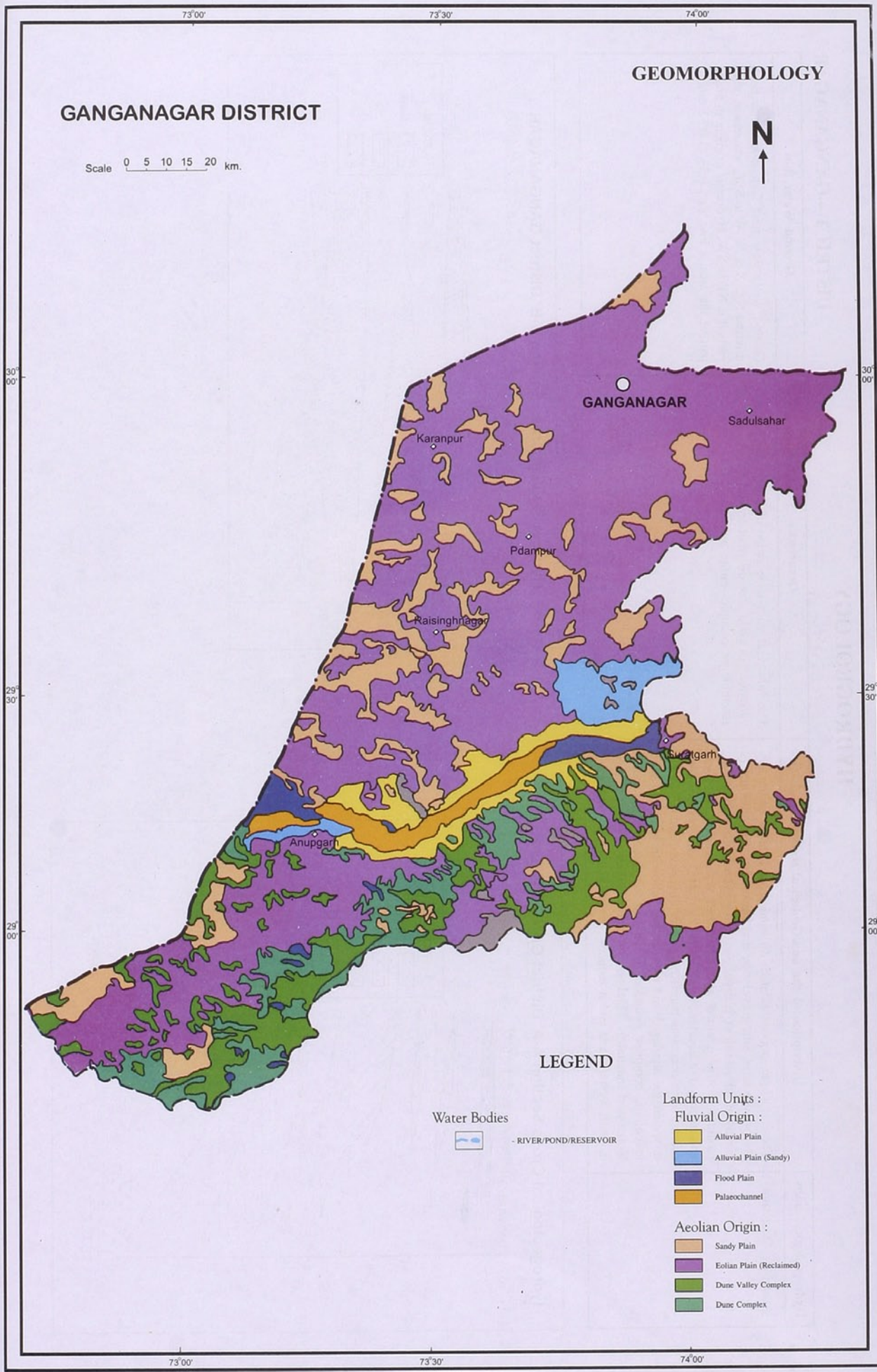


GEOMORPHOLOGY

DISTRICT—GANGANAGAR

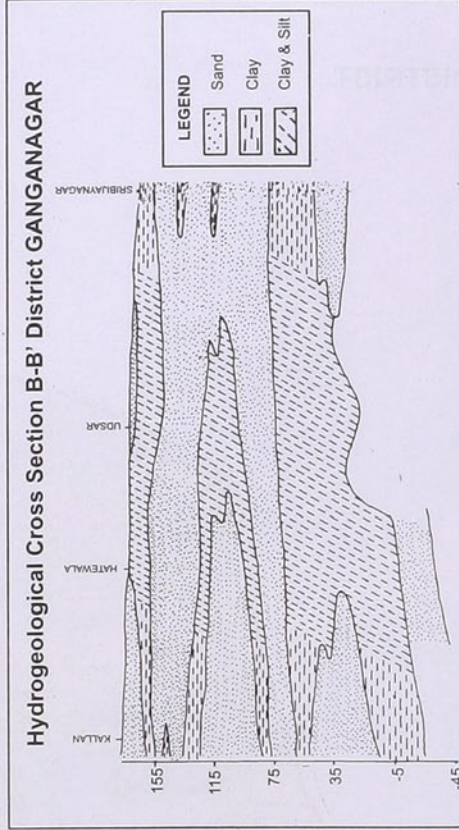
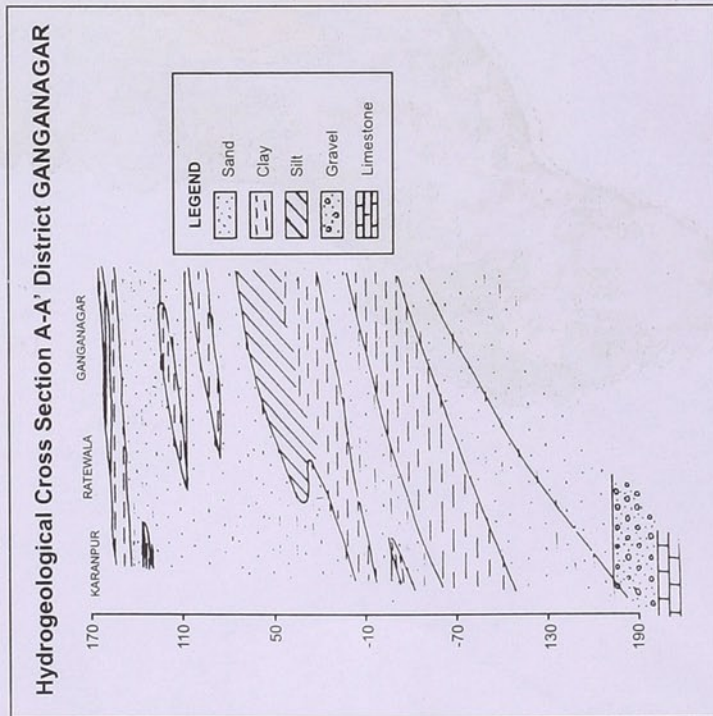
Landform Units	Symbol	Lithology / Material / Description	Occurrence in district	Land use/Land cover
Fluvial Origin Alluvial Plain	AP	Mainly undulating land scape formed due to fluvial activity, consisting of gravels, sand, silt and clay. Terrain mainly undulating, produced by extensive deposition of alluvium.	Along Ghaggar river bed.	Double crop, also double crop in pockets, single crop (Rabi / Kharif), open scrub.
Alluvial Plain (Sandy)	AP (S)	Flat to gentle undulating plain formed due to fluvial activity, mainly constitutes of gravel, sand, silt and clay with unconsolidated material of varying lithology, predominantly sand.	Surrounding Manewala & Shyopra village on eastern margin and north of Anoopgarh town.	Marginal double crop, marginal Kharif crop, open scrub, fallow land.
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.	Banks of river Ghaggar in eastern and western part.	Double crop, marginal single crop (Rabi).
Palaeochannel	PC	Mainly buried or abandoned stream/river courses, comprising of coarse textured material of variable sizes.	In between Diginpura and Anoopgarh town (Ghaggar bed).	Double crop, single crop (Rabi).
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 with main concentration in south east, surrounding Rahasar village.	Single crop (Kharif), open scrub (sand patches), fallow land.
Eolian Plain (Reclaimed)	EP (R)	Gently sloping with sheet of sand or sand dunes. Scattered xerophytic vegetation.	Cover major portion, mainly in command area.	Double crop, single crop (Rabi / Kharif), fallow.
Dune Valley Complex	DVC	Cluster of dunes and interdunal spaces with undulating topography formed due to wind blown active sand, comprising of unconsolidated sand and silt.	Scattered in lower half surrounding Raziasar village.	Marginal double crop, single crop (Kharif), sand patches, fallow land.
Dune Complex	DC	An undulating plain composed of number of sand dunes.	Scattered in lower half of the district.	Marginal single crop (Kharif), open scrub.

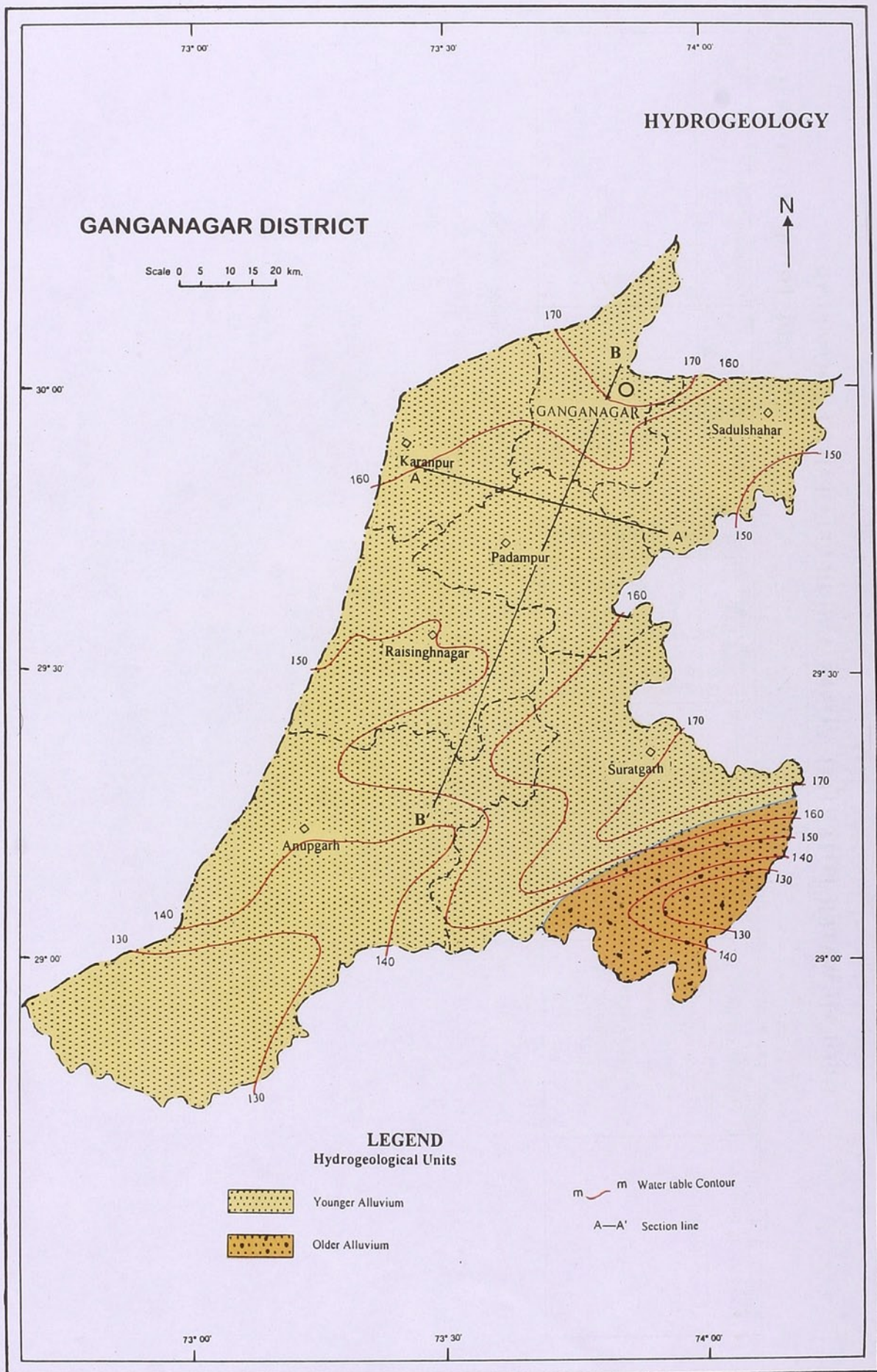


HYDROGEOLOGY

DISTRICT—GANGANAGAR

Hydrogeological units	Description of the unit/Geological section	Occurrence	Ground Water flow
Alluvium (Quaternary)	These include unconsolidated & semi consolidated sediments comprising sand, silt, gravel clay and kanker etc. The alluvium is mostly of fluvial origin. It is yellowish to greyish brown in colour, medium to fine grained and intermixed with kanker. In local terminology the aquifer is called Reji. gypsite, white to ash grey colour, often occurs as bands ranging in thickness from 0.5 to 1.5 m within the aquifer. Wind blown sand yellowish brown to buff in colour, comprise rounded to subrounded quartz with minor biotite and magnetite. Thickness of the alluvium is much higher in north western area and it reduces towards south and south east.	The litho unit with wide range of lateral and vertical variations in grain size distribution and mineralogical assemblages occupies entire area.	Ground water flow near Ganganagar has been inferred N to S or NNW to SSE, whereas in other parts it is NE to SW. Hydraulic gradient in major part of the area is low, i.e., 0.33 to 0.52 m/km.



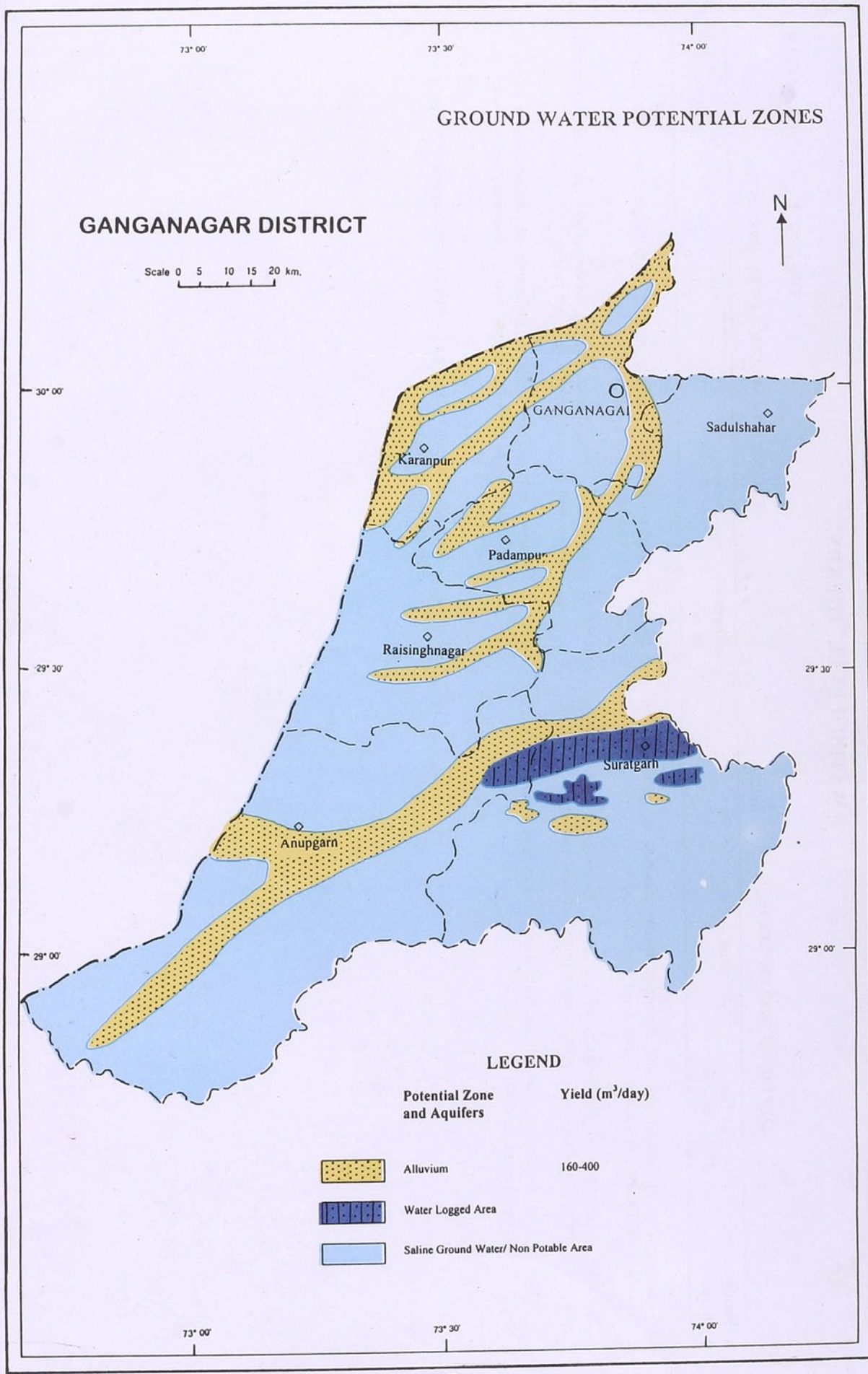


GROUND WATER POTENTIAL ZONES AND DEVELOPMENT PROSPECTS

DISTRICT - GANGANAGAR

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		
Alluvium (1925.40)	* Anupgarh (641.70)	<20	TW/DCB	30-40	<4,4-8	Safe
	* Ganganagar (244.00)	<15	TW/DCB	40-60	<4,4-8	Safe
	* Karanpur (249.70)	<15	TW/DCB	30-40	<4,4-8	Safe
	* Padampur (146.40)	<20	TW/DCB	25-40	<4,4-8	Safe
	* Raisinghnagar (96.30)	<20	TW/DCB	25-40	<4,4-8	Safe
	* Sadulshahar (113.90)	<20	TW/DCB	35-60	<4,4-8	Safe
	* Suratgarh (423.40)	<30	TW/DCB	30-50	<4,4-8	Safe
					Discharge in m ³ /day	
				200		
				450		
				300		
				240		
				360		
				360		
				250		

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

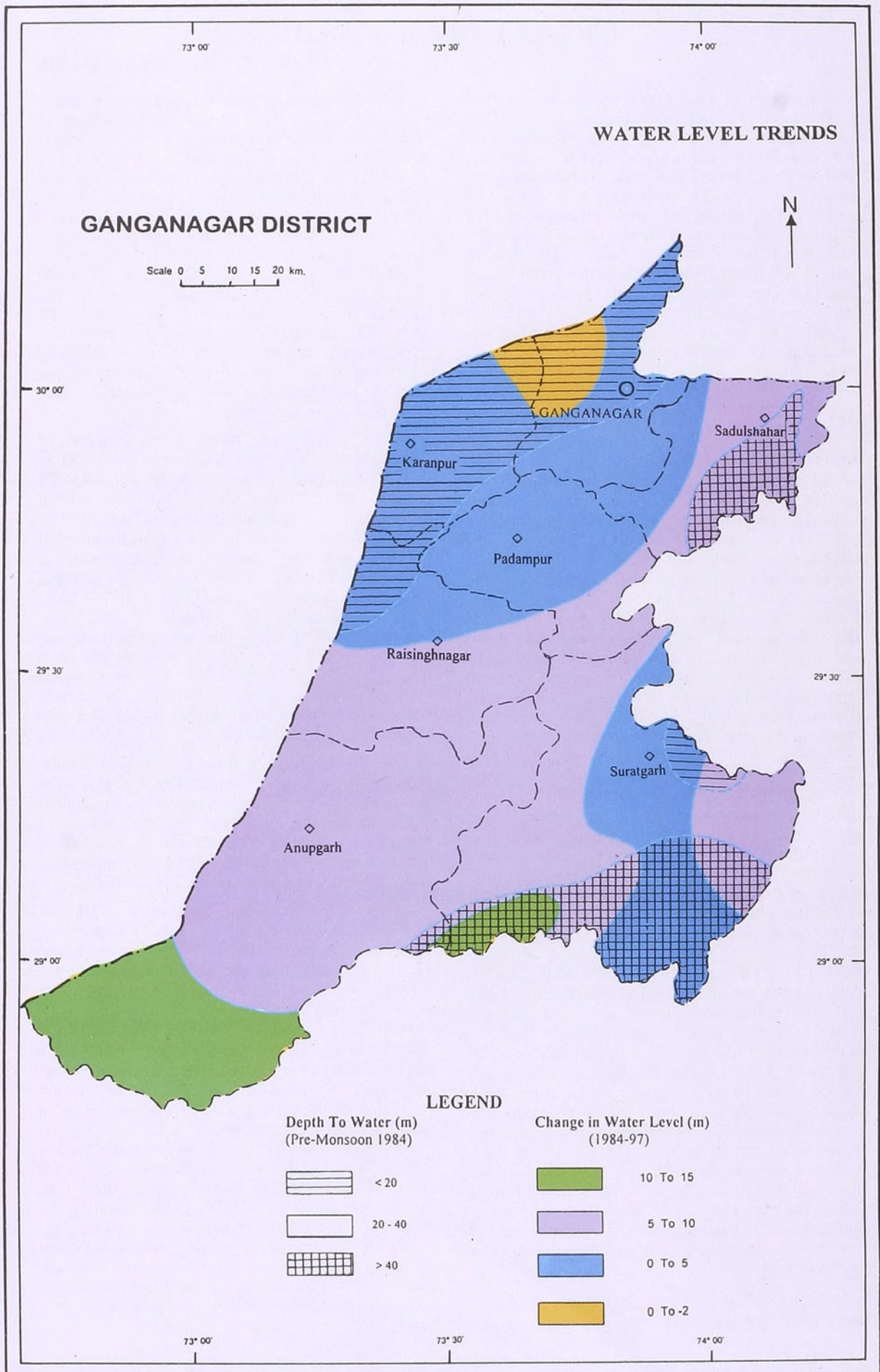


WATER LEVEL TRENDS

DISTRICT : GANGANAGAR

CHANGE IN WATER LEVEL (1984-1997)

Range in m	Area	Range in m	Area
< 20	Part of Ganganagar and Karanpur blocks situated in north western boundary has shallow water level less than 20 m.	10 to 15	Part of Anupgarh block situated in southern periphery exhibits rise in water level within the range.
20 to 40	Major part of the district, leaving aside northwestern and southern peripheral area, has depth to water level between the range.	5 to 10	Major part of the district, leaving aside southern and northwestern part, show rise in water level within the range.
> 40	Small pockets in Suratgarh and Sadulshahar blocks have deep water level ranging more than 40 m.	0 to 5	Part of Ganganagar, Karanpur, Padampur, and Raisinghnagar blocks in northwestern part of the district exhibit marginal rise in water level between the range.
		0 to -2	A localised pocket in Ganganagar block show marginal depletion in water level within the range.



GROUND WATER POTABILITY

DISTRICT GANGANAGAR

The district Ganganagar is pioneer in agriculture production. Although irrigation is carried out by canal water, the ground water is the valuable source for irrigation in most of the region during lean periods. Being part of arid zone, the variation in the chemical quality of ground water is noticed to a great extent during hydrogeochemical investigation. The native ground water is saline and occurs under water table conditions in alluvial aquifer. The map of salinity and field conditions reveal that ground water quality has been influenced by the seepage of surface water and waterlogging conditions prevailing in the district. The seepage of fresh water has created limited phreatic zone of fresh to slightly saline waters with depth range of 25 to 60 meters. At the same time waterlogging at many places has deteriorated the ground water quality to a great extent.

The salinity varies from slightly saline in north west to highly saline in east and south of the district. About 35% well waters covering more than 50% of area in east, south and south-west are of sodium-chloride type. The electrical conductivity of waters (21.19%) are often far above 8000 $\mu\text{S}/\text{cm}$. The slightly saline waters with EC less than 4000 $\mu\text{S}/\text{cm}$ are observed in north-west and covers most of the regions of the Ganganagar and Karanpur blocks. Further north-west of Padampur, north of Raisinghnagar and few patches around Anoopgarh and Suratgarh have similar salinity. The bar chart of salinity indicates the influence of the seepage as more than 40% ground waters have salinity below 2000 $\mu\text{S}/\text{cm}$. The ground water is highly saline with conductivity more than 8000 $\mu\text{S}/\text{cm}$ in Anoopgarh (47.06%), Sadulshahar (33.33%) and Suratgarh (28.57%) blocks. It is seen from the chart that well waters from Ganganagar (70.59%), Karanpur (82.95%), Padampur (61.11%) and Raisinghnagar (73.92%) blocks have low salinity ground water (EC <4000 $\mu\text{S}/\text{cm}$) The minimum and maximum salinity are noticed in the well waters of Kesharsinghpur (400 $\mu\text{S}/\text{cm}$) in Karanpur block and Tatarsar (2700 $\mu\text{S}/\text{cm}$) in Padampur blocks respectively. The average salinity of ground water of various blocks clearly illustrates the highly saline character of ground water in Padampur (5078 $\mu\text{S}/\text{cm}$), Suratgarh (5555 $\mu\text{S}/\text{cm}$), Anoopgarh (6246 $\mu\text{S}/\text{cm}$) and Sadulshahar (8625 $\mu\text{S}/\text{cm}$). The sodium and chloride are the dominating ions in 35.59% ground waters. These sodium-chloride type waters have high salinity and occur in Anoopgarh, Raisinghnagar, Sadulshahar and Suratgarh blocks. More than 42% ground waters with mix type character are encountered in Karanpur, Padampur and parts of Raisinghnagar and Suratgarh blocks, showing the occurrence of ground water in transitional state. The presence of bicarbonate type waters in Karanpur and Padampur reveals the influence of seepage from canal. Thus the factors like seepage, water logging and arid climate conditions play an important role in governing the chemical quality of the ground water in the district.

Nitrate is the principal constituent of ground water which governs its potability. The map of nitrate

shows the presence of high concentration of nitrate with salinity. The low salinity ground waters of Ganganagar, Karanpur, Padampur and Raisinghnagar in north-west of the district contain nitrate less than 100mg/L. The saline ground water have very high concentration of nitrate i.e. above 100 mg/L. The bar chart illustrates that ground water from Anoopgarh, Sadulshahar and Suratgarh have been contaminated by the presence of nitrate contents of more than 100mg/L. The nitrate content ranges from nil to 870 mg/L in the well water of Bhojasar in Suratgarh. The bar chart shows that 79% waters have less than 100 mg/L of nitrate while 21% ground waters with more than 100 mg/L are confined usually in east, south and south-west where ground water is already saline. Thus the potable ground water is more or less free from nitrate contamination.

The analysis data reveal the association of fluoride with salinity and alkalinity. Fluorides more than 1.5 mg/L are found in saline ground water. At few places in south-west of Padampur, north and east of Karanpur and in north of Ganganagar, the low salinity ground water also contain high fluorides. It is seen from the bar chart that the ground water in Raisinghnagar (80%), Sadulshahar (75%), Padampur (68.75%), Suratgarh (60%) and Ganganagar (62.56%) are characterised by low fluoride (<1.5mg/L) as compared with ground water of Anoopgarh and Karanpur blocks where fluoride contents are more than 1.5mg/L in 44.44% and 52.63% respectively. Fluoride ranges between 0 to 9.2 mg/L in the well water of Pipran (Suratgarh block) having electrical conductivity of 1600 $\mu\text{S}/\text{cm}$.

In general ground water is hard in nature. Hardness ranges from 100 to 2210 mg CaCO_3/L . The average hardness of ground water of various blocks are above 450 mg CaCO_3/L . Thus, the hardness of ground water indicate towards exchange of alkaline-earths between formation material and infiltrating water through seepage or return irrigation flow.

Besides surface water, more than 42.3% and 68.6% ground water can be used for domestic purposes with respect to ICMR recommendations. The health affecting constituents should be within the recommended levels of potability. The integrated map prepared on the basis of ICMR recommendations of potability for salinity, nitrate and fluoride concentrations clearly shows the area of potable ground water in the district. Agriculture is the main occupation of the local people and are mainly dependent on the surface water. However, irrigation potential with respect to ground water is very good in north-east. The salinity of ground water (below 4000 $\mu\text{S}/\text{cm}$) and the loamy soils are available for good agriculture. About 13.6% ground waters with salinity between 4000 to 8000 $\mu\text{S}/\text{cm}$, covering the parts of Sadulshahar, Padampur, Anoopgarh and Suratgarh, can be used for growing salt-tolerant crops on loamy soils. However, 21.19% ground waters in east, south and south-west of the district should be considered unsuitable for irrigation as the salinity is very high.

GROUND WATER POTABILITY

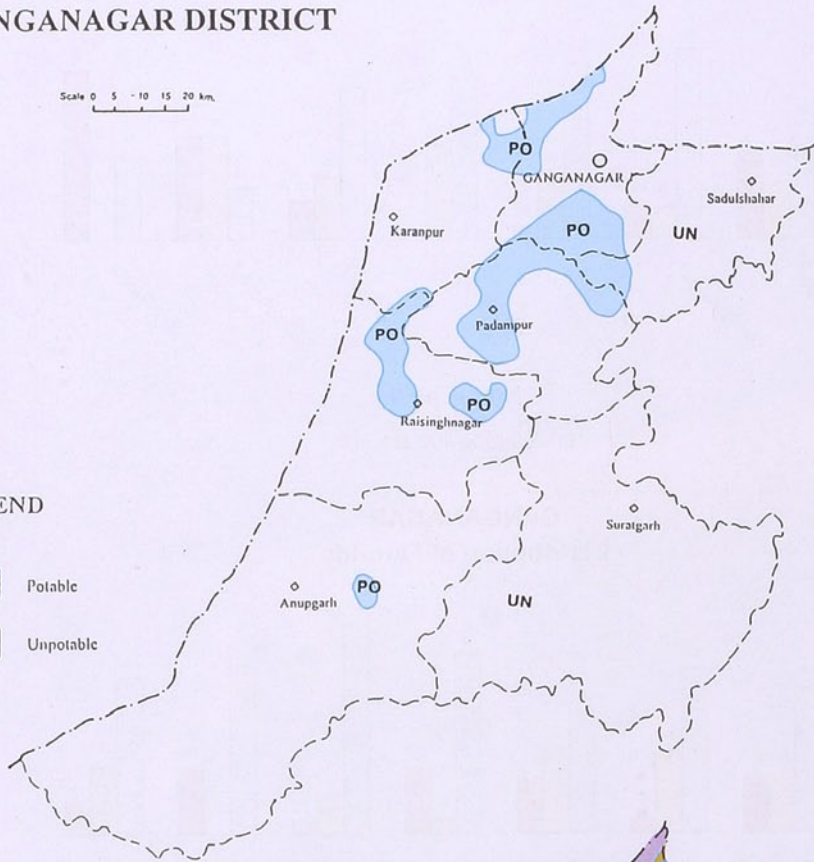
GANGANAGAR DISTRICT

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

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

