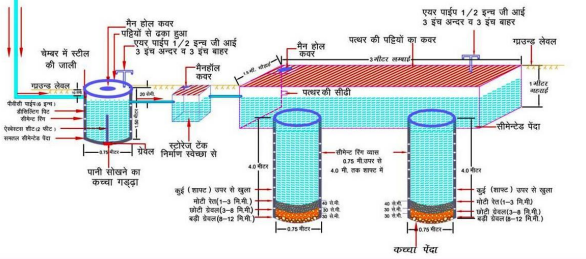
- PVC पाईप 4"– 6" व्यास
- सीमेन्ट रिंग से निर्मित डीसिल्टिंग पिट (0.75 मी.व्यास x 1.25 मी.गहरा)
- रीचार्ज टेंक 1.5 मी.चौड़ा x 2 मी.लम्बा x 1 मी.गहरा
- सीमेन्ट रिंग से निर्मित शाफ्ट (0.75 मी.व्यास x 4 मी.गहरी)
- संरचना की अनुमानित लाग़त रु 15,000–16,000
- वार्षिक पुनर्भरित जल लगभग 1,25,000 लीटर
- 20 वर्षों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



चित्र–4 भवन छत क्षेत्रफल 300 से 500 वर्गमीटर तक

निर्माण किये जाने वाले मुख्य भाग एवं डिज़ाईन

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



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Myths and Facts about Ground Water

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

ROLTA

Rolta India Limited

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

www.rolta.com