# GEOMORPHOLOGY

## DISTRICT—JALOR

| 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 Sagi, Sukri and scattered in northern part of district. | Marginal double crop, single crop (Rabi / Kharif), fallow. |
| Alluvial Plain (Sandy) | AP (S) | Flat to gentle undulating plain formed due to fluvial activity, mainly comprises of gravels, sand, silt and clay with unconsolidated material of varying lithology, predominantly sand along river. | In central part, mainly along river Sagi, Sukri and north of river Jawai. | Marginal double crop, single crop (Kharif), fallow. |
| Flood Plain | FP | 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. | Along major rivers of the districts. | Marginal double crop, single crop (Kharif / Rabi). |
| Salt Encrustation/ Playa | SE/PL | Topographical depressions comprising of clay, silt, sand and soluble salts, usually undrained and devoid of vegetation. | Scattered in north east and rann of Kutch south west. | Salt waste. |
| **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. | Around hills in south east. | Single crop (Kharif), open scrub, fallow. |
| Burried Pediment | BP | Pediment covered essentially with relatively thicker alluvial, colluvial or weathered materials. | Around Kalapura village in south east. | Marginal double crop, single crop (Kharif), fallow, open scrub. |
| Intermontane Valley | IV | Depression between mountains, generally broad & linear, filled with colluvial deposit. | In between hills in south east. | Marginal double crop, single crop (Rabi / Kharif), fallow. |
| **Aeolian Origin** | | | | |
| Sandy Plain | SP | Formed by aeolian activity, wind blown sand with gentle sloping to undulating plain, comprising of coarse sand, fine sand, silt & clay. | Scattered in entire district. | Marginal Kharif crop, land with or without scrub. |
| Eolian Plain | EP | Formed by aeolian activity, with sand dunes of varying heights, size, slope. Long stretches of sand sheet. Gentle sloping flat to undulating plain, comprised of fine to medium grained sand and silt. Also scattered xerophytic vegetations. | Negligible, scattered in entire district. | Single crop (Kharif), open scrub, fallow. |
| Dune Valley Complex | DVC | Clusters of dunes and interdunal spaces with undulating topography formed due to wind blown active sand, comprising of unconsolidated sand and silt. | North of Kumba & Navaranta village and south of Sarava village. | Land with or without scrub. |
| Obstacle Dune | OD | Formed on windward/leeward sides of obstacle like isolated hills or continuous chain of hill, due to obstruction in path of sand ladden winds. Badly dissected well cemented and vegetated. | Windward side of hills. | Land with or without scrub. |
| **Hill** | | | | |
| Denudational Hill | DH | Steep sided, relict hills undergone denudation, comprising of varying lithology with joints, fractures and lineaments. | Scattered in south east and north east and in south & south west of Jalor town. | Forest, mining. |

# JALOR DISTRICT

## GEOMORPHOLOGY

Scale 0 5 10 15 20 km.

N

71°30' 72°00' 72°30' 73°00'

25°30' 25°00'

Ahore
Jawai River
JALORE
Sayla
Khari River
Bhinmal
Luni River
Sukri River
Jaswantpura
Sanchore
Raniwara

### 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
- Alluvial Plain (Sandy)
- Flood Plain
- Salt Encrustation/Playa

Denudational Origin :
- Pediment
- Burried Pediment
- Intermontane Valley

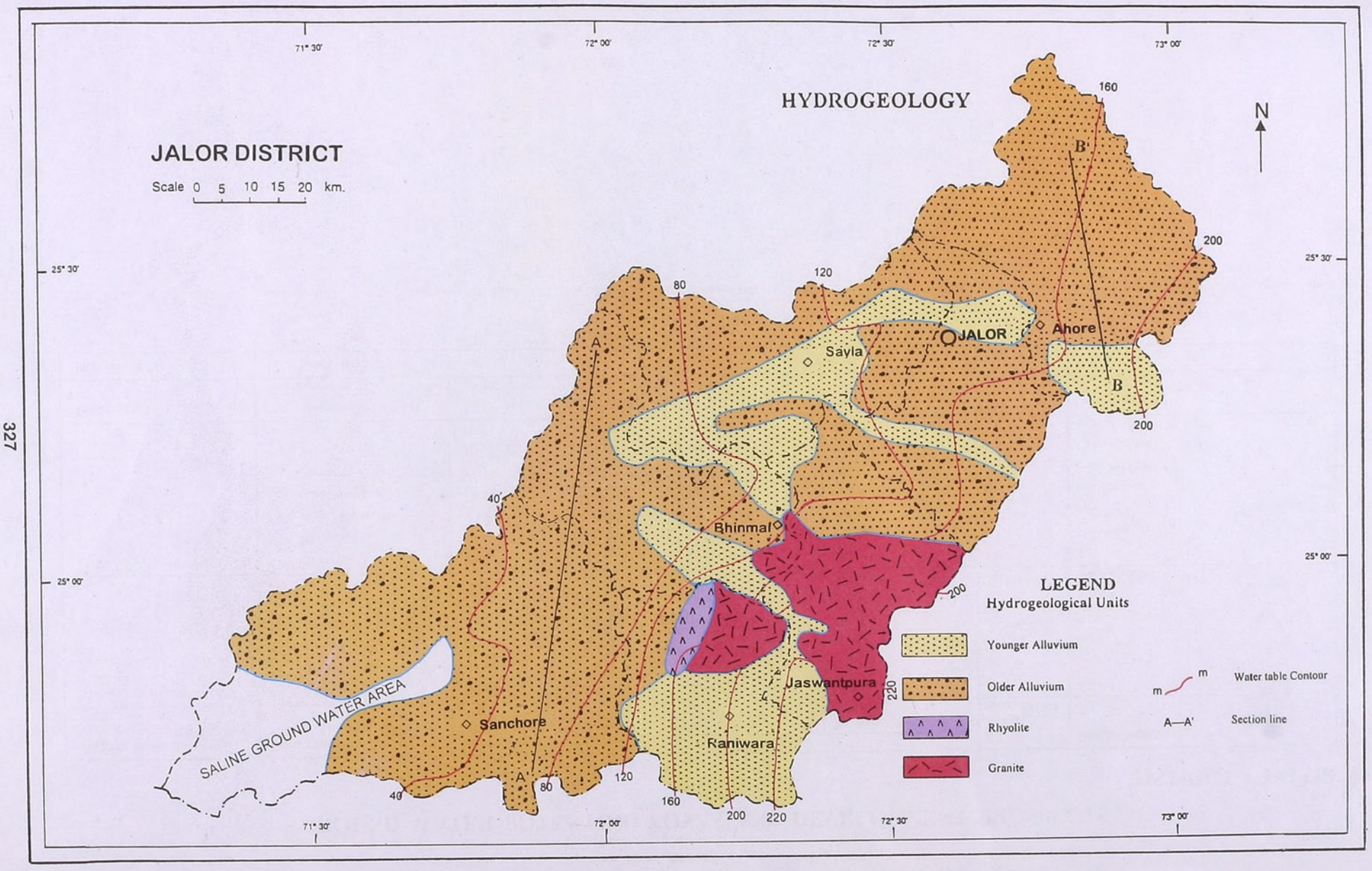
Aeolian Origin
- Sandy Plain
- Eolian Plain
- Dune Valley Complex
- Obstacle Dune

# HYDROGEOLOGY

## DISTRICT—JALOR

| Hydrogeological units | Description of the unit/Geological section | Occurrence | Ground Water flow |
|---|---|---|---|
| Younger Alluvium (Quaternary) | It comprises unconsolidated sediments, sand, silt and clays in varying proportions. | The second wide spread litho unit occurs in flood plains and low terrace deposits along palaeo channels and drainage courses. Younger alluvium occupy nearly 16% potential area. | The general direction of ground water flow in southern and northern part has been inferred EES to WWN. Central and Western peripheral regions however have ground water flow from E to W and NE to SW respectively. The Sayala-Sankada axis, trending NE-SW, divide the area into eastern part having steep hydraulic gradient and western part having moderate to lower gradient. Hydraulic gradient in eastern and western area have been computed between 5.2 to 6.4 and 1.2 to 1.9 m/km respectively. |
| Older Alluvium (Quaternary) | It includes piedmont alluvial sediments unsorted rock fragments, gravel, sand with higher clay percentage; and higher terrace deposits - upper sandy loam and kankar layers and lower fine to medium, sand, gravel and silt, cross section north east of Jalor indicate thick clay horizones which at places contain gravel and kankar. Basement is shallow in north and more deep southward, i.e., about 80 m. Another section in the central part along Sukri river in E-W direction reveals thick clay horizones on northern bank and medium to coarse sand and gravel interbedded with clay lenses on southern bank where coarse sediments increases towards east. Cross section between Sanchore and Sayla exhibits E-W striking fault along the coarse of Sukri river resulting upthrow of the northern area. Thickness of the sediments in the southern area has been tapped 100 to 150 m. It reduces northward to less than 10 m. Thick buff to greyish clay layers containing rock fragments below alluvium has been identified as mark horizons between quaternary and tertiary sediments. | This litho unit encompasses almost entire area. Piedmont alluvial sediments occur as alluvial fanes and cones along hill slopes. Higher river terrace deposits have been identified in area between Khari-Bandi and north of Jawai, Sukri rivers. These cover entire area between piedmont plains and lower terrace deposits. Older alluvium cover nearly 76% potential area. | |
| Jalor, Erinpura, Granite & Malani Rhyolite (Post Delhi to Delhi Super Group) | Erinpura granite is grey coloured, medium to coarse grained rock mainly composed of quartz, feldspar with biotite and hornblende as minor constituents. Jalor granite is pink in colour, fine to coarse grained with phenocrysts of feldspar, mainly composed of quartz. Orthoclase feldspar with some plagicoclase feldspar, biotite and aegirine. Biotite is most abundant ferromagnesian mineral. Malani suite of volcanic rocks indicate rhyolite associated with agglomerate, volcanic ash, felsites intercalated with acid tuffs and pyroclastic materials. | Jalor and Erinpura granites occur in Jalor, Jaswantpura, Bhinmal and Raniwara blocks. Malani rhyolite encloses small area in Raniwara block. Granite and rhyolite together cover nearly 8% potential area. | |

*For cross section(s) please see page no. 551*

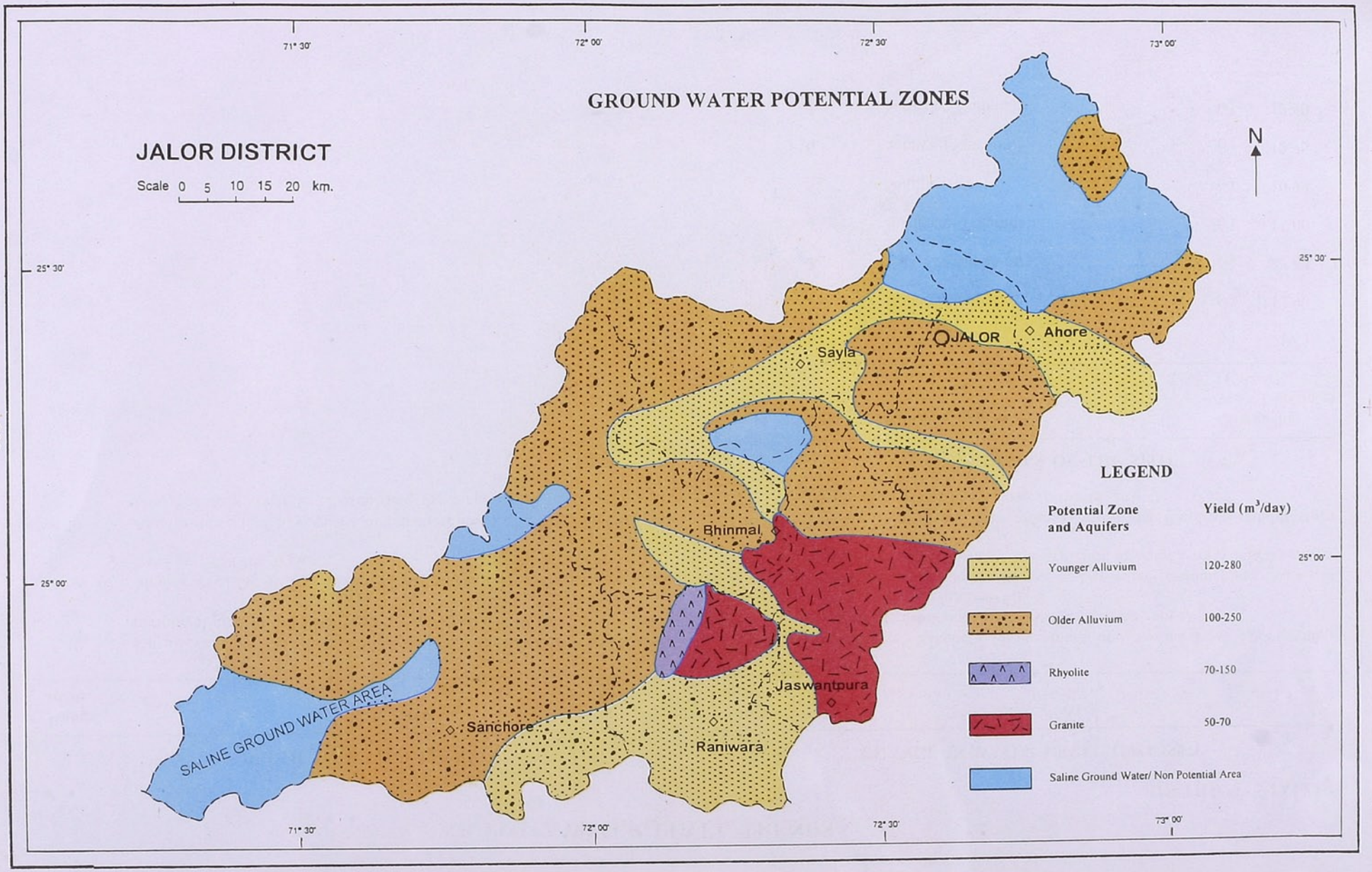

HYDROGEOLOGY
JALOR DISTRICT
Scale 0 5 10 15 20 km.
N
71° 30'
72° 00'
72° 30'
73° 00'
25° 30'
25° 00'
JALOR
Ahore
Sayla
Bhinmal
Sanchore
Jaswantpura
Raniwara
SALINE GROUND WATER AREA
A
A'
B
B'
40
80
120
160
200
220
LEGEND
Hydrogeological Units
Younger Alluvium
Older Alluvium
Rhyolite
Granite
m
Water table Contour
A—A'
Section line

# GROUND WATER POTENTIAL ZONES AND DEVELOPMENT PROSPECTS

## DISTRICT - JALOR

| Aquifer in the Potential Zone (Area in Km²) | Occurrence * Block (Area in Km²) | Water Level (1997) in m. | Well Parameters | | | E.C. X10³µ siem/cm | Development Prospects |
|---|---|---|---|---|---|---|---|
| | | | Type | Proposed depth in m | Discharge in m³/day | | |
| Younger Alluvium | * Ahore (128.12) | 15-30 | TW/DW | 70-90/20-35 | 120-280 | <4 | Safe |
| (1378.37) | * Bhinmal (187.50) | 25-40 | TW/DW | 60-100/30-40 | 120-280 | <4,4-6 | Safe |
| | * Jalor (225.00) | 10-35 | TW/DW | 70-90/15-25 | 100-240 | <4 | Safe |
| | * Jaswantpura (62.50) | <15 | TW/DW | 50-70/20-40 | 120-220 | <4 | Over exploited |
| | * Raniwara (359.25) | 10-20 | TW/DW | 50-60/15-25 | 100-180 | 4-6 | Critical |
| | * Sayla (416.00) | 10-25 | TW/DCB | 60-80/30-60 | 100-180 | <4 | Over exploited |
| Older Alluvium | * Ahore (407.12) | 10-25 | TW/DW | 60-90/20-25 | 100-240 | 4-8 | Safe |
| (6098.61) | * Bhinmal (1135.25) | 10-40 | TW/DCB | 80-240/35-70 | 100-250 | 4-8 | Over exploited |
| | * Jalor (609.37) | 10-30 | TW/DW | 60-80/20-40 | 180-240 | 4-8 | Safe |
| | * Jaswantpura (437.50) | 15-35 | TW/DW | 80-100/15-20 | 80-220 | <4 | Over exploited |
| | * Raniwara (340.62) | 15-35 | TW/DW | 50-100/20-40 | 120-220 | 4-8 | Over exploited |
| | * Sanchore (2312.50) | 10-30 | TW/DW | 100-200/20-35 | 100-250 | 4-8 | Over exploited |
| | * Sayla (856.25) | 10-25 | TW/DW | 60-80/20-35 | 100-250 | 4-8 | Over exploited |
| Granite (582.37) | * Jaswantpura (432.37) | 15-25 | DW | 20-35 | 70-150 | <4 | Over exploited |
| | * Raniwara (150.00) | 10-20 | DW | 20-35 | 70-150 | <4 | Over exploited |
| Phyllite (68.75) | * Raniwara (68.75) | <20 | DW | 30-40 | 50-70 | <4 | 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


GROUND WATER POTENTIAL ZONES
JALOR DISTRICT
Scale 0 5 10 15 20 km.
N
71° 30'
72° 00'
72° 30'
73° 00'
25° 30'
25° 00'
JALOR
Ahore
Sayla
Bhinmal
Jaswantpura
Raniwara
Sanchore
SALINE GROUND WATER AREA
LEGEND
Potential Zone and Aquifers
Yield (m³/day)
Younger Alluvium 120-280
Older Alluvium 100-250
Rhyolite 70-150
Granite 50-70
Saline Ground Water/ Non Potential Area

# WATER LEVEL TRENDS

**DISTRICT : JALOR**

## DEPTH TO WATER LEVEL

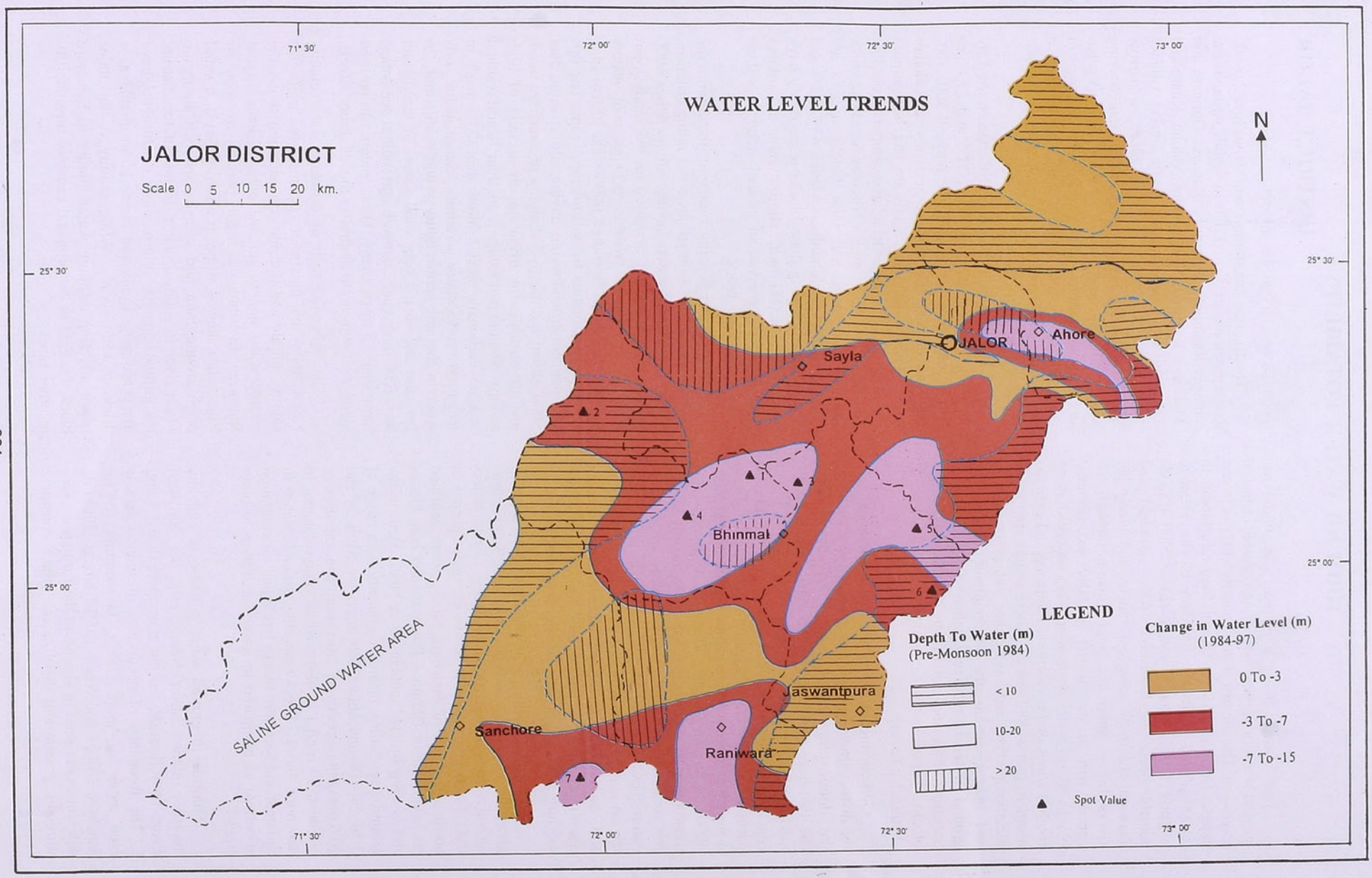
| Range in m | Area |
|---|---|
| < 10 | Part of Sanchore and Bhinmal blocks, area northeast of Jalor and eastern peripheral area has shallow water level less than 10 m. |
| 10 to 20 | Major part of the district leaving aside peripheral area has depth to water level between the region. |
| > 20 | Area northwest of Sayla, east of Sanchore and encircling Bhinmal and Jalor has deep water level exceeding the range of 20 m. |

## CHANGE IN WATER LEVEL (1984-1997)

| Range in m | Area |
|---|---|
| 0 to -3 | Area around Sanchore, Jaswantpura and northeast of Jalor exhibit marginal depletion in water level within the range. |
| -3 to -7 | Central part of the district encircling Sayla-Jalor-Bhinmal and area south of Sanchore and Raniwara show depletion in water level within the range. |
| -7 to -15 | Part of Bhinmal and area around Ahore and Raniwara exhibit steep depletion in water level between the range. |

### DETAILS OF THE SPOT

| Spot code | Village (Block) | Change in water level in m (1984-97) |
|---|---|---|
| 1. | Daspa (Bhinmal) | (-) 19.5 |
| 2. | Bolia (Bhinmal) | (-) 12.90 |
| 3. | Jhak (Jaswantpura) | (-) 22.65 |
| 4. | Jhanghani (Bhinmal) | (-) 15.00 |
| 5. | Santhu (Jalor) | (-) 10.98 |
| 6. | Sarawa (Sanchore) | (-) 12.75 |
| 7. | Sarthala (Bhinmal) | (-) 12.30 |


WATER LEVEL TRENDS
JALOR DISTRICT
Scale 0 5 10 15 20 km.
N
71° 30'
72° 00'
72° 30'
73° 00'
25° 30'
25° 00'
JALOR
Ahore
Sayla
Bhinmal
Jaswantpura
Sanchore
Raniwara
SALINE GROUND WATER AREA
1
2
3
4
5
6
7
LEGEND
Depth To Water (m)
(Pre-Monsoon 1984)
< 10
10-20
> 20
Change in Water Level (m)
(1984-97)
0 To -3
-3 To -7
-7 To -15
Spot Value

# GROUND WATER POTABILITY

## DISTRICT JALOR

Jalor district being a part of arid region has ground water of varying salinity and diverse chemical character. The electrical conductivity (EC) of water ranges from 530 µS/cm (Wara; Raniwara block) to 21000 µS/cm (Chilwara; Sanchore block). Fresh to slightly saline ground waters (EC <2000 µS/cm) mostly occur in Raniwara (65% samples) and Jaswantpura (60% samples) blocks and along the rivers Jawai, Sukri and Sagi flowing through the central part of the district in Jalor and Bhinmal blocks. Fresh water pockets are also observed along foothill zones of Jaswantpura, Raniwara and extreme northern part of Saila block. These waters are mostly bicarbonate type and have either sodium or calcium and magnesium as the predominant cation. The ground water is relatively saline in most part of Sanchore block and eastern part of Ahore and Jalore blocks. These waters have sodium-chloride type of chemical character.

Geo-chemically, 67.3 per cent ground water in the district show Tertiary character having chloride as the dominating anion, majority of these waters (62.4%) have sodium as the principal cation and are moderately saline in nature (EC>4000 µS/cm). 17 per cent waters show secondary character wherein no particular anion has dominating appearance. These waters have intermediate salinity of the range 2000-4000 µS/cm. The primary character of water having bicarbonate as the principal anion is seen only in 15.7 per cent water samples. These waters are fresh in nature (EC <1500 µS/cm) and occur along hilly terrain and foot-hill zones of Jaswantpura. Raniwara and Sayla blocks. These waters show sodium dominance in 7.9 per cent cases while the rest have calcium plus magnesium as the dominant cations.

The concentration of nitrate in ground water is generally low. Only 20.6 per cent well waters show nitrate values above 100 mg/L. High nitrate waters (NO3) >100 mg/L) occur in two elongated stripes in north and south of Sanchore block, some confined pockets in Sayla, Bhinmal, Raniwara and Jalor blocks and as a few isolated spots in Ahore block. Statistically, groundwater falling in nitrate concentration range of 0-50, 50-100 and above 100 mg/L are 51.3, 28 and 20.6 per cent respectively. Maximum concentration of nitrate (570 mg/L) is observed at village Dhanta in Sanchore block. Blockwise, the ground water in Bhinmal and Sanchore blocks has higher concentration of nitrate as compared to its concentration in other blocks.

Fluoride in ground water is cause of endemic fluorosis in the district. Nearly, 60.3 per cent well waters have fluoride concentration more than 1.5 mg/L. The frequency of occurrence of such waters is even more in Ahore (78%), Jaswantpura (64%), Sanchore (67%) and Sayla (65%) blocks. Fluoride rich waters are seen in almost all the formations viz., alluvium, granite and rhyollite etc. which constitute potential aquifers in the district.

The fluoride distribution map shows low fluoride concentration (<1.5 mgF/L) in south around the villages Ratanpura, Rampura, Rewara, Golwara and Melwa in Raniwara block, Kotra, Valona, Khara and Jherat in Sanchore block, in north around villages Kuaber and Nimbalana in Sayla block, a narrow stripe from Jalore extending southward and covering villages Bakra, Sarat and Bibalsar and a small patch in northeast around Ghana and Bakli villages in Ahore block. The maximum fluoride concentration in the district is observed as 14.0 mg/L village Dhanpur in Jalor block.

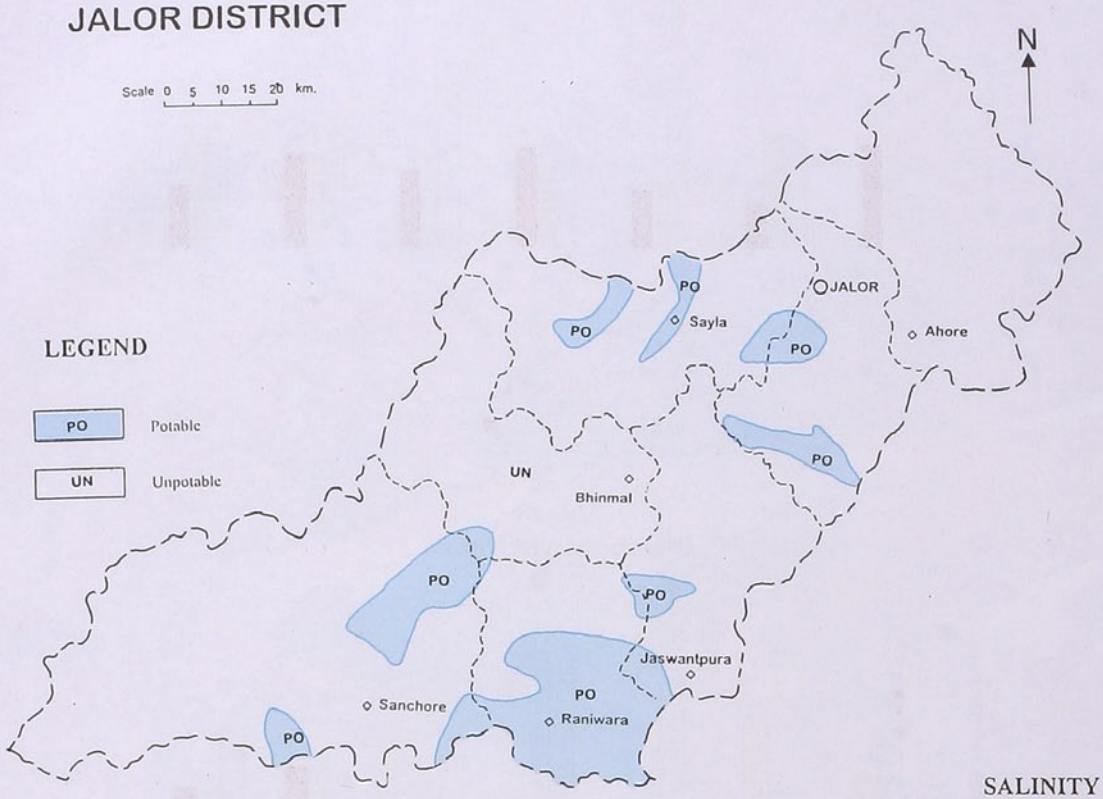
Ground water in the district is characterised by moderate to high hardness. 43.4, 27.5 and 29.1 per cent waters have hardness in the range 0-300, 300-600 and above 600 mg/L respectively as calcium carbonate. The Bhinmal, Raniwara and Jaswantpura blocks in south of the district have comparatively low hardness (TH < 300 mg/L) whereas Sanchore block in west and Ahore and Jalor blocks in east are characterised by high hardness vlaues. 43%, 41% and 38% ground water in these blocks respectively have hardness above 600 mg/L. Highest value of hardness 3025 mg/L is observed in ground water at village Ghana in Ahore block.

Ground water is major source of irrigation in the district. As per the Anonymous water rating criterion, 82 per cent ground waters having salinity below 6000 µS/cm are suitable for irrigation on the sandy loam soils of the district whereas 6.7 per cent waters having salinity in the range 6000-8000 µS/cm may be used for irrigation for salt tolerant crops. The rest 11.5 per cent ground waters having salinity more than 8000 µS/cm and mostly belonging to Sanchore block are not suitable for irrigation on account of high salinity. Sodium percentage more than 70 and residual sodium carbonate (RSC) more than 2.0 meq/l in irrigation waters cause alkalinity hazard in the soils wherein the soil permeability is badly impaired. 26 per cent and 46 per cent well waters of the district have RSC more than 2.0 meq/L and sodium percentage more than 70 respectively. These waters can be used along with gypsum to neutralise the alkalinity effects.

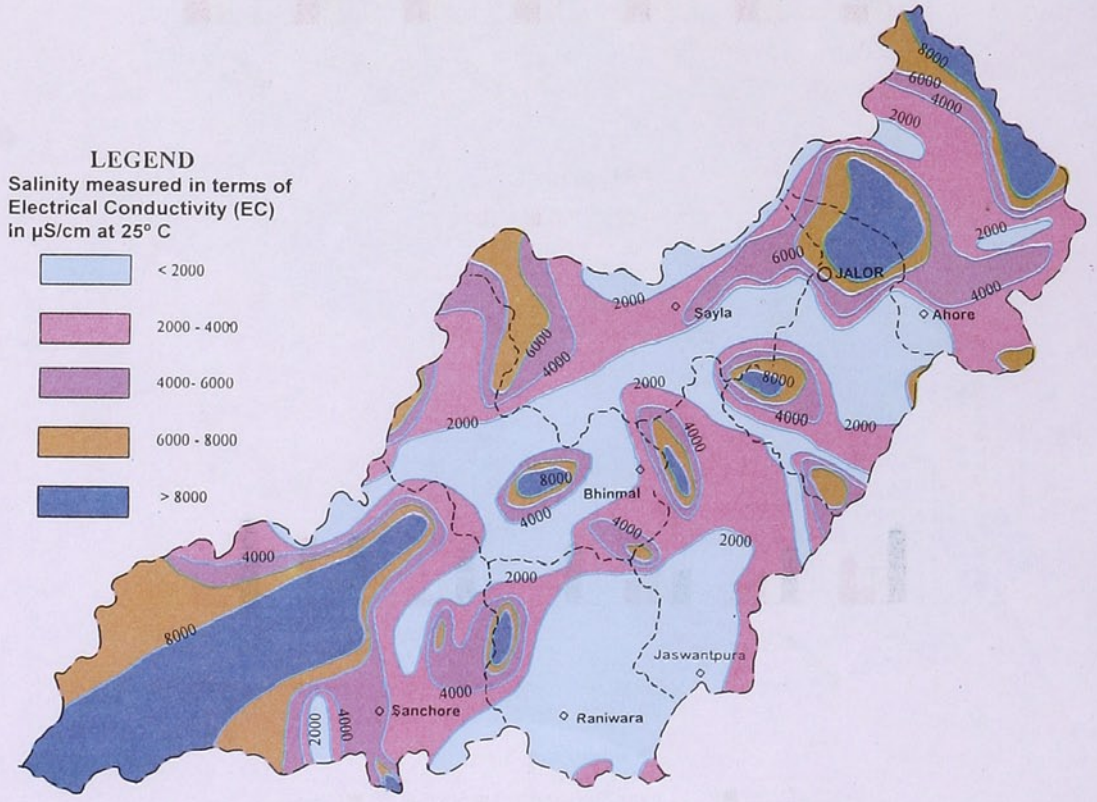
The integrated map of drinking water quality based upon the maximum permissible limits for salinity, nitrate and fluoride concentration shows the ground water quality suitable only in areas around Raniwara in south, a small portion in west of Bhinmal, a skewed stripe in north of Sayla, a small patch around Jalor and in a narrow belt along the Jawai river in south of Jalor. In rest of the district, the groundwater has one or more constituent above the permissible limits and hence is unsuitable as a drinking water source. While salinity is the major factor affecting drinking water quality in Sanchore block, fluoride is the principal cause of unsuitability in other blocks.

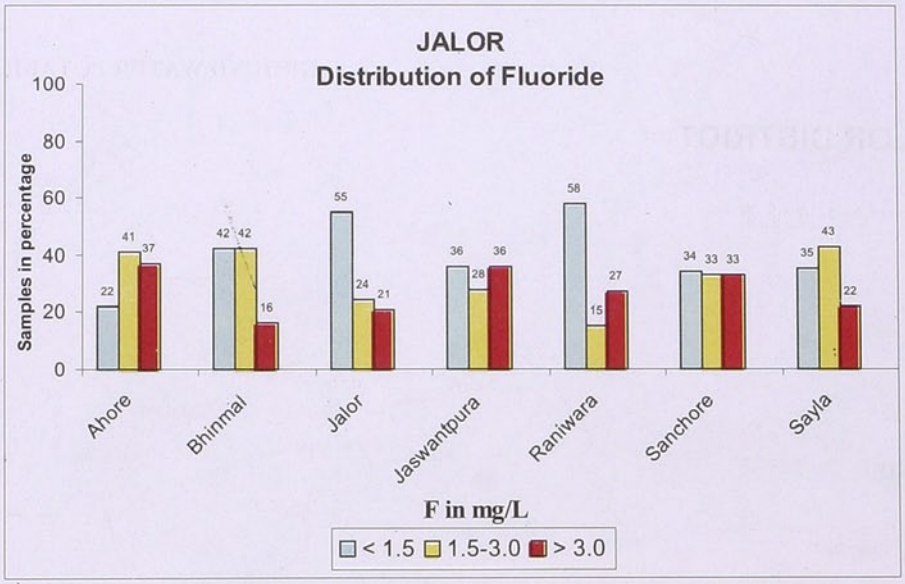
## GROUND WATER POTABILITY

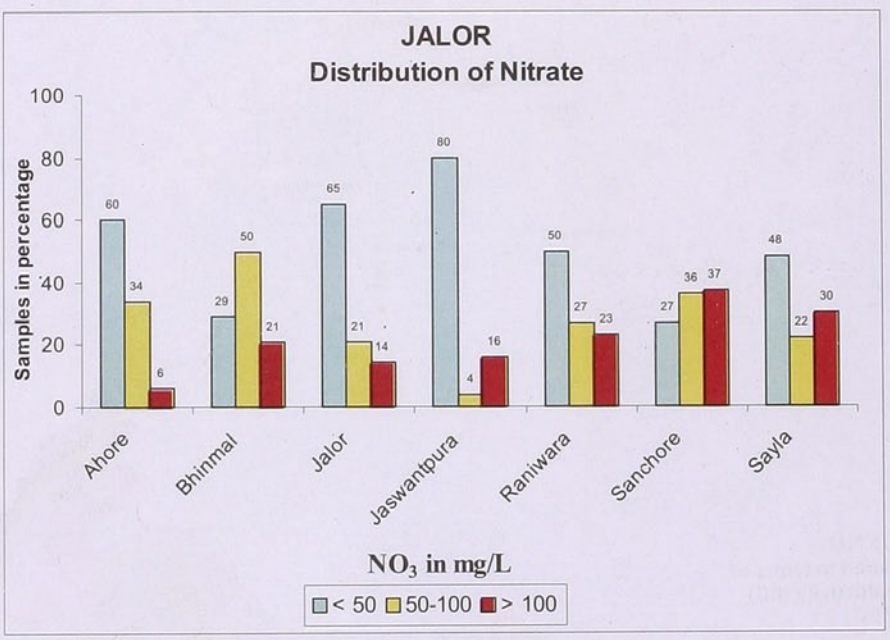
# JALOR DISTRICT

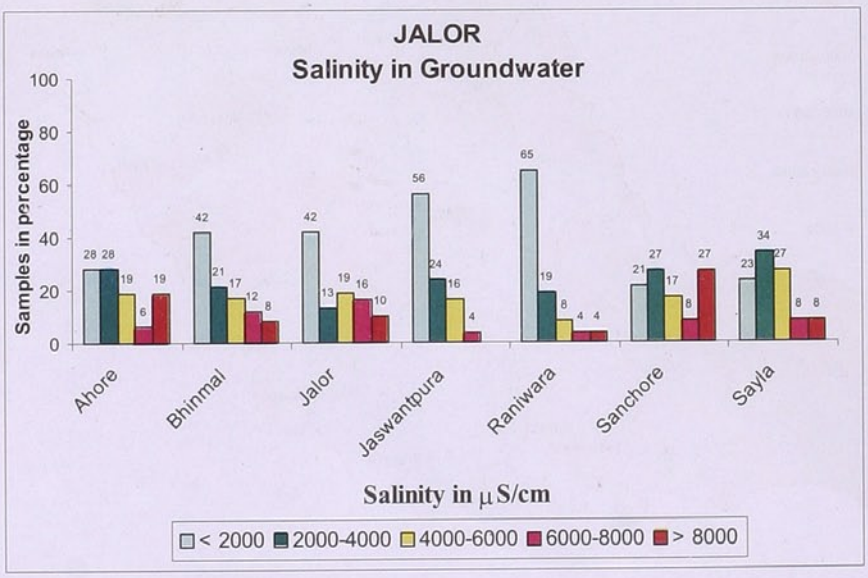



## SALINITY




JALOR
Distribution of Fluoride
Samples in percentage
100
80
60
40
20
0
22 41 37
42 42 16
55 24 21
36 28 36
58 15 27
34 33 33
35 43 22
Ahore
Bhinmal
Jalor
Jaswantpura
Raniwara
Sanchore
Sayla
F in mg/L
< 1.5
1.5-3.0
> 3.0


JALOR
Distribution of Nitrate
Samples in percentage
100
80
60
40
20
0
60 34 6
29 50 21
65 21 14
80 4 16
50 27 23
27 36 37
48 22 30
Ahore
Bhinmal
Jalor
Jaswantpura
Raniwara
Sanchore
Sayla
NO3 in mg/L
< 50
50-100
> 100

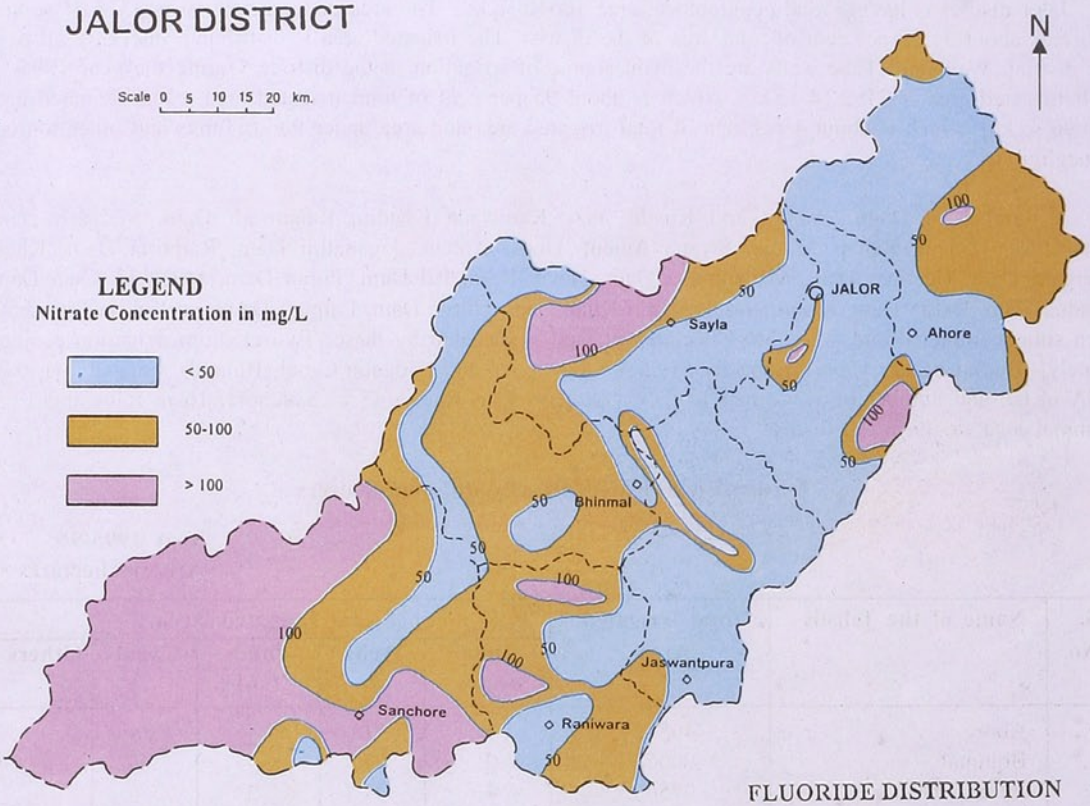

JALOR
Salinity in Groundwater
Samples in percentage
100
80
60
40
20
0
28 28 19 6 19
42 21 17 12 8
42 13 19 16 10
56 24 16 4
65 19 8 4 4
21 27 17 8 27
23 34 27 8 8
Ahore
Bhinmal
Jalor
Jaswantpura
Raniwara
Sanchore
Sayla
Salinity in μS/cm
< 2000
2000-4000
4000-6000
6000-8000
> 8000

NITRATE DISTRIBUTION

# JALOR DISTRICT

Scale 0 5 10 15 20 km.

N




FLUORIDE DISTRIBUTION