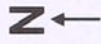


GEOMORPHOLOGY

DISTRICT—JHALAWAR

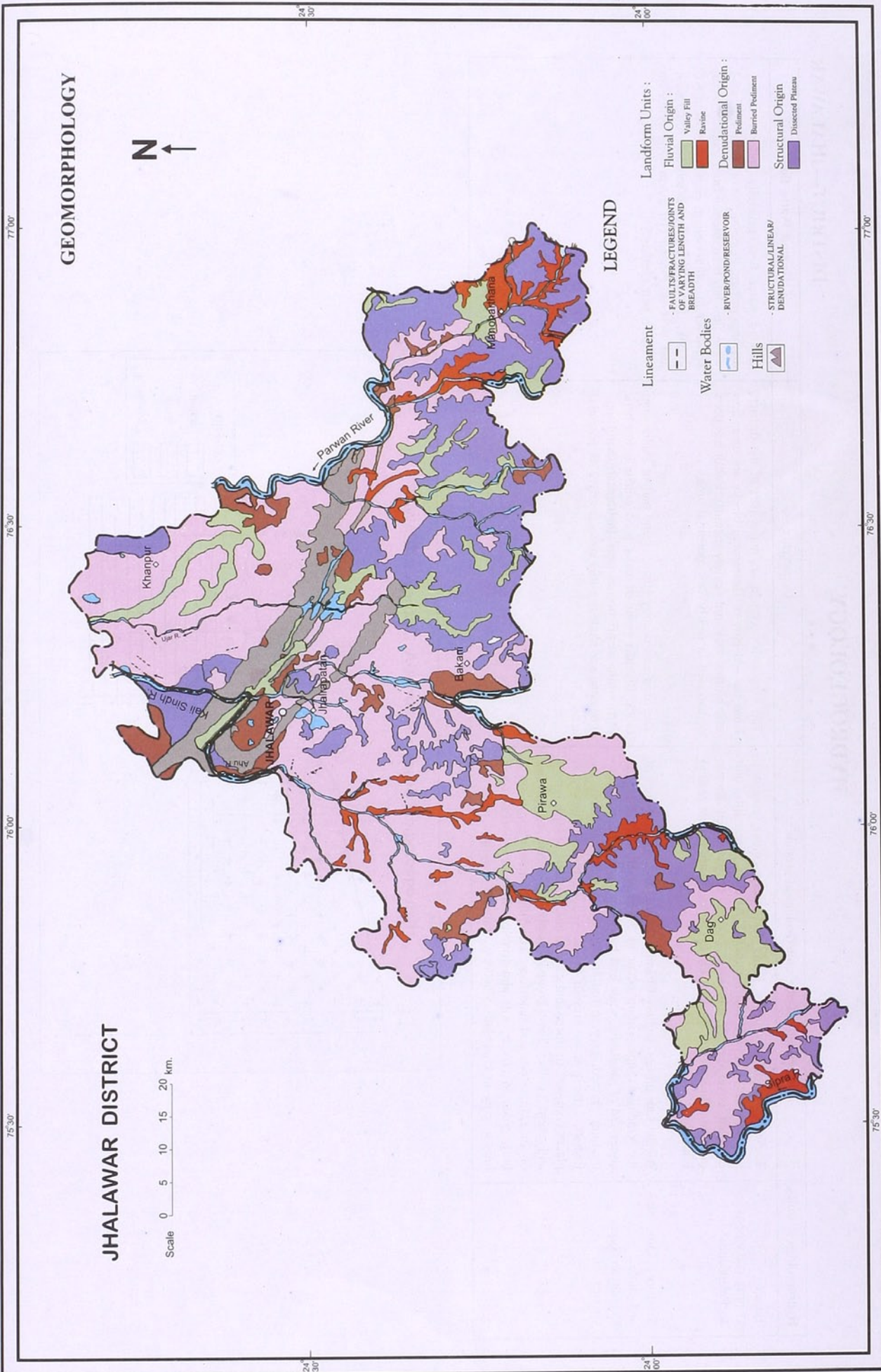
Landform Units	Symbol	Lithology / Material / Description	Occurrence in districts	Land use/Land cover
Fluvial Origin Valley Fill	VF	Formed by fluvial activity, usually at lower topographic locations, comprising of boulders, cobbles, pebbles, gravels, sand, silt and clay. The unit has consolidated sediment deposits.	Scattered in entire district, more concentrated in south west & central.	Dominated by Rabi crop, marginal Kharif.
Ravine	RV	Small, narrow, deep, depression, smaller than gorges, larger than gulley, usually carved by running water.	Along rivers Parwan, Ahu, Kalisindh and their tributaries.	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.	In small patches, mainly in west, north east and central part.	Marginal Kharif crop, fallow, open scrub.
Burried Pediment	BP	Pediment covered essentially with relatively thicker alluvial, colluvial or weathered materials.	Mainly concentrated in northern, central, western and south west.	Marginal double crop, single crop (Rabi / Kharif), fallow, open scrub.
Structural Origin Dissected Plateau	DP	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. Plateau, criss-crossed by fractures forming deep valleys.	Scattered in central & prominent in south west. In central and eastern part.	Marginal single crop, land with or without scrub. Single crop, fallow, land with or without scrub.
Hill Structural Hill	SH	Linear to arcuate hills showing definite trend-lines with varying lithology associated with folding, faulting etc.	In central part.	Forest and mining activities.

GEOMORPHOLOGY



JHALAWAR DISTRICT

Scale 0 5 10 15 20 km.



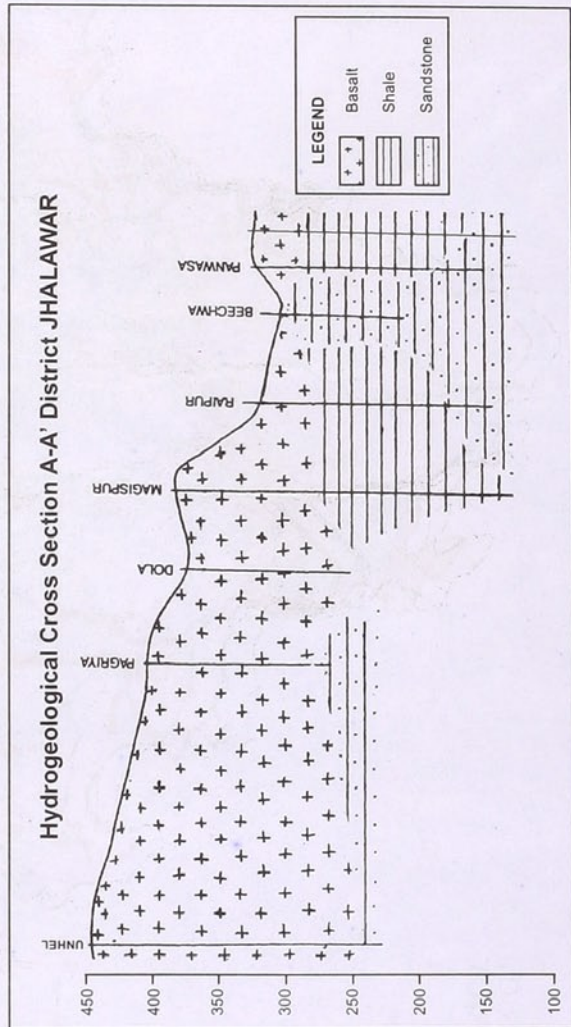
LEGEND

- | | |
|---------------------|---|
| Lineament | - FAULTS/FRACTURES/JOINTS OF VARYING LENGTH AND BREADTH |
| Water Bodies | - RIVER/POND/RESERVOIR |
| Hills | - STRUCTURAL/LINEAR/DENUDATIONAL |
-
- | | |
|------------------------------|------------------------------|
| Landform Units : | Fluvial Origin : |
| Valley Fill | Valley Fill |
| Ravine | Ravine |
| Denudational Origin : | Denudational Origin : |
| Pediment | Pediment |
| Barren Pediment | Barren Pediment |
| Structural Origin | Structural Origin |
| Dissected Plateau | Dissected Plateau |

HYDROGEOLOGY

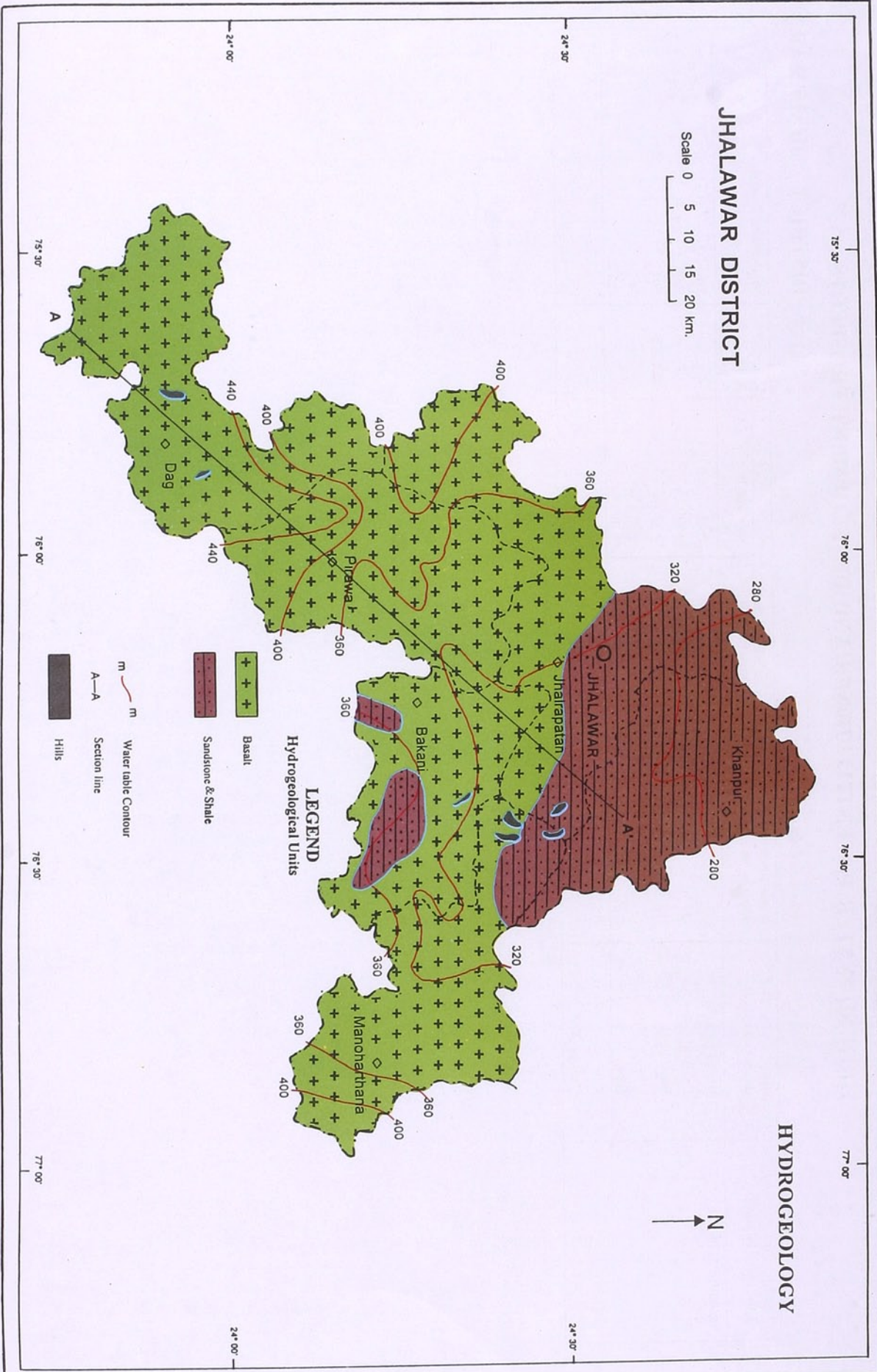
DISTRICT—JHALAWAR

Hydrogeological units	Description of the unit/Geological section	Occurrence	Ground Water flow
Basalt (Upper cretaceous to Paleocene)	These are dark grey, olive green and green colour, compact, vesicular, amygdaloidal and weathered. At most places litho unit is either covered with thin layer of soil or weathered laterite material. Thickness of the unit increases southward except around Bakani.	The litho unit encompasses major part of the district. Khanpur and part of Jhalrapatan blocks are exception where other rock unit occupy the area. Basalt has been demarcated in nearly 78% potential area.	Ground water flow generally follows surface drainage pattern. In major part of the area, ground water flow has been inferred from south to north. However in south western corner it is from NE to SW. Hydraulic gradient is more in south west and west of Pirawa (10 m/km) and gentle in northern part (3m/km.)
Sandstone, Limestone and shale (Vindhyan Super Group)	All the four groups, namely Bhandar, Rewa, Kaimur and Semri of the Vindhyan Super Group occur in the area. Bhandar group is composed of sandstone, shale and limestone. Sandstone is fine to medium grained, grey to red in colour, compact and profusely jointed. Limestone is greyish black, yellow, reddish brown, at places compact, fractured and cavernous. Shale is reddish brown and greenish colour. Semri group is mainly argillaceous, comprising of shale, limestone and sandstone. The Suket shale is purple grey, buff, green in colour, soft and friable. Nimbahera limestone is brown, grey to chocolate, siliceous, compact and hard.	The litho unit occupy Khanpur and part of Jhalrapatan block. Bhandar group of rocks, predominate in northern part, while Semri occurs near Jhalrapatan. Sandstone limestone and shale together cover nearly 22% potential area.	



JHALAWAR DISTRICT

Scale 0 5 10 15 20 Km.



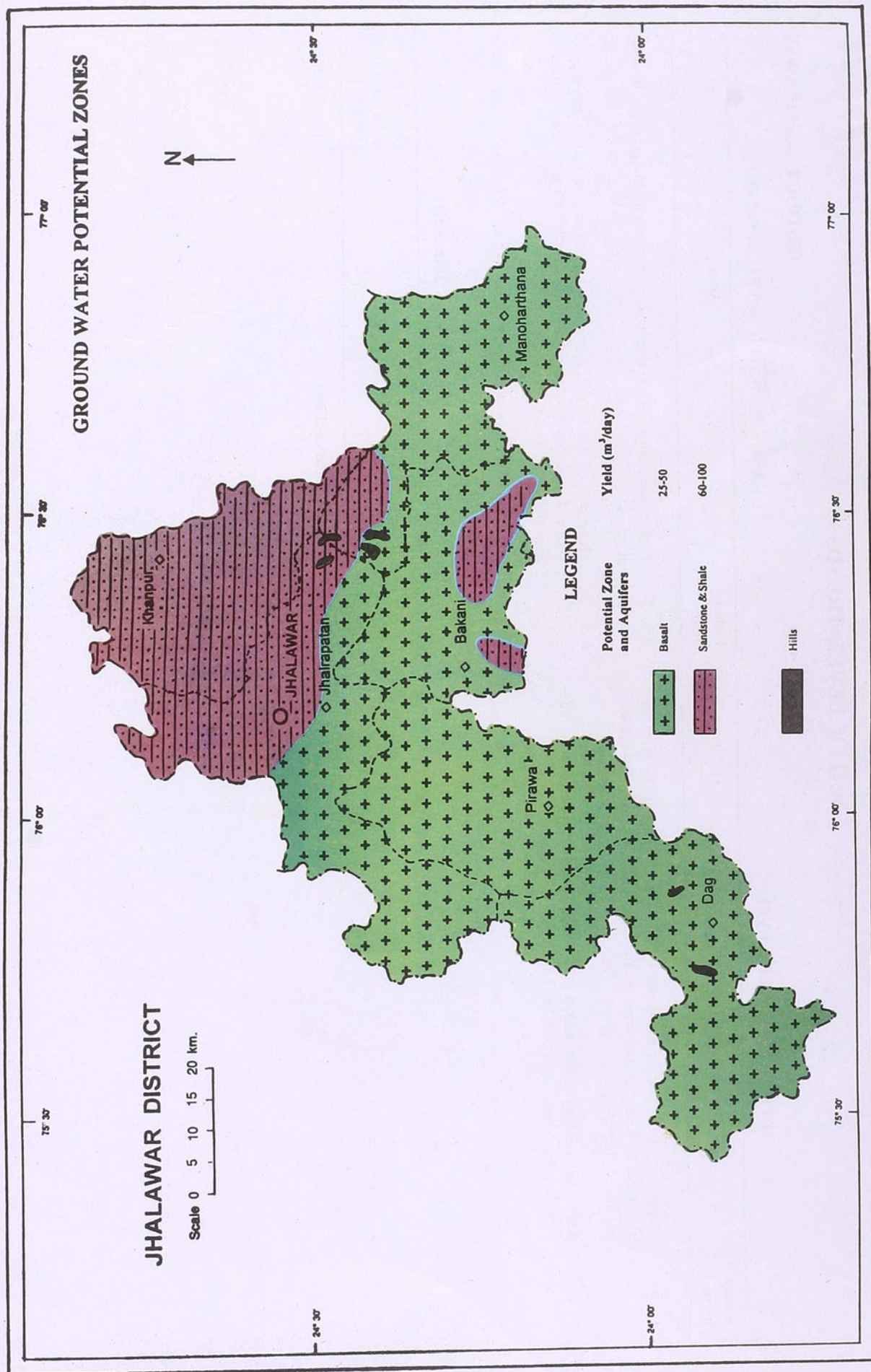
HYDROGEOLOGY

GROUND WATER POTENTIAL ZONES AND DEVELOPMENT PROSPECTS

DISTRICT - JHALAWAR

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 ⁻⁶ siem/cm	Development Prospects
			Type	Proposed depth in m		
Basalt (4732.08)	* Bakani (865.98)	<15	DW	20-25	<2	Safe
	* Dag (1087.00)	<20	DW	30-40	<2	Safe
	* Jhalarpatan (858.44)	<15	DW	25-40	<2	Safe
	* Manohar Thana (919.97)	<20	DW	30-40	<2	Safe
	* Pirawa (1000.60)	<20	DW	30-40	<2	Safe
	* Jhalarpatan (441.18)	<15	TW/DW	70-80/25-40	<2	Semi Critical
Sandstone (1374.08)	* Khanpur (952.90)	<20	TW/DW	70-80/30-40	<2	Semi Critical

TW - Tube wells 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 : JHALAWAR

DEPTH TO WATER LEVEL

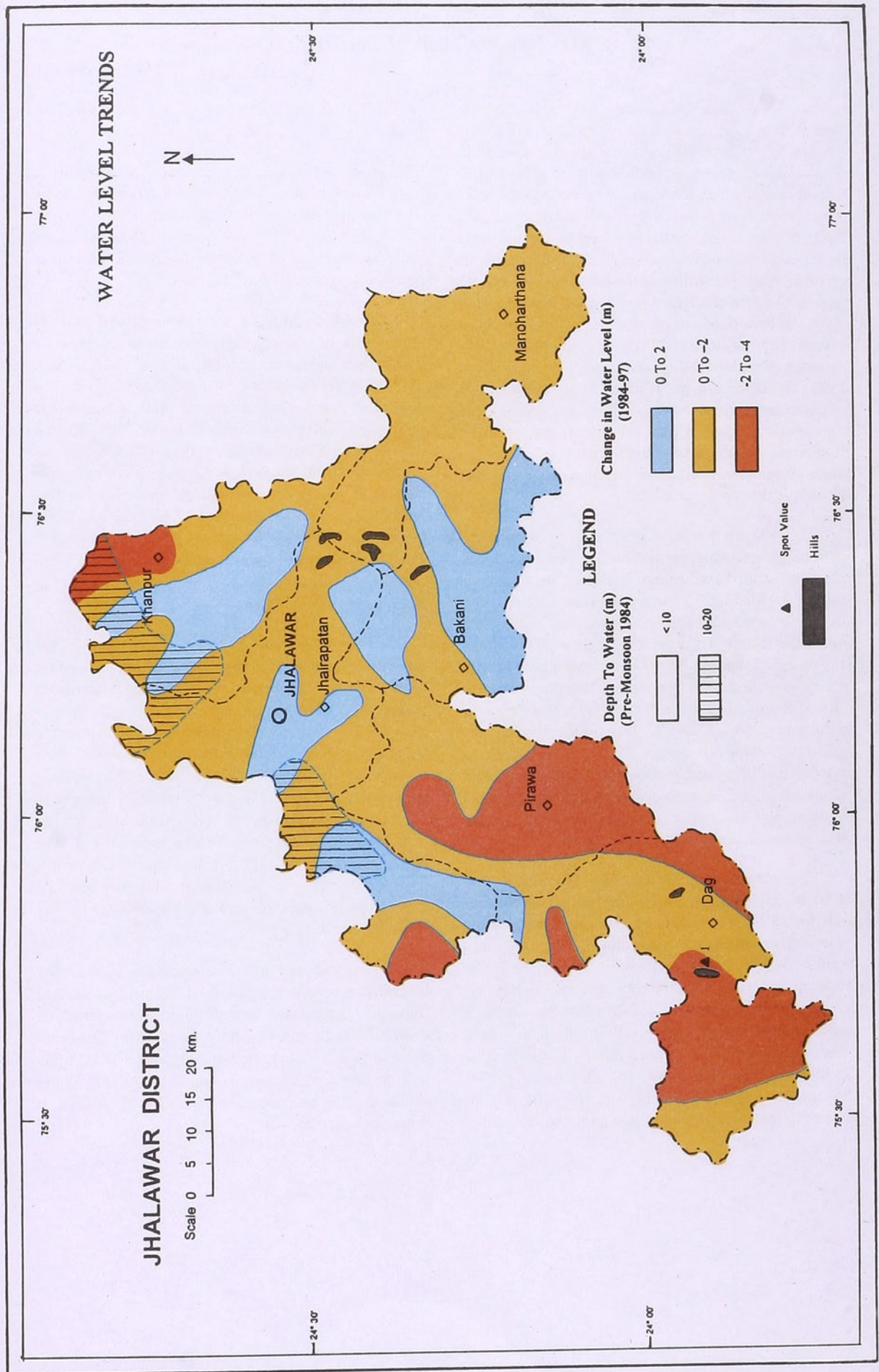
Range in m	Area
< 10	Major part of the district has depth to water level less than 10 m. Area northwest of Khanpur and west of Jhalrapatan are exception which do not lie in the range.
10 to 20	Area west of Jhalrapatan and northwest of Khanpur situated near the boundary has depth to water level between the range.

CHANGE IN WATER LEVEL (1984-1997)

Range in m	Area
0 to 2	Pockets situated in central and western part exhibit marginal rise in water level.
0 to -2	Major part of the district, leaving aside area around Pirawa and west of Dag and several pockets located in central part, show marginal depletion in water level within the range.
-2 to -4	Area around Pirawa and west of Dag exhibit depletion in water level between the range.

DETAILS OF THE SPOT

Spot code	Village (Block)	Change in water level in m (1984-97)
1.	Bharka (Dag)	(-) 9.30



GROUND WATER POTABILITY

DISTRICT JHALAWAR

The ground water in the district is fresh in nature. The electrical conductivity (EC) of water is usually less than 1500 $\mu\text{S}/\text{cm}$ which corresponds to total dissolved solids (TDS) less than 1000 mg/L. Geo-chemically the ground water is mostly bicarbonate type. 79 per cent well waters in the district have this type of chemical character followed by mixed anion type (14%) and chloride type (7%). The salinity of ground water gradually increases from bicarbonate type of water to chloride type of water. It is seen that while the bicarbonate type of water is fresh in nature having EC less than 1500 $\mu\text{S}/\text{cm}$, the chloride type of water is usually saline and have EC ranging from 1500 to 8300 $\mu\text{S}/\text{cm}$. The alkaline earth metal calcium and magnesium are the main constituents among the cations in low salinity waters but their dominance is subdued by alkali metal sodium as the water acquires chloride type of character and gains in salinity.

The salinity map clearly reveals the occurrence of fresh ground water in the district. Barring a saline stripe in south east around Harispura and Jhirniya villages of Jhalawar block and a isolated small patch of saline water around Garnawad in Jhalrapatan block, the salinity of water is less than 4000 $\mu\text{S}/\text{cm}$. It is observed that out of 167 water samples, 146 well waters have electrical conductivity less than 1500 $\mu\text{S}/\text{cm}$. The lowest value of salinity is observed at Reechawa (260 $\mu\text{S}/\text{cm}$) in Dag block whereas its maximum value is observed as 8300 $\mu\text{S}/\text{cm}$ at Jhirniya in Jhalrapatan block. It is also observed that waters having EC more than 4000 $\mu\text{S}/\text{cm}$ are localised in nature and occur only as small pockets in east and west of the district.

The ground water in the district is mostly free of toxic and health hazardous constituents like nitrate and fluoride. 83%, 10% and 7% well waters in the district have nitrate concentration in the range 0-50 mg/L, 51-100 mg/L and more than 100 mg/L respectively. High concentration of nitrate (>100 mg/L) is mainly caused by local pollution which is evinced by relatively higher salinity of such waters. The maximum nitrate concentration is observed at Dehikhara in Khanpur block (EC-3200 $\mu\text{S}/\text{cm}$, NO₃-397 mg/L) followed by Kalikhara (EC-2500 $\mu\text{S}/\text{cm}$, NO₃-282 mg/L) in Pirawa block and Anawali kalkan

(EC 1560 $\mu\text{S}/\text{cm}$, NO₃-214 mg/L) in Jhalrapatan block.

Above 99 per cent well waters in the district have fluoride content less than 1.5 mg/L which shows that the ground water in the district is free from fluoride problem. Only at Golana in Khanpur block the concentration of fluoride in ground water has been observed as 1.6 mg/L.

Notwithstanding the dominance of calcium and magnesium in ground water, the hardness of water varies from as low as 59 mg/L as CaCO₃ to as high as 1420 mg/L as CaCO₃. 59.3, 33.5 and 7.2 per cent ground waters in the district have total hardness value in the concentration range of 0-300, 300-600 and more than 600 mg/L respectively as CaCO₃. Only at 12 places the hardness in water was observed above 600 mg/L. Some of these places are Garnawad and Harispura in Jhalrapatan block (TH 1420 and 1090 mg/L) and Sunel in Pirawa block (TH 1133 mg/L). The minimum and maximum values of TH are observed at Semla in Pirawa and Gurnawad in Jhalrapatan block respectively.

Owing to low salinity, the ground water in the district is suitable for agriculture. Although at certain places the water is characterised by high sodicity in terms of sodium percentage and residual sodium carbonate (RSC), but the problem could be overcome by use of gypsum along with irrigation water. Na% more than 70 and RSC more than 2.0 meq/L in irrigation water may cause such problem leading to reduced crop yield and poor soil permeability. 3.6 per cent and 4.8 per cent ground water in the district have Na% above 70 and RSC value above 2.0 meq/L respectively. Only in Jhalrapatan, Manoharthana and Pirawa blocks, such problem of ground waters quality is encountered.

The integrated map of drinking water quality based upon permissible limits of salinity, nitrate and fluoride concentration reveals the ground water in the district by and large is suitable for drinking and other domestic use. Only at a few places where the fluoride or nitrate concentration is high, the ground water needs quality management prior to its use as a drinking water source.

GROUND WATER POTABILITY

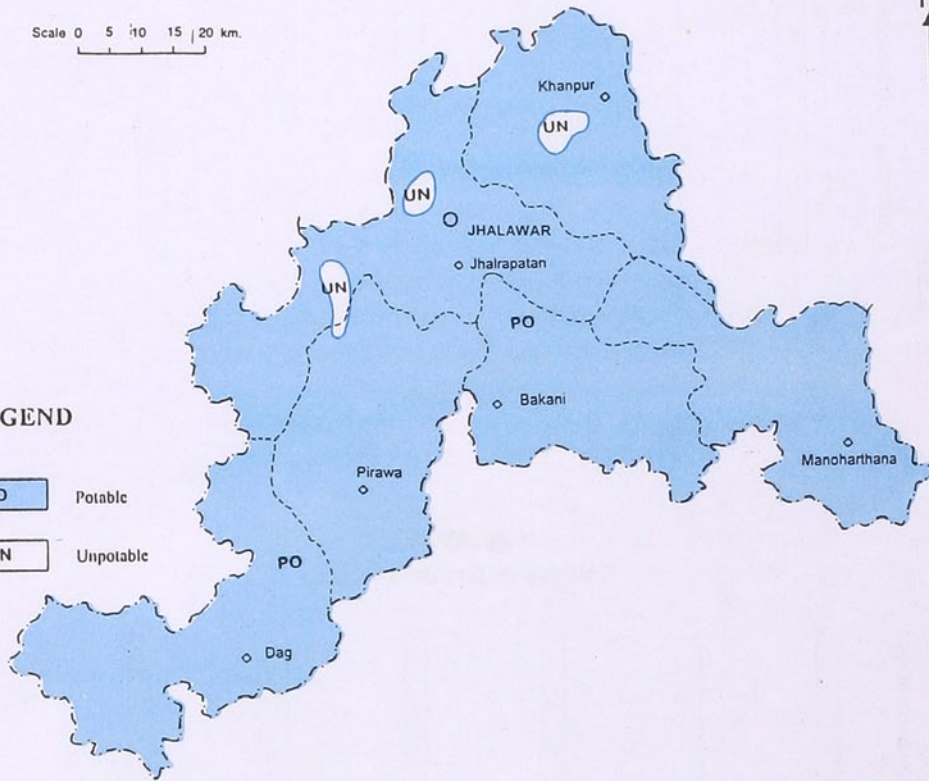
JHALAWAR DISTRICT

Scale 0 5 10 15 20 km.



LEGEND

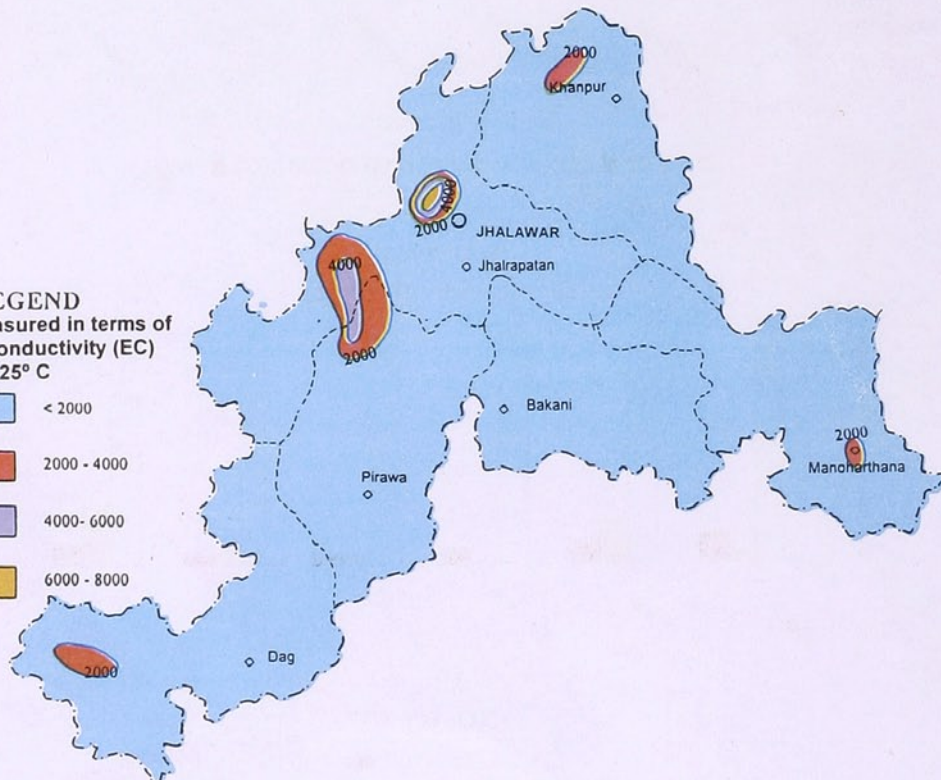
- PO Potable
- UN Unpotable

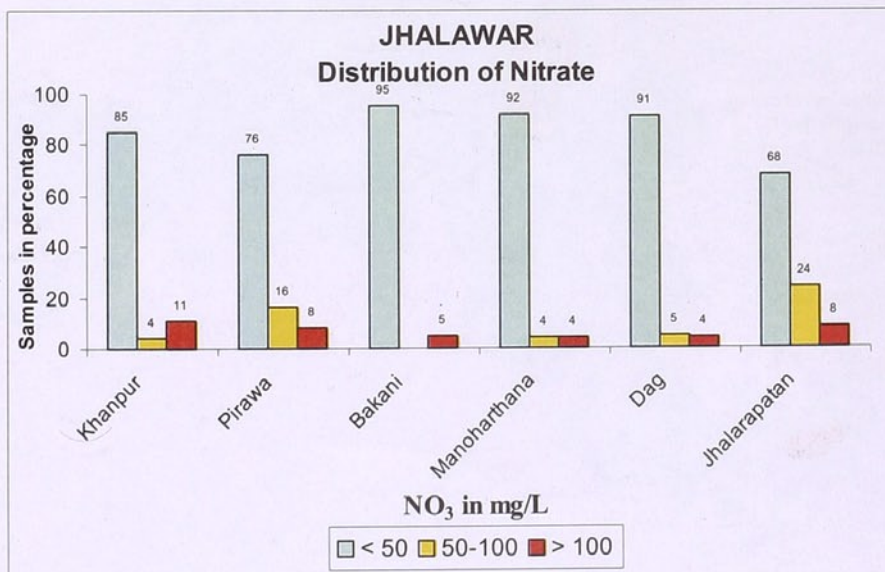
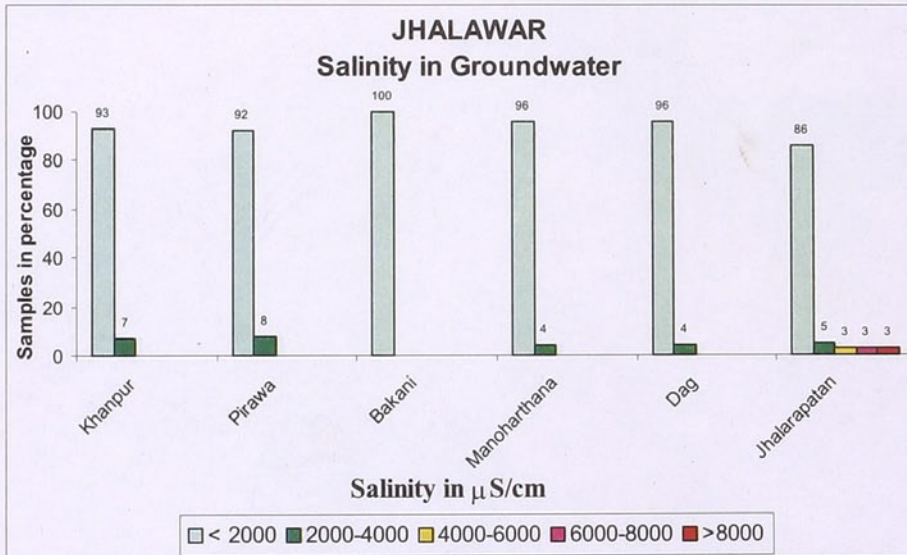
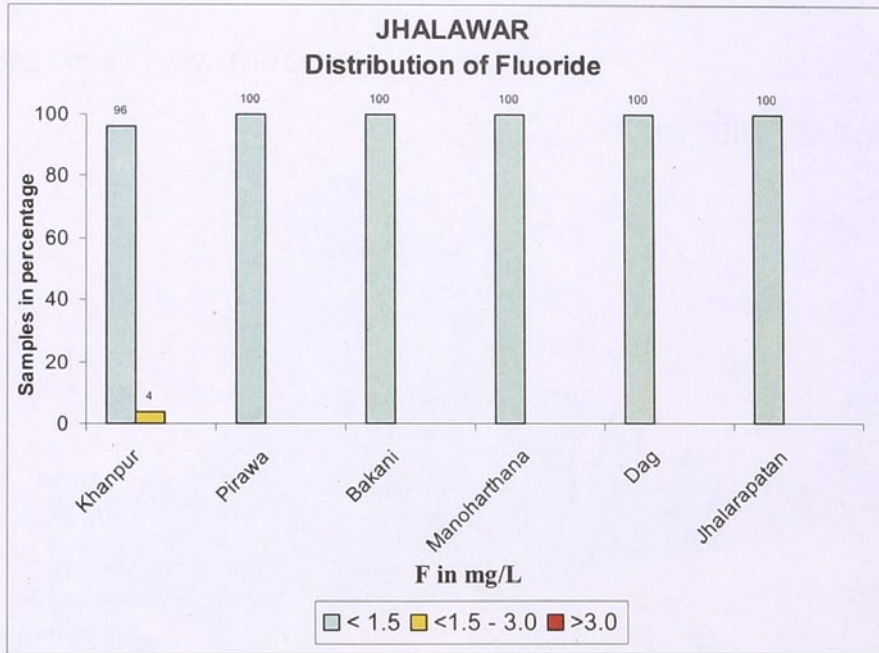


SALINITY

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

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

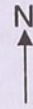




NITRATE DISTRIBUTION

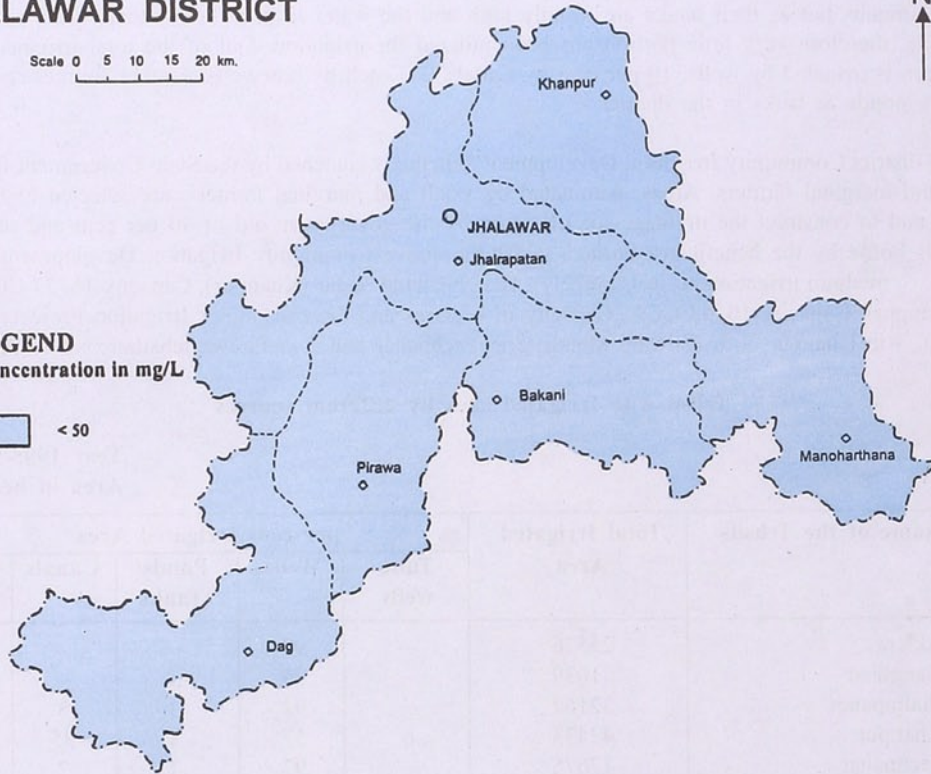
JHALAWAR DISTRICT

Scale 0 5 10 15 20 km.





LEGEND Nitrate Concentration in mg/L

 < 50



FLUORIDE DISTRIBUTION

LEGEND Fluoride Concentration in mg/L

 < 1.5
 1.5 - 3.0

