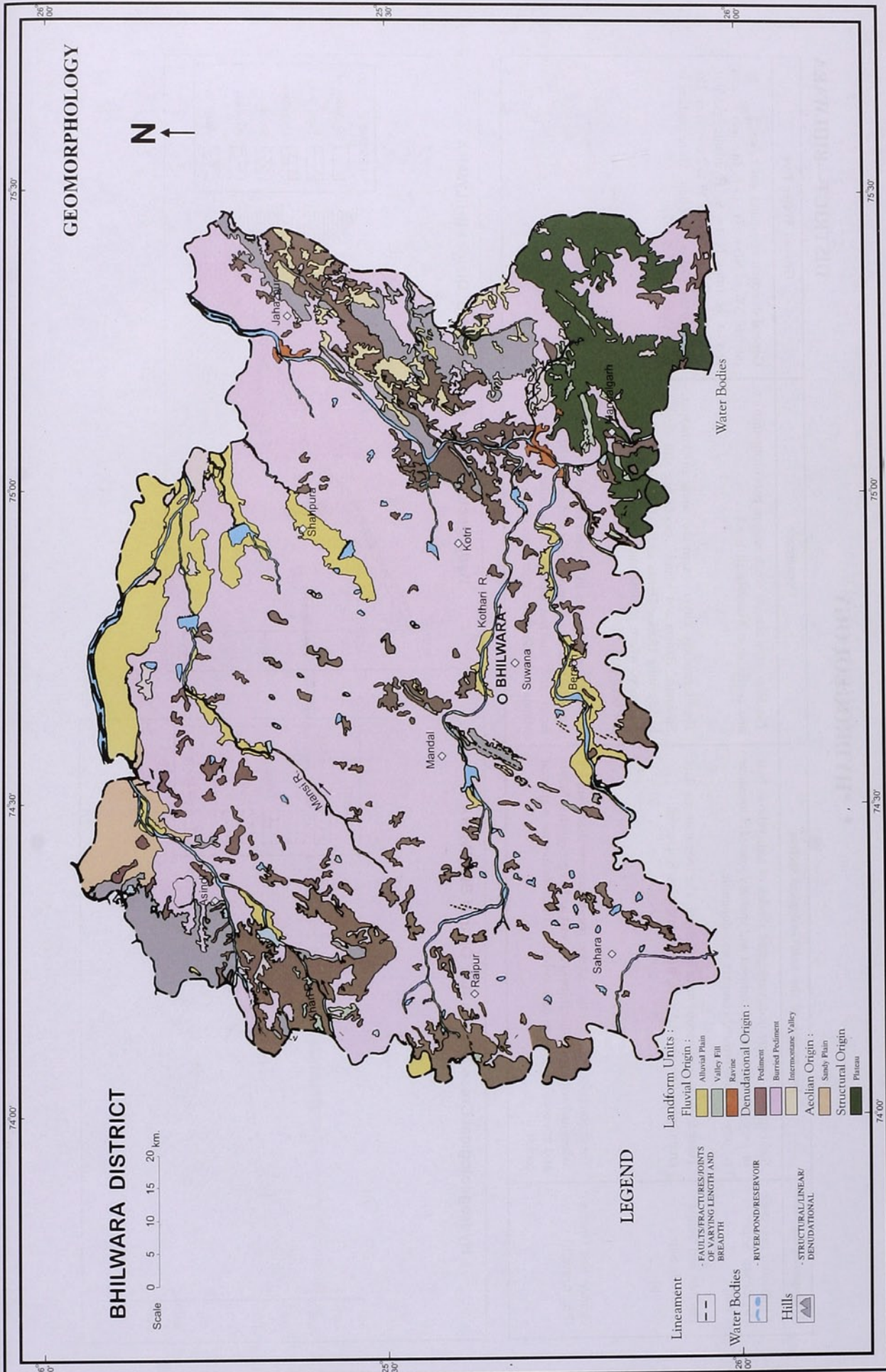


GEOMORPHOLOGY

DISTRICT—BHILWARA

Landform Units	Symbol	Lithology / Material / Description	Occurrence in district	Land use/Land cover
Fluvial Origin Alluvial Plain	AP	Mainly undulating land scape formed due to fluvial activity, consisting of gravels, sand, silt and clay. Terrain mainly undulating, produced by extensive deposition of alluvium by river system.	Along rivers-Khari, Mausai, Banas, Kothari and near Umed Sagar dam.	Double crop, single crop (Rabi / Kharif), fallow, open scrub.
Valley Fill	VF	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.	Small scattered patches in east and west.	Marginal double crop, single crop (Rabi).
Ravine	RV	Small, narrow, deep, depression, smaller than gorge, larger than gully, usually carved by running water.	Along river Berach in south.	Open scrub.
Denudational Origin Pediment	P	Broad gently sloping rock flooring, erosional surface of low relief between hill and plain, comprised of varied lithology, criss crossed by fractures & faults.	Scattered in entire district main concentration in east and west of district.	Single crop (Kharif), fallow, open scrub.
Burried Pediment	BP	Pediment covered essentially with relatively thicker alluvial, colluvial or weathered materials.	Almost entire district except (less concentration) in east, south, east and north.	Marginal double crop, single crop (Kharif), fallow, open scrub.
Intermontane Valley	IV	Depression between mountains, generally broad & linear, filled with colluvial deposit.	Scattered in east and south west.	Marginal double crop, single crop (Rabi / Kharif).
Aeolian Origin Sandy Plain	SP	Formed of aeolian activity, wind blown sand with gentle sloping to undulating plain, comprising of coarse sand, fine sand, silt & clay.	In north of district.	Marginal double crop, single crop (Kharif), open scrub.
Structural Origin Plateau	PT	Formed over varying lithology with extensive, flat, landscapes, bordered by escarpment on all sides. Essentially formed over horizontally layered rocky marked by extensive flat top and steep slopes. It may be criss crossed by lineament.	In south east.	Single crop (Kharif), open scrub.
Hills Linear Ridge	LR	Long narrow low-lying ridge usually barren having high run off, mayform over varying lithology with controlled strike.	Near Jahazpur town.	Barren, land with or without scrub, forest land.
Structural Hill	SH	Linear to arcuate hills showing definite trend-lines with varying lithology associated with folding, faulting etc.	In north west & eastern part of district, also north and north west of Bhilwara town.	Barren, land with or without scrub.

GEOMORPHOLOGY



BHILWARA DISTRICT

Scale 0 5 10 15 20 km.

LEGEND

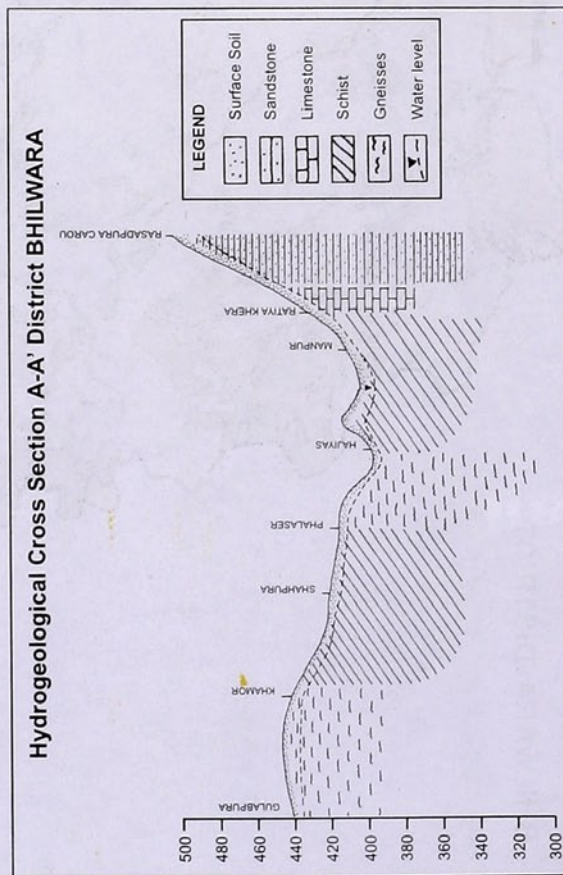
- Lineament**
 - FAULTS/FRACTURES/JOINTS OF VARYING LENGTH AND BREADTH
 - Water Bodies**
 - RIVER/POND/RESERVOIR
 - Hills**
 - STRUCTURAL/LINEAR/DENUDATIONAL
- Landform Units :**
- Fluvial Origin :**
 - Alluvial Plain
 - Valley Fill
 - Ravine
 - Denudational Origin :**
 - Pediment
 - Burned Pediment
 - Intermontane Valley
 - Aeolian Origin :**
 - Sandy Plain
 - Structural Origin**
 - Plateau

HYDROGEOLOGY

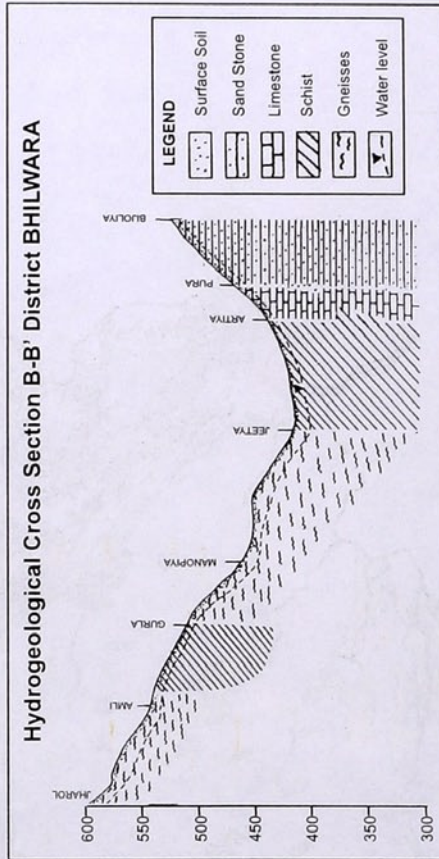
DISTRICT—BHILWARA

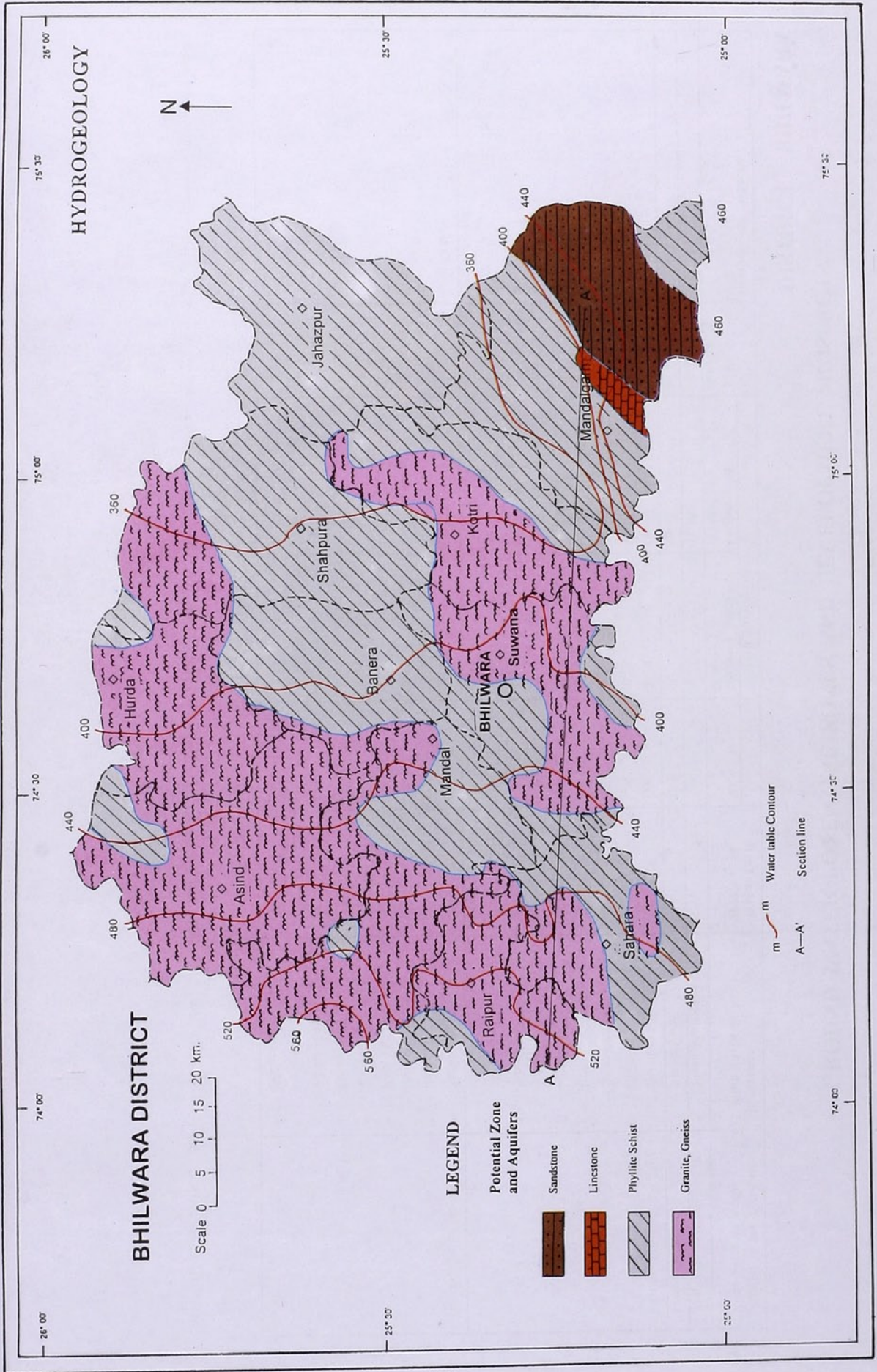
Hydrogeological units	Description of the unit/Geological section	Occurrence	Ground Water flow
Sandstone, limestone (Vindhyan Super Group)	Sandstone is fine grained, variegated shades of red, yellow, buff or grey colours, hard and compact and sparsely jointed. Limestone is grey to light brown, compact and dolamitic.	The litho units occupy south eastern part of the district and confined to Mandalgarh block.	General direction of ground water flow has been inferred SW to NE or W to E. In south eastern part it is from N to S. Hydraulic gradient generally ranges between 2.58 to 2.66 m/km. The south eastern part is exception, where gradient is more steep, i.e., 5.8 m/km.
Phyllite and Schist (Aravalli Super Group)	These include argillaceous meta sediments. The formation are dark green, grey fine grained soft, friable and closely cleaved.	The formation cover extensive area in Jahazpur, Shahpura, Banera and Mandal blocks are also spreads in adjoining blocks. Hurda and Asind blocks are only in exception, where phyllite and schists formations have not been noticed.	
Granite and Gneiss (Pre Aravalli)	These comprises porphyritic and non porphyritic gneissic complex associated with aplite amphibolite schist and augen gneiss. Schist and gneisses are grey to dark coloured, medium to coarse grained rocks.	The litho units spreads in western half of the district in Hurda, Asind and Raipur blocks and in Central part of Kotri and Suwana blocks. A localised pocket in Mandalgarh block has also been delineated.	

Hydrogeological Cross Section A-A' District BHILWARA



Hydrogeological Cross Section B-B' District BHILWARA



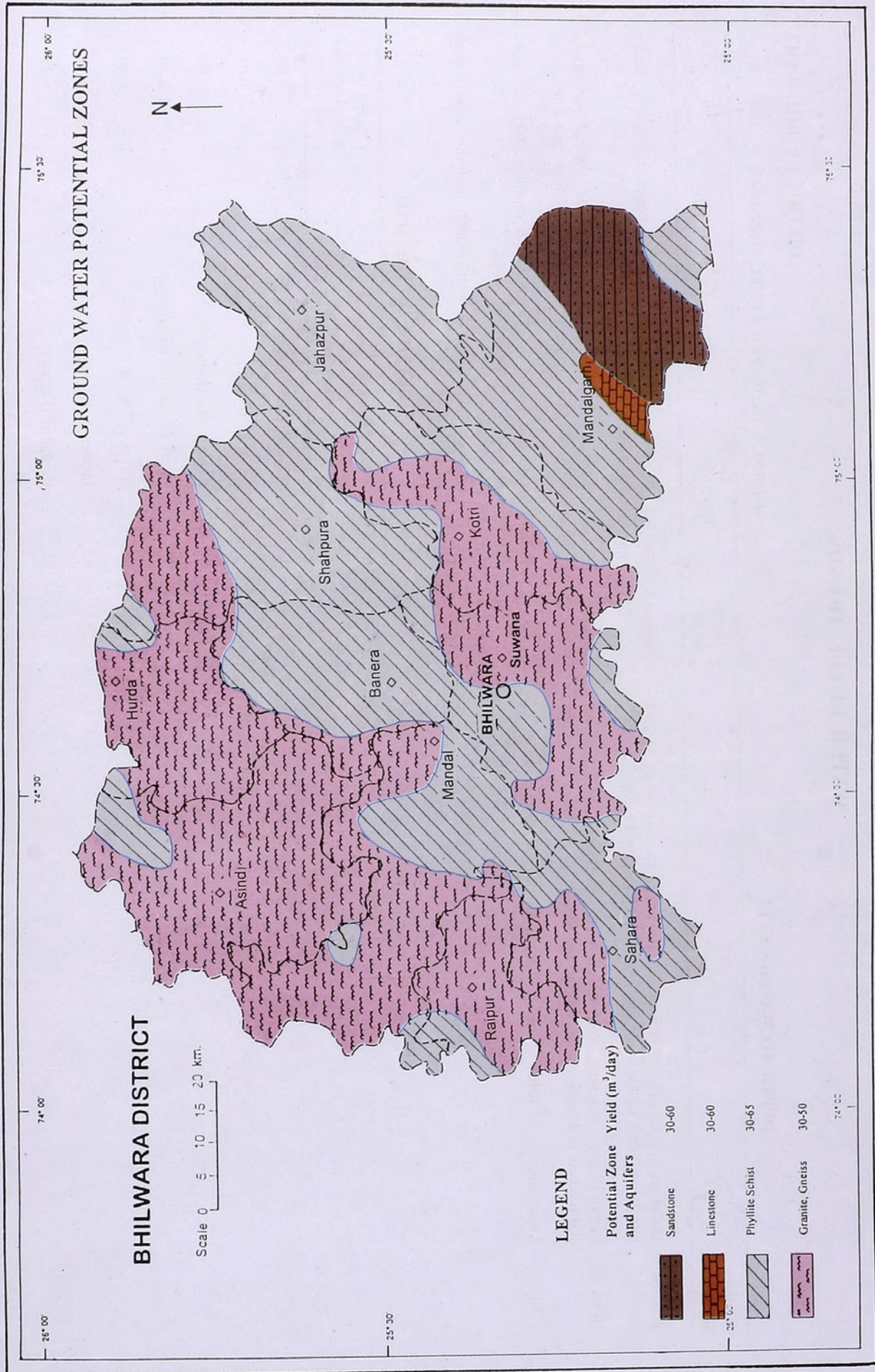


GROUND WATER POTENTIAL ZONES AND DEVELOPMENT PROSPECTS

DISTRICT - BHILWARA

Aquifer in the Potential Zone (Area in Km ²)	Occurrence * Block (Area in Km ²)	Water Level (1997) in m.	Well Parameters		E.C. X10 ³ µ siem/cm	Development Prospects	
			Type	Proposed depth in m			
Sandstone (428.76)	* Mandalgarh (428.76)	<20	DW	20-25	<4	Safe	
Limestone (60.66)	* Mandalgarh (60.66)	<10	DW	20-25	<4	Safe	
Phyllite & Schist (4325.80)	* Asind (127.96)	<15	DW	20-25	55-65	Semi Critical	
	* Banera (538.96)	<20	DW	20-25	50-60	Semi Critical	
	* Jahazpur (865.87)	<20	DW	20-25	50-60	Semi Critical	
	* Kotri (345.46)	<20	DW	20-25	50-60	Safe	
	* Mandal (431.59)	<20	DW	20-25	50-60	Over exploited	
	* Mandalgarh (543.31)	<15	DW	20-25	50-60	Semi Critical	
	* Sahara (353.21)	<15	DW	20-25	50-60	Safe	
	* Shahpura (816.84)	<15	DW	20-25	45-50	Safe	
	* Suwana (298.60)	<25	DW	20-25	45-55	Over exploited	
	Granite Gneiss (4543.63)	* Asind (862.50)	<20	DW	20-25	45-55	Semi Critical
		* Banera (123.62)	<20	DW	20-25	45-55	Safe
		* Hurda (612.76)	<20	DW	20-25	45-55	Safe
		* Kotri (552.85)	<15	DW	20-25	45-55	Safe
* Mandal (724.36)		<15	DW	20-25	45-50	Safe	
* Raipur (486.36)		<20	DW	20-25	40-55	Semi Critical	
* Sahara (281.48)		<10	DW	20-25	40-55	Safe	
* Shahpura (308.29)		<20	DW	20-25	40-55	Safe	
* Suwana (591.41)		<25	DW	20-25	40-50	Semi Critical	

TW - Tube wells DCB - Dug cum borewells DW - Dug wells Safe - <65% stage of development Semi Critical - 65-85% development Critical - 85-100% development Over exploited - >100% development



WATER LEVEL TRENDS

DISTRICT : BHILWARA

DEPTH TO WATER LEVEL

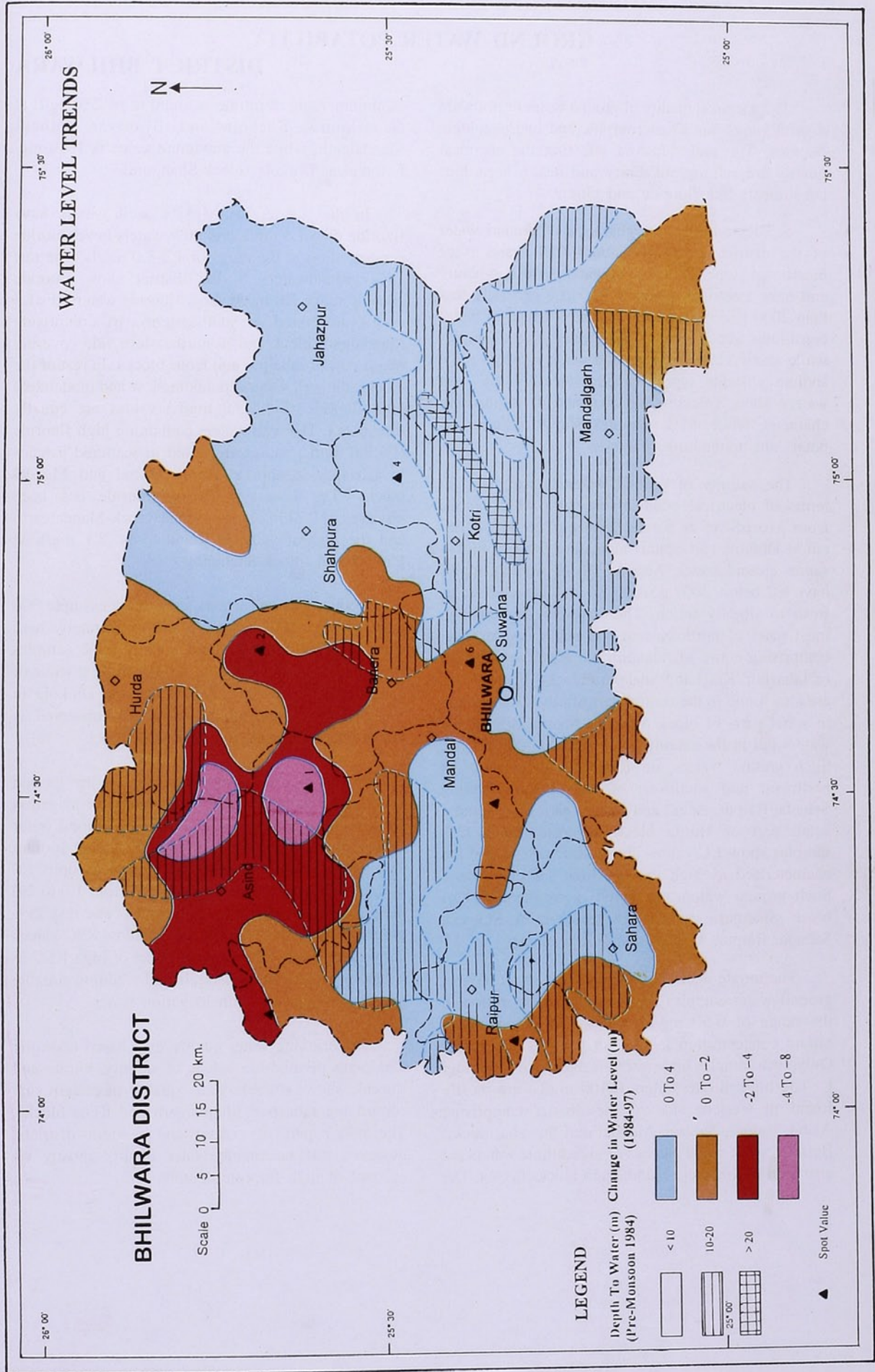
Range in m	Area
0 to 10	Major part of Jahajpur, Shahpura and Mandal blocks and small pockets located in other blocks have shallow water level ranging upto 10 m.
10 to 20	Part of Kotri, Mandalgarh, Suwana and Banera blocks in southeastern part and pockets in Hurda, Asind, Raipur and Sahara blocks lie in the range.
> 20	Area southeast of Kotri has deep water level ranging more than 20 m.

CHANGE IN WATER LEVEL (1984-1997)

Range in m	Area
0 to 4	Eastern half of the district and in western part enclosing Raipur, Sahara and Mandal show rise in water level within the range.
0 to -2	Small area located in western part around Hurda, Mandal, Sahara and Raipur exhibit marginal depletion in water level less than 2 m.
-2 to -4	Part of Asind and Hurda blocks situated in north-western part show depletion in water level within the range.
-4 to -8	Two small pockets situated east of Asind exhibit steep depletion in water level within the range.

DETAILS OF THE SPOT

Spot code	Village (Block)	Change in water level in m (1984-97)
1.	Haziyas (Hurda)	(-) 8.00
2.	Kasoria (Banera)	(-) 9.05
3.	Kochriya (Suwana)	(-) 11.90
4.	Sareri Bhramana Ki (Asind)	(-) 8.00
5.	Shivpura Thana (Mandal)	(-) 6.50
6.	Taswariya (Suwana)	(-) 8.70
7.	Toongarh (Raipur)	(-) 6.25



GROUND WATER POTABILITY

DISTRICT BHILWARA

The chemical quality of ground water in Bhilwara district varies due to geomorphic and hydrogeologic features. The major factors affecting the chemical quality are salinity, alkalinity and health hazardous constituents like fluoride and nitrate.

Studies on chemical character of ground water of the district reveal that about 40% water is of bicarbonate type. This type of water is fresh in nature and have electrical conductivity (EC) generally less than 2000 $\mu\text{S}/\text{cm}$ at 25°C. The mixed type of water constitutes about 29% of the ground water samples while about 31% of the ground water samples show sodium chloride type character. Nearly 39% well waters show calcium and magnesium dominating character while 61% samples show sodium and potassium dominating character.

The salinity of ground water is expressed in terms of electrical conductivity (EC) which varies from 310 $\mu\text{S}/\text{cm}$ at Sarsia (Jahazpur) to 11200 $\mu\text{S}/\text{cm}$ at Dhikola (Shahpura) indicating fresh to highly saline ground water. About 67% of water samples have EC below 2000 $\mu\text{S}/\text{cm}$ and are characterised as fresh to slightly saline. These waters are found in most parts of north eastern and south eastern side, comprising entire Mandalgarh block and major parts of Jahazpur, Kotri and Shahpura blocks. Such waters are also found in the central part of block Banera and in some parts of block Suwana. Nearly 20% of the waters fall in the salinity level of 2000-4000 $\mu\text{S}/\text{cm}$. Such ground waters are found in major parts of northwest and southwest of the district covering Sahada, Raipur, Asind and Mandalgarh blocks and a small part of Hurda block in north. Only 13% samples show EC values above 4000 $\mu\text{S}/\text{cm}$ and are characterised as high to vary high salinity waters. Such ground waters are found in southern part of block Shahpura and a few patches in Suwana, Sahada, Raipur, Mandal and Hurda blocks.

The nitrate distribution shows that about 65% of ground water samples have nitrate concentration in the range of 0-50 mg/L, while, 16% waters have nitrate concentration in the range of 51-100 mg/L. Only 19% samples have nitrate values above 100 mg/L. The high nitrate waters (>100 mg/L) are mostly found in western side of the district comprising Asind, Raipur, Sahada, Mandal and Suwana blocks. Besides, some small patches of high nitrate waters are also seen in Kotri and Mandalgarh blocks in east. The

minimum value of nitrate is found to be 2.0 mg/L at Ganeshpura, Kachola and Bijolijan (block-Mandalgarh) while the maximum value is 1010 mg/L found at Dhikola (block-Shahpura).

In the district nearly 57% well waters have fluoride upto 1.5 mg/L and 30% waters have fluoride concentration in the range of 1.5-3.0 mg/L. The rest 13% groundwaters in the district show fluoride content above 3.0 mg/L. Low fluoride waters ($F < 1.5$ mg/L) are found in southeastern part comprising Mandalgarh block and in northeastern side covering major part of Jahazpur and Kotri blocks. In rest of the blocks, the well waters containing low and moderately high fluoride (F -1.5-3.0 mg/L) values are equally distributed. The well waters containing high fluoride ($F > 3.0$ mg/L) values are found in scattered patches in Jahazpur, Shahpura, Hurda, Asind and Mandal blocks. The lowest value of fluoride has been observed as 0.23 mg/L at Resunda (block-Mandalgarh) and the highest value is found to be 8.1 mg/L at Phuliakhurd (block-Shahpura).

About 52% well waters show hardness upto 300 mg/L while 31% waters show moderately hard character (TH 300-600 mg/L). Only 17% samples show hardness above 600 mg/L. The highest value of hardness is found to be 2775 mg/L at Dhikola in Shahpura block and minimum value is observed as 105 mg/L at Taswariya in Jahazpur block.

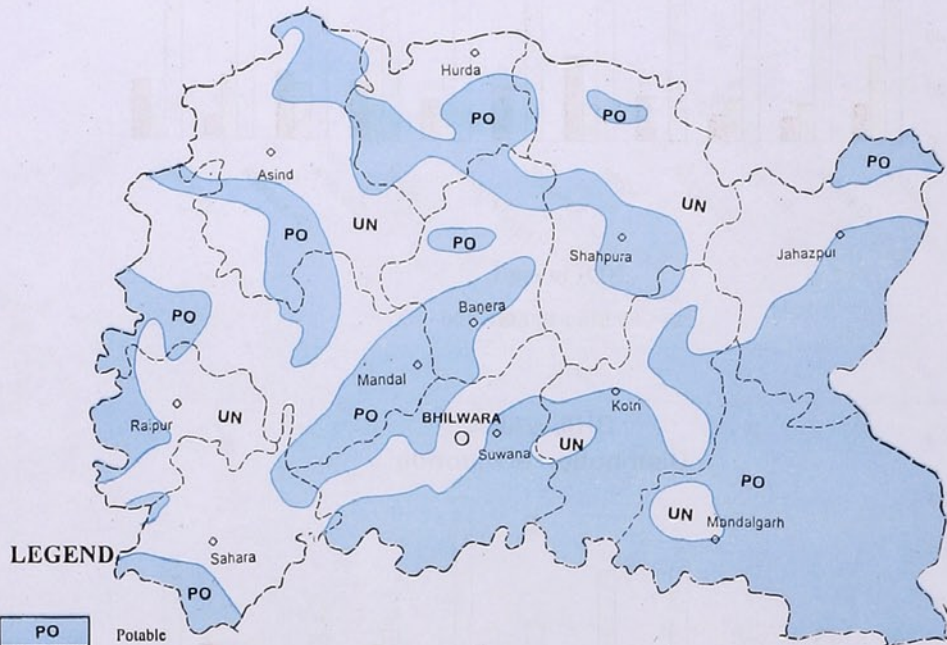
Owing to low to medium salinity, the ground water in the district is of suitable quality for irrigation purpose. However, at some places, the ground water shows alkalinity hazard in terms of residual sodium carbonate (RSC). Its values are found as upto 1.0 meq/L in 67% of the well waters and from 1.0 to 2.0 meq/L in about 8% of water samples. The rest 25% ground water samples in the district show RSC values above 2.0 meq/L. The adverse effect of high RSC in irrigation water can be neutralised by adding suitable quantity of gypsum with irrigation water.

The drinking water quality map based upon the maximum permissible values of salinity, nitrate and fluoride shows suitable water quality in eastern side comprising Jahazpur, Mandalgarh and Kotri blocks. The major part of central and western districts, however, has unsuitable water quality mostly on account of high fluoride content.

GROUND WATER POTABILITY

BHILWARA DISTRICT

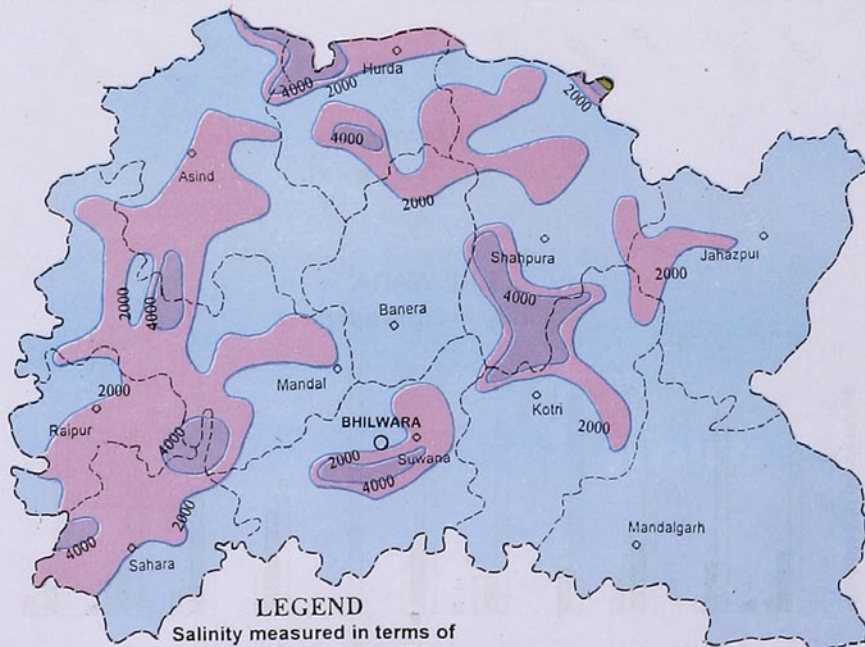
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LEGEND

- PO Potable
- UN Unpotable

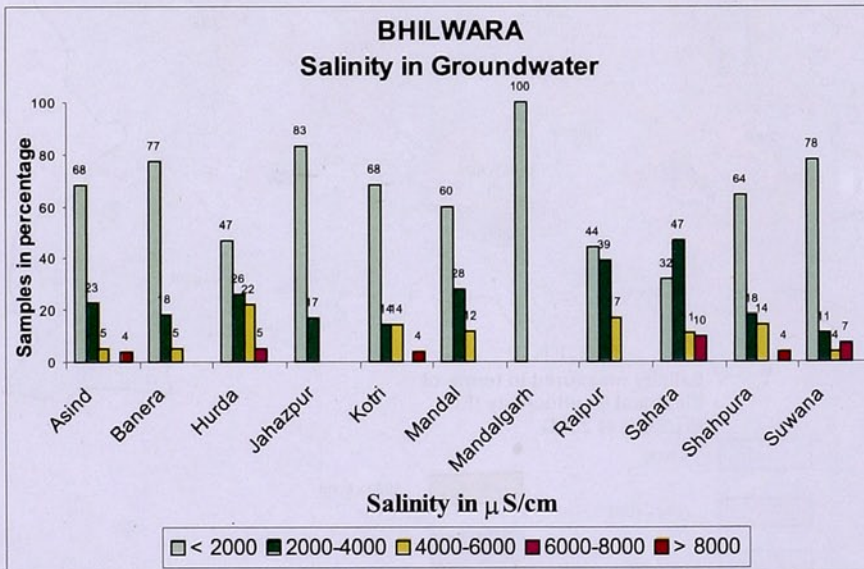
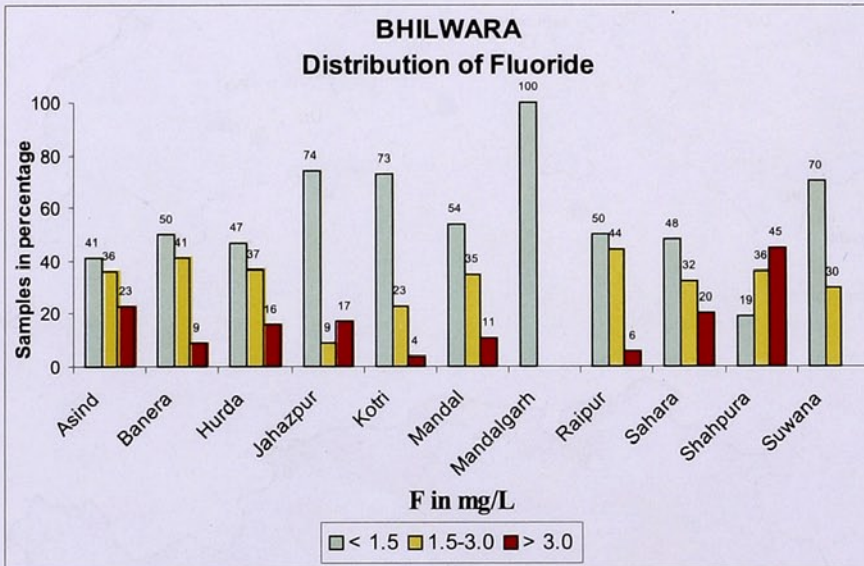
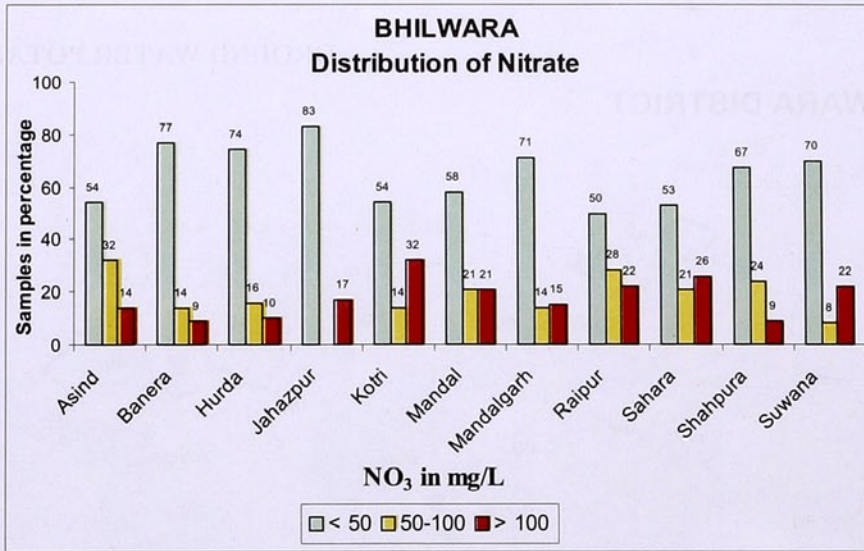
SALINITY



LEGEND

Salinity measured in terms of Electrical Conductivity (EC) in $\mu\text{S}/\text{cm}$ at 25°C

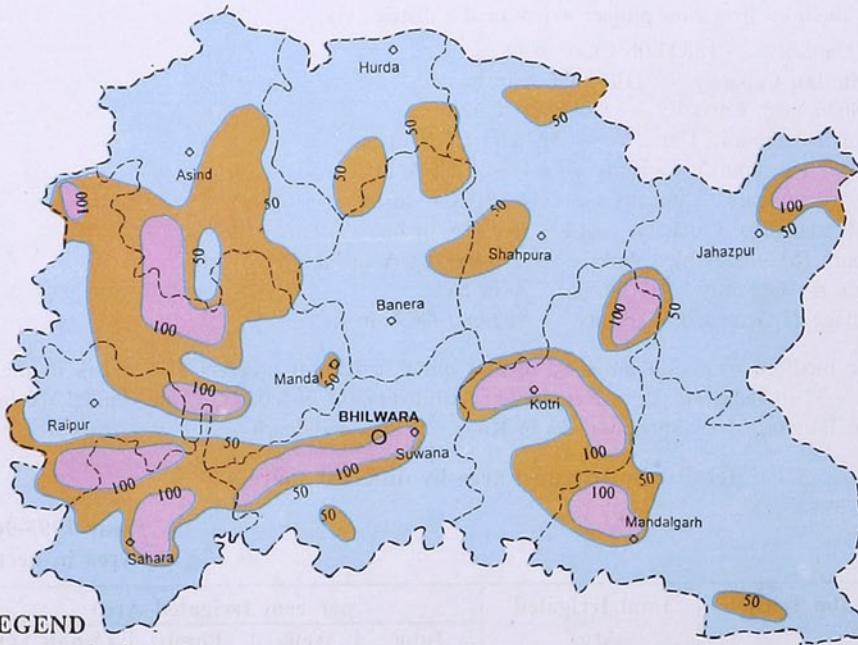
- < 2000
- 2000 - 4000
- 4000 - 6000
- 6000 - 8000
- > 8000



BHILWARA DISTRICT

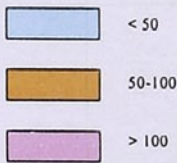
NITRATE DISTRIBUTION

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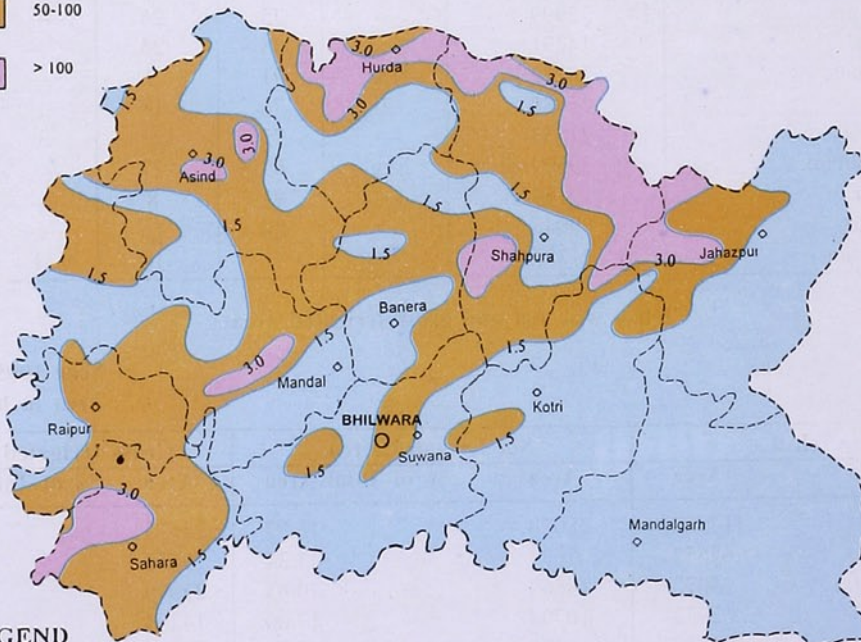


LEGEND

Nitrate Concentration in mg/L



FLUORIDE DISTRIBUTION



LEGEND

Fluoride Concentration in mg/L

